CHAPTER
RATIO AND PROPORTION

PAST YEAR QUESTIONS

PROPORTION

1. The third proportional to $(a^2 - b^2)$ and $(a+b)^2$ is : **Feb - 2008**

(a) $\frac{a+b}{a-b}$ (b) $\frac{a-b}{a+b}$ (c) $\frac{(a-b)^2}{a+b}$ (d) $\frac{(a+b)^3}{a-b}$

Solution:

$$\frac{a^2-b^2}{(a+b)^2}=\frac{(a+b)^2}{p} \Rightarrow P=\frac{(a+b)^2(a+b)^2}{(a-b)(a+b)} \Rightarrow P=\frac{(a+b)^3}{a-b}$$

2. Fourth proportional to x, 2x, (x+1) is : **June - 2009**

(a) (x+2) (b) (x-2) (c) (2x+2) (d) (2x-2)

Solution:

$$\frac{x}{2x}=\frac{x+1}{p} \qquad Px=2x+2$$

3. Which of the numbers are not in proportion ? **June-2012**

(a) 6, 8, 5, 7 (b) 7, 14, 6, 12 (c) 18, 27, 12, 18 (d) 8, 6, 12, 9

Solution:

$$\frac{a}{b}=\frac{c}{d}-\text{Proportion} \Rightarrow \frac{6}{8}=\frac{5}{7} \Rightarrow \frac{7}{14}=\frac{6}{12}$$

$$\frac{{}^{6}\cancel{18}^{2}}{{}_{9}\cancel{27}_{3}}=\frac{12}{18}$$

$$\frac{2}{3}=\frac{2}{3}$$

$$\frac{{}^{4}\cancel{8}^{2}}{{}_{3}6}=\frac{\cancel{12}^{4}}{9^{3}}$$

$$\Rightarrow \frac{4}{3}=\frac{4}{3}$$

4. Find two numbers such that mean proportional between them is 18 and third proportional to them is 144 **Dec-2012**

(a) 9,36 (b) 8,32 (c) 7,28 (d) 6,24

Solution : let the two numbers be x & y $\Rightarrow$ x : 18:18:y $\Rightarrow \frac{x}{18}=\frac{18}{y} \Rightarrow x=\frac{324}{y}$ ..... (i)

x : y : y : 144 $\Rightarrow \frac{x}{y}=\frac{y}{144} \Rightarrow x.144=y^2 \Rightarrow x=\frac{y^2}{14^n}$ ..... (ii)

Comparing (i) and (ii)

$$\frac{324}{y}=\frac{y^2}{144} \Rightarrow y^3=46656 \Rightarrow y=36$$

5. The mean proportional between 24 and 54 is : **June-2013**

(a) 33 (b) 34 (c) 35 (d) 36

Solution: 24 : x : x : 54 $\frac{24}{x}=\frac{x}{54}$ $x=36$

6. The ratio of third proportion of 12, 30 to the mean proportion of 9, 25 is : **Dec-2015**

(a) 2 : 1 (b) 5 : 1 (c) 7 : 15 (d) 3 : 5

Solution :

12:30::30: x mean proportion = $\sqrt{9\times25}$

$\Rightarrow \frac{12}{30}=\frac{30}{x}$ =15

$\Rightarrow$ x = 75

ratio=75 : 15

=5 : 1

7. What number must be added to each of the numbers 10, 18, 22, 38 to make the numbers is proportion? **Dec-2015**

(a) 2 (b) 4 (c) 8 (d) None of these

Solution :

let, the number is x

(10+x) : (18+x) : (22+x) : (38+x)

$\Rightarrow \frac{10+x}{18+x}+\frac{22+x}{38+x}$

$\Rightarrow$ (10+x)(38+x)=(22+x)(18+x)

$\Rightarrow 380+10x+38x+x^2=396+22x+18x+x^2$

$\Rightarrow 8x=16$

8. If a:b = 2:3, b:c = 4:5 and c;d = 6:7, then a:d is: **June - 2017**

(a) 24:35 (b) 8:15 (c) 16:35 (d) 7:15

Solution :

$\frac{a}{b}=\frac{2}{3}\times4$ | $\frac{b}{c}=\frac{4}{5}\times3$ | $\frac{c}{d}=\frac{6}{7}$

$\frac{a}{b}=\frac{8}{12}$ | $\frac{b}{c}=\frac{12}{15}$

$\frac{a}{c}=\frac{8}{15}$ | $\frac{c}{d}=\frac{6}{7}\times15$

$\frac{a}{c}=\frac{48}{90}$ | $\frac{c}{d}=\frac{90}{105}$

$\frac{a}{d}=\frac{48}{105}=\frac{16}{35}$ 16 : 35

9. If $\frac{1}{2}, \frac{1}{3}, \frac{1}{5}, and\ \frac{1}{x}$ are in proportion, then the value of 'x' will be : **Dec-2017**

(a) $\frac{15}{2}$ (b) $\frac{6}{5}$ (c) $\frac{10}{3}$ (d) $\frac{5}{6}$

Solution : If $\frac{1}{2}, \frac{1}{3}, \frac{1}{5}, and\ \frac{1}{x}$ are in proportion, then, product of extremes= product of means

$\frac{1}{2}\times\frac{1}{x}=\frac{1}{3}\times\frac{1}{5}$

$\frac{1}{2x}=\frac{1}{3}$

2x=15

X=15/2

10. The mean proportional between 24 and 54 is : **May-2018**

(a) 33 (b) 34 (c) 35 (d) 36

Solution:

Mean proportion b= $\sqrt{ac}$

=$\sqrt{24\times54}$

=$\sqrt{1296}$

=36

RATIO

11. If p : q is the sub-duplicate ratio of $p-x^2$: $q-x^2$, then x^2 is : **Nov – 2006, May 2018**

(a) $\frac{p}{p+q}$ (b) $\frac{q}{p+q}$ (c) $\frac{qp}{p-q}$ (d) None

Solution: Sub duplicate ratio of $(p-x^2)$: $(q-x^2)=\sqrt{p-x^2}:\sqrt{q-x^2}$

P:q=$\sqrt{p-x^2}:\sqrt{q-x^2}$

$\frac{p}{q}=\frac{\sqrt{p-x^2}}{\sqrt{q-x^2}}$

An squaring both side

$\frac{p^2}{q^2}=\frac{p-x^2}{q-x^2}$

$p^2(q-x^2)=q^2(p-x^2)$

$p^2q-q^2x^2=q^2p-q^2x^2$

$pq-q^2p=p^2x^2-q^2x^2$

$Pq(p-q)=(p^2-q^2)x^2$

$Pq(p-q)=(p+q)(p-q)x^2$

$x^2=\frac{pq(p-q)}{(p+q)(p-q)}$

$x^2=\frac{pq}{(p+q)}$

12. If $\frac{p}{q}=-\frac{2}{3}$ then the value of $\frac{2p+q}{2p-q}$ is : **June - 2009**

(a) 1 (b) -1/7 (c) 1/7 (d) 7

Solution:

$$\frac{p}{q}=\frac{-3}{3}\Rightarrow P=\frac{-2q}{3} \quad = \frac{2p+q}{2p-q}\Rightarrow\frac{2\left(\frac{-2q}{3}\right)+q}{2\left(\frac{2q}{3}\right)-q}\Rightarrow\frac{\frac{4q}{3}+q}{\frac{-4q}{3}-q}$$

$$\Rightarrow\frac{\frac{-4q+3q}{3}}{\frac{-4q-3q}{3}}\Rightarrow\frac{\frac{-q}{3}}{\frac{-7q}{3}}\Rightarrow\frac{-q}{3}\times\frac{3}{-7q} \qquad =\frac{1}{7}$$

13. If A : B = 2 : 5, then (10A + 3B): (5A + 2B) is equal to **Dec - 2010**

(a) 7:4 (b) 7:3 (c) 6:5 (d) 7:9

Solution: A=2

B = 5

$$\frac{10A+3B}{5A+2B}=\frac{10.2+3.5}{5.2+2.5}\Rightarrow\frac{35}{20}$$

14. The ratio Compounded of 4 : 5 and sub-duplicate ratio of "a" : 9 is 8 : 15 Then Value of "a" is : **Dec-2011**

(a) 2 (b) 3 (c) 4 (d) 5

Solution: $\frac{8}{15}=\frac{4}{5}\times\frac{\sqrt{a}}{\sqrt{9}}\Rightarrow\sqrt{a}=\frac{8\times5\times3}{4\times15}=2\Rightarrow a=4$

15. The triplicate ratio of 4 : 5 is: **June-2013**

(a) 125 : 64 (b) 16 : 25 (c) 64 : 125 (d) 120 : 46

Solution: the triplicate ratio of $4:5=4^3:5^3$

=64:125

16. If x : y = 2: 3 then (5x + 2y) : (3x – y) = **June - 2014**

(a) 19:3 (b) 16:3 (c) 7:2 (d) 7:3.

Solution:

$\frac{x}{4}=\frac{2}{3}, let, x=2k, y=3k$

$$\frac{5x+2y}{3x-y}=\frac{5.2k+2.3k}{3.2k-3k}=\frac{10k+6k}{3k}$$

$= \frac{16k}{k} = \frac{16}{3} = 16:3$

17. If $15(2p^2 - q^2) = 7pq$, where p and q are positive, then p : q will be: **Dec-2015**

(a) 5 : 6 (b) 5 : 7 (c) 3 : 5 (d) 8 : 3

Solution:

$15(2p^2-q^2) = 7pq$

$\Rightarrow 30p^2-15q^2 = 7pq \Rightarrow 30p^2-7pq-15q^2 = 0$

$\Rightarrow 30p^2-(25-18)pq-15q^{2=0}$

$\Rightarrow 30p^2-25pq+18pq-15q^2=0$

$\Rightarrow 5p(6p-5q)+3q(6p-5a)=0$

$\Rightarrow (6p-5q)(5p+3q)=0$

$6p=5q \quad 5p= -3q$

18. What must be added to each term of the ratio 49 : 68, so that it becomes 3:4? **June-2010**

(a) 3 (b) 5 (c) 8 (d) 9

Solution: $\frac{49+x}{68+x} = \frac{3}{4}$

19. $\frac{3x-2}{5x+6}$ is the duplicate ratio of $\frac{2}{3}$ then find the value of x: **Nov-2018**

(a) 2 (b) 6 (c) 5 (d) 9

Solution: $\frac{3x-2}{5x+6}$ is the duplicate ratio of $\frac{2}{3}$

i.e. $\frac{3x-2}{5x+6} = \frac{2^2}{3^2}$

or $\frac{3x-2}{5x+6} = \frac{4}{9}$

$27x-18=20x+24$

$27x-20x=24+18$

$7x=42$

$X=6$

20. If x : y : z = 7 : 4 : 11 then $\frac{x+y+z}{z}$ is: **Nov-2018**

(a) 2 (b) 3 (c) 4 (d) 5

Solution: If x:y:z=7:4:11

Let x=7k,y=4k,z=11k

$\frac{x+y+z}{2} = \frac{7k+4k+11k}{11k} = \frac{22k}{11k} = 2$

21. if a:b =3:7, then 3a +2b : 4a + 5b = ? **Nov – 2020**

(a) 23:47 (b) 27: 43 (c) 24:51 (d) 29:53

Solution: If a:b=3:7

Let a=3k, b=7k

$\frac{3a+2b}{4a+5b} = \frac{3\times3k+2\times7k}{4\times3k+5\times7k} = \frac{9k+14k}{12k+35k}$

$=$

$\frac{23k}{47k}$

$=23:47$

22. If a:b = 9 : 4, then $\sqrt{\frac{a}{b}} + \sqrt{\frac{b}{a}} = ?$ **Nov – 2020**

(a) 3/2 (b) 2/3 (c) 6/13 (d) 13/6

Solution: If a:b=9:4

Let a=9k,b=4k

$\sqrt{\frac{a}{b}}+\sqrt{\frac{b}{a}}=\sqrt{\frac{9k}{4k}}+\sqrt{\frac{4k}{9k}}$

$=\frac{3}{2}+\frac{2}{3}=\frac{9+4}{6}=\frac{13}{6}$

23. If A : B = 5 : 3, B : C = 6 : 7 and C : D = 14 : 9 then the value of A : B : C : D **July – 2021**

(a) 20 : 14 : 12 : 9 (b) 20 : 9 : 12 : 14 (c) 20 : 9 : 14 : 12 (d) 20 : 12 : 14 : 9

Solution:

(d) We have $\frac{A}{B} = \frac{5}{3}$ and $\frac{B}{C} = \frac{6}{7}$

To make the Bs same, let's multiply $\frac{A}{B} = \frac{5}{3}$ with $\frac{2}{2}$

Now, $\frac{A}{B} = \frac{5}{3} \times \frac{2}{2} = \frac{10}{6}$ and $\frac{B}{C} = \frac{6}{7}$

Also, we have $\frac{C}{D} = \frac{14}{9}$

To make the Cs same, let's multiply $\frac{B}{C} = \frac{6}{7}$ with $\frac{2}{2}$

Therefore, $\frac{B}{C} = \frac{6}{7} \times \frac{2}{2} = \frac{12}{14}$

Now, we have $\frac{A}{B} = \frac{10}{6}; \frac{B}{C} = \frac{12}{14}; \frac{C}{D} = \frac{14}{9}$

Again, to make the Bs same, let's multiply $\frac{A}{B} = \frac{10}{6}$ *with* $\frac{2}{2}$

Therefore, $\frac{A}{B} = \frac{10}{6} \times \frac{2}{2} = \frac{20}{12}$.

So, now we have $\frac{A}{B} = \frac{20}{12}; \frac{B}{C} = \frac{12}{14}; \frac{C}{D} = \frac{14}{9}$

Therefore, A : B : C: D = 20 : 12 : 14 : 9

24. If x: y = 4 : 6 and z : x = 4 : 16 find Y? **June 2022**

(a) 4 (b) 6 (c) 16 (d) 1

Solution:

(b) If x:y = 4:6 and z:x = 4:16find y

⇒ z:x = 1:4

so, y:x= 6:4 and x:z = 4:1

y:x:z = 6:4:1

so, y = 6

STATEMENT TYPE

25. An alloy is to contain copper and zinc in the ratio 9 : 4. The zinc required to melt with 24kg of copper is: **Nov-2006**

(a) $10\frac{2}{3}kg$ (b) $10\frac{1}{3}kg$ (c) $9\frac{2}{3}kg$ (d) 9 kg

Solution: $\frac{9x}{4x} = \frac{24}{p} \quad \Rightarrow P = \frac{24\times4}{9} = \frac{32}{3} = 10\frac{2}{3}Kg$

26. If X Varies inversely as square of Y and given that Y = 2 for X = 1, then the Value of X for Y = 6 will be : **Dec - 2011**

(a) 6 (b) 9 (c) 1/3 (d) 1/9

Solution: $x \times \frac{1}{y^2} \quad \Rightarrow x = \frac{k}{y^2}$

27. Ratio of earnings of A and B is 4 : 7. If the earnings of A increase by 50% and those of B decrease by 25%, the new ratio of their earning becomes 8:7. What is A's earning ? **: Aug - 2007**

(a) ₹ 21,000 (b) ₹ 26,000 (c) ₹ 28,000 (d) Data inadequate

Solution:

$\frac{4x+2x}{7x-1.75x} = \frac{8}{7} \quad \Rightarrow 56x - 13.6x = 28x + 14x$

28. P, Q and R are three cities. The ratio of average temperature between P and Q is 11 : 12 and that between P and R is 9 : 8. The ratio between the average temperature of Q and R is : **Aug-2007**

(a) 22:27 (b) 27 :22 (c) 32 :33 (d) None.

29. ₹ 407 are to be divided among A, B and C so that their shares are in the ratio $\frac{1}{4}:\frac{1}{5}:\frac{1}{6}$. The respective shares of A, B, C are : **Nov-2007**

(a) ₹ 165, ₹ 132, ₹ 110 (b) ₹ 165, ₹ 110, ₹ 132

(c) ₹ 132, ₹ 110, ₹ 165 (d) ₹ 110, ₹ 132, ₹ 165

Solution: $\frac{x}{4}+\frac{x}{5}+\frac{x}{6}=407$

$\Rightarrow \frac{80x+24x+20x}{120}=407 \Rightarrow x=660 \Rightarrow \frac{660}{4},\frac{660}{5},\frac{660}{6} \Rightarrow 165,\ 132,\ 110$

30. If A, B and C started a business by investing ₹ 1,26,000, ₹ 84,000 and ₹ 2,10,000. Sharing profits in ratio of capital If at the end of the year profit is ₹ 2,42,000 then the share of each is: **Dec-2008**

(a) 72,600, 48,400, 1,21,000 (b) 48,400, 1,21,000, 72,600

(c) 72,000, 49,000, 1,21,000 (d) 48,000, 1,21,400, 72,600

Solution: $\frac{A}{B}=\frac{126000}{84000}=\frac{126}{84}$

$\frac{B}{C}=\frac{84000}{210000}=\frac{84}{210}$

A : B : C = 126 : 84 : 210

31. The students of two classes are in the ratio 5 : 7, if 10 students left from each class, the remaining students are in the ratio of 4 :6 then the number of students left in each class is : **June-2010**

(a) 30,40 (b) 25,24 (c) 40,60 (d) 50,70

Solution : $\frac{5x-10}{7x-10}=\frac{4}{6} \Rightarrow 28x-40=30x-60 \Rightarrow 20=2x$

B = 5

$\frac{10A+3B}{5A+2B}=\frac{10.2+3.5}{5.2+2.5} \Rightarrow \frac{35}{20}$

32. In a film shooting, A and B received money in a certain ratio and B and C also received the money in the same ratio. If A gets ₹ 1,60,000 and C gets ₹ 2,50,000. Find the amount received by B.: **June-2011**

(a) ₹ 2,00,000 (b) ₹ 2,50,000 (c) ₹ 1,00,000 (d) ₹ 1,50,000

Solution :

$\frac{A}{B}=\frac{B}{C}$

$\therefore B=\sqrt{160000\times 250000}$

= ₹ 2,00,000

33. Find three numbers in the ratio 1 : 2 : 3, so that the sum of their squares is equal to 504 **Dec-2013**

(a) 6, 12, 18 (b) 3, 6, 9 (c) 4, 8, 12 (d) 5, 10, 15

Solution: Let, the no's x, 2x, 3x

$x^2 + (2x)^2 + (3x)^2 = 504$

$x^2 + 4x^2 + 9x^2 = 504$

$14x^2 = 504$

34. Divide 80 into two parts so that their product is maximum, then the numbers are **Dec-2013**

(a) 25, 55 (b) 35, 45 (c) 40, 40 (d) 15, 65

Solution:

The sum of two No.=80

First No. x

Second No.= (80-x)

Product two No =x. (80-x)

$P=80x-x^2$

w.r.f.(x)

$\frac{dq}{dx}$ =80-2x

$d^2p/dx^2=-2$

For max/manima

dp/dx=0
80-2x=0
2x=80
x=40
x=40 in equation (iii)
d^2p/dx^2= -2 (Negative)
function is maximum at x=40
Numbers are 40,(80-40)
=40,40

35. If the salary of P is 25% lower than that Q and the salary of R is 20% higher than that of Q, the Ratio of the salary of R and P will be : **June-2014**
(a) 5:8 (b) 8:5 (c) 5:3 (d) 3:5

Solution: let, the salary of Q=100
P's Salary =100 - 25: = 75
R's Salary =100 + 20: =120
$\Rightarrow x^2+y^2+2x = 9xy$
$\Rightarrow (x + y)^2 = 9xy$
$\Rightarrow \log (x + y)^2 = \log 9xy$
$\Rightarrow 2 \log(x+y) = 2 \log^3 + \log x + \log y$
$\Rightarrow 2\log(x+y)-2\log^3 = \log^x + \log^y$
$\Rightarrow 2(\log(\frac{x+y}{3})= \log x + \log y$
$\Rightarrow \log \frac{1}{3}(x+4)= \frac{1}{2}(\log x + \log y)$

36. A person has assets worth ₹1,48,200. He wish to divide it amongst his wife, son and daughter in the ratio 3:2:1 respectively. From this assets, the share of his son will be: **June-2014**
(a) ₹ 24,700 (b) ₹ 49,400 (c) ₹ 47,100 (d) ₹ 37,050

Solution: Total Worth of Assets =1,48,200

37. For three months, the salary of a person are in the ratio 2:4:5. If the difference between the product of salaries of the first two months and last two months is ₹ 4,80,00,000; then the salary of the second month will be : **Dec-2014**
(a) ₹ 4,000 (b) ₹ 6,000 (c) ₹ 8,000 (d) ₹ 12,000

Solution:
let, the salary of three months 2x, 4x, 5x
$(4x \times 5x) - (4x \times 2x) = 4,80,00,000$
$20x^2 - 8x^2 = 4,80,00,000$
$12x^2 = 4,80,00,000$
x = 2000

38. X, Y, Z together starts a business, If X invests 3 times as much as Y invests and Y invests two third of what Z invests, then the ratio of capitals of X, Y, Z is **June-2016**
(a) 3:9:2 (b) 6:3:2 (c) 3:6:2 (d) 6:2:3

Solution: X=3y | $y=\frac{2}{3}z$

$\frac{x}{y}=\frac{3}{1}$ | $\frac{y}{z}=\frac{2}{3}$

x : y = 3 : 1 | y : z = 2 : 3
x : y = 6 : 2
x : y : z =6:2

39. A group of 400 soldiers posted at border area had a provision for 31 days. After 28 days 280 soldiers from this group were called back. Find the number of days for which the remaining ration will be sufficient? **Dec 2022**
(a) 3 (b) 6 (c) 8 (d) 10
Solution:

Here, total men=400, No. of days=31
Total No. of unit of food for 400 men in 31 days
=400 × 31=12400unit
Total No. of unit of food for 400 men in 28 days
=400 ×28=11200 unit
Rest food=12400-11200=1200unit
Remain men after 28 days = 400-280=120
No. of days for which the remaining food will be sufficient
$= \frac{Total\ Rest\ food}{No.of\ remaining\ men}$
$= \frac{1200}{120}$
10 days

40. The ratio of number of boys and the number of girls in a school is found to be 15 : 32. How many boys and equal number of girls should be added to bring the ratio to 2/3 ? **Nov – 2020**
(a) 19 (b) 20 (c) 23 (d) 27
Solution: On calculator, we find that 2/3=0.67
Let the number added to each term of the ratio15:32 be x.
Option (a) 19
$\frac{15+19}{32+19} = 0.67$
Therefore, option (a) is the answer

41. In a certain business A and B received profit in a certain ratio B and C received profits in the same ratio. If A gets ₹1600 and C gets ₹2500 then how much does B get? **Jan – 2021**
(a) ₹ 2,000 (b) ₹ 2,500 (c) ₹ 1,000 (d) ₹ 1,500
Solution:
$\frac{A}{B} = \frac{B}{C}$
$B^2 = A \times C$
$B = \sqrt{A \times C} = \sqrt{1600 \times 2500} = 2000$

42. The ratio of two quantities is 15:17. If the consequent of its inverse ratio is 15, then the antecedent is; **Jan – 2021**
(a) 15 (b) $\sqrt{15}$ (c) 17 (d) 14
Solution:
Inverse ratio=$\frac{17}{15}$
Therefore, antecedent=17

43. The salaries of A, B and C are in the ratio 2:3:5. If increments of 15%, 10% and 20% are allowed respectively to their salary, then what will be the new ratio of their salaries? **Jan – 2021, July 2021**
(a) 3 : 3 : 10 (b) 10 : 11 : 20
(c) 23 : 33 : 60 (d) Cannot be determined
Science the ration of the salaries of A,B and C is 2:3:5, let the salaries be 200,300 and 500 respectively.
A's new salary=200 +(15% of 200)=230
B's new salary=300 +(10% of 300)=330
C's new salary=500 +(20% of 500)=600
Therefore, clearly, the new ratio is 23:33:60

44. Incomes of R and S are in the ratio 7:9 and their expenditures are in the ratio 4:5. Their total expenditures is equal to income of R. What is the ratio of their savings? **Dec 2021**
(a) 23:36 (b) 28:41 (c) 31:43 (d) 35:46
Solution: Let the income of R and S be in 7x and 9x respectively, and their expenditures be 4y and 5y respectively.
Savings of R=7x-4y
Savings of S=9x-5y
Also, it is given that their total expenditures is equal to the income of R.

Therefore, 4y+5y=7x

$\rightarrow 9y = 7x$

$\rightarrow x = \frac{9y}{7}$….Eq.(1)

Ratio of their expenditures=$\frac{7x-4y}{9x-5y}$

Putting the value of x= $\frac{9y}{7}$ from Eq. (1)

Above:

$\frac{7\left(\frac{9y}{7}\right)-4y}{9\left(\frac{9y}{7}\right)-5y}$

$= \frac{5y}{\frac{81y}{7} - 5y}$

$= \frac{5y}{\frac{81y-35y}{7}}$

$= \frac{7\times 5y}{46y}$

$= \frac{35}{46}$

45. In a department, the number of males and females are in the ratio 3:2. If 2 males and 5 females join the department, then the ratio becomes 1 : 1. Initially, the number of females in the department is **Dec 2021**

(a) 9 (b) 6 (c) 3 (d) 8

Solution: Let the initial number of males and females be 3x and 2x respectively.

As per the question, $\frac{3x+2}{2x+5} = \frac{1}{1}$

Or 3x +2=2x+5

Or 3x-2x=5-2

Or x=3

Therefore .initial number of fimales=2×3=6

46. If $\sqrt[3]{a} + \sqrt[3]{b} + \sqrt[3]{c} = 0$ then the value of $\left(\frac{a+b+c}{3}\right)^3$ is equal to: **June 2023**

(a) abc (b) 9abc (c) 1/abc (d) 1/9abc

Solution:

If $\sqrt[3]{a} + \sqrt[3]{b} + \sqrt[3]{c} = 0$

$(a)^{1/3}+(b)^{1/3}+(c)^{1/3}=0$

Let $a^{1/3}=x, b^{1/3}=y, c^{1/3}=z$

Then x+y+z+0

And $a=x^3, b=y^3, c=z^3$

Now if x+y+z=0 then $x^3+y^3+z^3=3xyz$

Now $\left(\frac{a+b+c}{3}\right)^3 = \left(\frac{x^3+y^3+z^3}{3}\right)^3 = \left(\frac{3xz}{3}\right)^3$

$=(a^{1/3}.b^{1/3}.c^{1/3})$

$=(abc)^{1/3\times 3}=abc$

47. Given that $\log_{10}x=m+n-1$ and $\log_{10}y=m-n$, the value of $\log_{10}\left(\frac{100x}{y^2}\right)$ expressed in terms of m and n is: **June 2023**

(a) 1-m+3n (b) m-1+3n (c) m+3n+1 (d) m^2-n^2

Solution: Given that $\log_{10}x=m+n-1$ and $\log_{10}y=m-n$, $\log_{10}$

Then $\log_{10}\left(\frac{100x}{y^2}\right) = \log_{10} 100x - \log_{10}y^2$

$= 2+\log_{10}x-2\log_{10}y$

$=2+m+n-1-2(m-n)$

$=2+m+n-1-2m+2n$

$=1-m+3n$

48. The value of $\{\log_6\{3\log_{10}100\}\}$

(a) 1 (b) 2 (c) 10 (d) 100

Solution: $[\log_6\{3\log_{10}100\}] = \log_6\{3\log_{10}10^2\}$

$= \log_6\{3\times2\log_{10}10\}$

$= \log_6\{6\times1\}$

$=\log_6 6$

$=1$

49. ~~If $x=y^a, y=z^b, z=x^c$ then the value of abc is~~

~~(a) 1 (b) 2 (c) 3 (d) 4~~

~~Solution:~~

~~$x=y^a, y=z^b, z=x^c$~~

~~$\log x=\log y^a, \log y=\log z^b, \log z=\log x^c$~~

~~$\log x=a \log y,\ \log y=b \log z\ \log z=c \log x$~~

~~$a=\frac{\log x}{\log y}, b=\frac{\log y}{\log z}, c=$~~

Answer Key																			
1.	d	2.	c	3.	a	4.	a	5.	d	6.	b	7.	a	8.	c	9.	a	10.	d
11.	d	12.	c	13.	a	14.	c	15.	c	16.	b	17.	a	18.	c	19.	b	20.	a
21.	a	22.	d	23.	d	24.	b	25.	a	26.	d	27.	d	28.	b	29.	a	30.	a
31.	c	32.	a	33.	a	34.	c	35.	b	36.	b	37.	c	38.	d	39.	d	40.	a
41.	a	42.	c	43.	c	44.	d	45.	b										

CHAPTER
LOGARITHM

LOG PAST YEAR QUESTIONS

BASIC

1. If log (2a – 3b) = log a – log b, then a = **: May-2007**

(a) $\frac{3b^2}{2b-1}$ (b) $\frac{3b}{2b-1}$ (c) $\frac{b^2}{2b+1}$ (d) $\frac{3b^2}{2b+1}$

Solution: $\log(2a-3b)=\log_a-\log b$

$$\Rightarrow \log_{(2a-3b)} = \log\left(\frac{a}{b}\right) \quad \Rightarrow (2a-3b)=\frac{a}{b} \quad \Rightarrow a=\frac{3b^2}{2b-1}$$

2. log (m + n) = log m + log n, m can be expressed as **: June-2009**

(a) $m=\frac{n}{n-1}$ (b) $m=\frac{n}{n+1}$ (c) $m=\frac{n+1}{n}$ (d) $m=\frac{n+1}{n-1}$

Solution: $\log(m+n)=\log m+\log n$

3. $log_4(x^2+x)-log_4(x+1)=2$. Find x **June-2009**

(a)16 (b) 0 (c) – 1 (d) None of these

Solution: $\log_4(x^2+x)-\log_4(x+1)=2$

$$\frac{\log(x^2+x)}{\log^n}-\frac{\log(x+1)}{\log^4}=2$$

$$\frac{\log(x^2+x)-\log(x+1)}{\log^4}=2 \quad \Rightarrow \log\frac{x^2+x}{x+1}=2.2\log^2 \qquad \log\frac{x^2+x}{x+1}=\log 2^4 \quad \frac{x^2+x}{x+1}=2^4$$

$$\Rightarrow 2^4x+2^4=x^2+x \quad \Rightarrow 16x+16=x^2+x \quad \Rightarrow x^2-15x-16=0 \quad \Rightarrow x^2(16-1)x-16=0$$

$$\Rightarrow x^2-16x+x-16=0 \quad \Rightarrow x(x-16)+1(x-16)=0 \quad \Rightarrow (x-16)(x+1)=0$$

x=16 m-1

4. The value of $2\log x+2\log x^2+2\log x^3+-------+2\log x^n$ will be : **: Dec-2010**

$\frac{n(n+1)\log x}{2}$

(a) (b) n(n+1) log x (c) n^2 log x (d) None of these

Solution : 2 log x+2log x^2+2 log x^3+…….2log x^n $\Rightarrow$ 2[log x+ 2log x+3log x+……+n log ^{n}]

$\Rightarrow$ 2 log x[1+2+3+…….+n] $\Rightarrow$ 2 log n $\frac{n(n+1)}{2}$ $\Rightarrow$ n(n+1) log n

5. Solve : $\left(\frac{\log_{10}x-3}{2}\right)+\left(\frac{11-\log_{10}x}{3}\right)=2$**: Dec-2010**

(a) 10^{-1} (b) 10^2 (c) 10 (d) 10^3

Solution: $\frac{\log_0 x-3}{2}+\frac{(11-\log_0 x)}{3}=2$

$$\frac{3\log_0 x-9+22-2\log_0 x}{6}=2 \Rightarrow \log_0 x+13=12 \quad \Rightarrow \log_0 x=-1 \quad \Rightarrow x=10^{-1}$$

6. Which of the following is true. If $\frac{1}{ab}+\frac{1}{bc}+\frac{1}{ca}=\frac{1}{abc}$**: Dec-2012**

(a) log (ab + bc + ca) = abc (b) $\log\left(\frac{1}{a}+\frac{1}{b}+\frac{1}{c}\right)=abc$

(c) log (abc) = 0 (d) log (a + b + c) = 0

Solution:

$$\frac{1}{ab}+\frac{1}{bc}+\frac{1}{ca}=\frac{1}{abc} \quad \Rightarrow \frac{c+a+b}{abc}=\frac{1}{abc} \quad \Rightarrow \log(a+b+c)=\log 1 \quad \Rightarrow \log(a+b+c)=0$$

7. For what value of x, the equation $\left(\log_{\sqrt{x}}2\right)^2=\log_x 2$ is true?**: June-2013**

(a) 16 (b) 32 (c) 8 (d) 4

Solution: $\left(\log_{\sqrt{x}}{}^{2}\right)^2 = \log^2 x \quad \Rightarrow \left(\frac{\log_2}{\log\sqrt{x}}\right)^2 = \frac{\log^2}{\log x}$

$\Rightarrow \left(\frac{\log_2}{\frac{1}{2}\log x}\right)^2 = \frac{\log^2}{\log x} \quad \Rightarrow \left(\frac{2\log^2}{\log x}\right)^2 = \frac{\log^2}{\log x} \quad \Rightarrow 4\left(\frac{\log^2}{\log x}\right)^2 = \frac{\log^2}{\log x}$

$\Rightarrow 4\left(\frac{\log^2}{\log x}\right)^2 = \frac{\log^2}{\log x} \quad \Rightarrow 4\frac{\log^2}{\log x} = 1 \quad \Rightarrow 4\log^2 = \log x \quad \Rightarrow \log 2^4 = \log x \quad \Rightarrow x = 2^4 = 16$

Solution: $\left(\log_y{}^{x}.\log_z{}^{y}.\log_x{}^{z}\right)^3 = \left(\frac{\log x}{\log y}.\frac{\log y}{\log z}.\frac{\log z}{\log x}\right)^3$

Solution : $x^2 + y^2 = 7xy$
$\Rightarrow x^2+y^2+2x=9xy$
$\Rightarrow (x + y)^2=9xy$
$\Rightarrow \log (x + y)^2 = \log 9xy$
$\Rightarrow 2\log(x+y) = 2\log^3 + \log x + \log y$
$\Rightarrow 2\log(x+y)-2\log^3 = \log^x + \log^y$
$\Rightarrow 2(\log(\frac{x+y}{3}) = \log x + \log y$
$\Rightarrow \log\frac{1}{3}(x+4) = \frac{1}{2}(\log x + \log y)$

8. If $\log x = a+b$; $\log y = a-b$ then $\log\frac{10x}{y^2} =$ _____. **: June-2015, Dec-2014**

(a) 1 – a + 3b (b) a – 1 + 3b (c) a + 3b + 1 (d) 1 – b + 3a

Solution: $\log x = a + b, \quad \log y = a - b \quad \Rightarrow \log\frac{10x}{y^2}$

$= \log 10x - \log y^2$
$\Rightarrow \log 10 + \log x - 2\log y$
$\Rightarrow 1 + a + b - 2a + 2b$

9. The value of $\log(1^3+2^3+3^3+\ldots\ldots n^3)$ is equal to: **: June 2017**

(a) $3\log 1 + 3\log 2 + \ldots\ldots + 3\log n$ (b) $2\log n + 2\log(n + 1) - 2\log^2$

(c) $\log n + \log(n + 1) + \log(2n + 1) - \log 6$ (d) 1

Solution: $\log(1^3+2^3+3^3+\ldots\ldots n^3)$

$= \log\left[\frac{n(n+1)}{2}\right]^2 \quad = 2\log\frac{n(n+1)}{2} \quad = 2\log n + 2\log(n+1) - 2\log^2$

10. The value of $\log_5\left(1+\frac{1}{5}\right) + \log_5\left(1+\frac{1}{6}\right) + \ldots\ldots\ldots + \log_5\left(1+\frac{1}{624}\right) =$ **June 2019**

(a) 2 (b) 3 (c) 5 (d) 0

Solution:

b) If $\log_5\left(1+\frac{1}{5}\right) + \log_5\left(1+\frac{1}{6}\right) + \text{----------} + \log_5\left(1+\frac{1}{624}\right)$

$= \log\left(\frac{6}{5}\right) + \log\left(\frac{7}{6}\right)\log\left(\frac{8}{7}\right) + \text{----------} + \log\left(\frac{625}{624}\right)$

$= \log_5\left(\frac{\cancel{6}}{5} \times \frac{\cancel{7}}{\cancel{6}} \times \frac{\cancel{8}}{\cancel{7}} \times \ldots\ldots\ldots \frac{\cancel{624}}{623} \times \frac{625}{\cancel{624}}\right)$

$= \log_5\left(\frac{625}{5}\right)$

$= \log_5(125) = \log_5 5^3 = 3\log_5 5$

$= 3 \times 1 \quad = 3$

11. If $\log_{10} 3 = x$ and $\log_{10} 4 = y$, then the value of $\log_{10} 120$ can be expressed as **Dec-2021**

(a) x – y + 1 (b) x + y + 1 (c) x + y – 1 (d) 2x + y – 1

12. Find the value of $\log(x^6)$, If $\log(x) + 2\log(x^2) + 3\log(x^3) = 14$. **Dec 2021**

(a) 3 (b) 4 (c) 5 (d) 6

13. Log $\left(\frac{p^2}{qr}\right)$ + log $\left(\frac{q^2}{pr}\right)$ + log $\left(\frac{r^2}{pq}\right)$ is: **June 2022**

(a) pqr (b) 0 (c) 1 (d) None

14. If $\log_{10} 2 = y$ and $\log_{10} 3 = x$, then the value of $\log_{10} 15$ is: **Dec 2022**

(a) x – y + 1 (b) x + y + 1 (c) x – y – 1 (d) y – x + 1

Exchange

15. If $log_{10000}\, x = -\frac{1}{4}$, then x is given by : **: Feb-2007**

(a) 1/100 (b) 1/10 (c) 1/20 (b) None of these

Solution: $log_{10000}\, x = -\frac{1}{4}$

$\Rightarrow x = 1000^{-1/4}$ $\Rightarrow x = \frac{1}{(10000)^{1/4}} = \frac{1}{10^{4/4}}$ $\Rightarrow x = \frac{1}{10}$ =10%

16. If $\log_x y = 100$ and $\log_2 x = 10$, then the value of 'y' is : **: June-2012**

(a) 2^{10} (b) 2^{100} (c) $2^{1,000}$ (d) $2^{10,000}$

Solution:

$\log_x y = 100$ | $\log_2 x = 10$

$y = x^{100}$ | $x = 2^{10}$

$= (2^{10})^{10}$

$= 2^{1000}$

17. If x = $\log_{24}$ 12, y = $\log_{36}$ 24 and z = $\log_{48}$ 36, then xyz + 1 = _____ **: June-2014**

a) 2xy b) 2zx c) 2yz d) 2

Solution: x = $\log_{24}{}^{12}$, y = $\log_{36}{}^{24}$, z = $\log_{48}{}^{36}$

$\Rightarrow$ xyz+1 $\Rightarrow \frac{\log 12}{\log 24} \times \frac{\log 24}{\log 36} \times \frac{\log 36}{\log 48} + 1 \Rightarrow \frac{\log 12}{\log 48} + 1 \Rightarrow \frac{\log 12 + \log 48}{\log 48} \Rightarrow$

$\frac{\log 576}{\log 48} \Rightarrow \frac{\log 242}{\log 48}$

$\Rightarrow 2\ \frac{\log 24}{\log 48}$ $\Rightarrow 2\ \frac{\log 24}{\log 36}\ \frac{\log 36}{\log 48}$ $\Rightarrow 2 \log_{36}{}^{24}\ \log_{48}{}^{36}$ $\Rightarrow$ x y z

18. if $\log_{q-} \sqrt{3} - 1/6$, find the value of Q **Non – 2020**

(a) 9 (b) 81 (c) 27 (d) 3

19. If $\log_a (ab) = x$, then $\log_b (ab)$ is **Jan – 2021**

(a) 1/x (b) $\frac{x}{x+1}$ (c) $\frac{x}{x-1}$ (d) None of these

20. Log$\sqrt{3}$ = 6 base a, then 'a' will be: **June 2022**

(a) $3^{1/12}$ (b) 36 (c) 15 (d) 1

Many log

21. Find the value of $\log_4 9 \cdot \log_3 2$ = **Dec-2017**

(a) 3 (b) 9 (c) 2 (d) 1

22. $log_2 log_2 log_2 16$ = ? **Nov-2018**

(a) 0 (b) 3 (c) 1 (d) 2

23. $\text{Log}_3{}^4 . \text{Log}_4{}^5 . \text{Log}_5{}^6 . \text{Log}_6{}^7 . \text{Log}_7{}^8 . \text{Log}_8{}^9$ equal to: **Dec 2022**

(a) 3 (b) 2 (c) 1 (d) 0

Base Change

24. Find the logarithm of $\frac{1}{64}$ to the base 4 is: **Dec 2018**

(a) 2 (b) – 2 (c) – 3 (d) 3

25. $\frac{1}{\log_{ab}(abc)}+\frac{1}{\log_{bc}(abc)}+\frac{1}{\log_{ca}(abc)}$ is equal to : **: Aug-2007**

(a) 0 (b) 1 (c) 2 (d) -1

Solution= $\frac{\log ab}{\log abc}+\frac{\log bc}{\log abc}+\frac{\log ca}{\log abc}=\frac{\log ab+\log bc+\log ca}{\log abc}$

$=\frac{\log ab.bc.ca}{\log abc}=\frac{2\log abc}{\log abc}=2$

Solution: 2^{64}

taking log = 64 $\log^2$ = 64×0.30103 = 19.26 = 20digits.

Solution:

$=\frac{\frac{\log^8}{\log^3}}{\frac{\log^{16}}{\log^9}\frac{\log^{10}}{\log^4}}=\frac{\frac{3\log^2}{\log^3}}{\frac{4\log^2}{2\log^3}\times\frac{\log^{10}}{2\log^2}}=\frac{3\times2\times2\log^2}{4\log^{10}}=\frac{3\times2\times2\log^2}{4\log^{10}}\Rightarrow 3\log_{10}2$

26. If x = 1 + $\log_p$ qr, y = 1 + $\log_q$ rp and z = 1 + $\log_r$ pq then the value of $\frac{1}{x}+\frac{1}{y}+\frac{1}{z}$ = _____ **: Dec-2014**

(a) 0 (b) 1 (c) 2 (d) –1

Solution :

x= 1+ $\log_p$qr	y = 1+$\log_q rp$	$1+\log_r pq$
x=1+ $\frac{\log qr}{\log p}$	y= 1+$\frac{\log^{rp}}{\log^q}$	$z=\frac{1+\log^{pq}}{\log^r}$
x= $\frac{\log p+\log qp}{\log p}$	y= $\frac{\log^q+\log^{rp}}{\log^q}$	$z=\frac{\log^r+\log^{pq}}{\log^r}$
$\frac{1}{x}=\frac{\log p}{\log pqr}$	$\frac{1}{y}=\frac{\log^q}{\log^{qrp}}$	$\frac{1}{z}=\frac{\log^r}{\log^{rpq}}$

$\frac{1}{x}+\frac{1}{y}+\frac{1}{z}=\frac{\log^p}{\log^{pqr}}+\frac{\log^q}{\log^{pqr}}+\frac{\log^r}{\log^{pqr}}=\frac{\log^{pqr}}{\log^{pqr}}=1$

27. Value of $\frac{1}{\log_3 60}+\frac{1}{\log_4 60}+\frac{1}{\log_5 60}$ is : **: June-2016**

a) 0 b) 1 (c) 5 d) 60

Solution : $\frac{1}{\log_3 60}+\frac{1}{\log_4 60}+\frac{1}{\log_5 60}=\log_{60}{}^3+\log_{60}{}^4+\log_{60}{}^5=\log_{60}{}^{(3\times4\times5)}$

$=\log\frac{60}{60}=1$

28. $log_2(512):log_{3\sqrt{2}}324=\log\frac{5}{2}:\log 324$ **June-2019**

(a) 128:81 (b) 2 : 3 (c) 3 : 2 (d) None

29. $\log_{0.01}10{,}000$ =? **Nov-2019**

(a) 2 (b) -2 (c) 4 (d) -4.

30. If $\log_4 x+\log_{16} x+\log_{64} x+\log_{256} x=\frac{25}{6}$ then the value of x is **July – 2021**

(a) 64 (b) 4 (c) 16 (d) 2

31. $log_{\sqrt{2}}64$is equal to: **June 2022**

(a) 12 (b) 6 (c) 1 (d) 8

Aloga Formula

32. The value of the expression : $a^{log_a b.\, log_b^c.\, log_c^d.\, log_d t}$ **Feb 2007, May-2018**

(a) t (b) abcdt (c) (a + b + c + d + t) (d) None

Solution: $a^{\log_a b.\log_b^c.\log_c^d.\log_d t}$

$$\Rightarrow a\times\frac{\log^b}{\log^a}\times\frac{\log^c}{\log^b}\times\frac{\log^d}{\log^c}\times\frac{\log^t}{\log^d} \Rightarrow a\frac{\log^t}{\log^a}\Rightarrow a\log a \Rightarrow t$$

Long Solution

33. $\mathbf{7\,log\left(\frac{16}{15}\right)+5\,log\left(\frac{25}{24}\right)+3\,log\left(\frac{81}{80}\right)}$ is equal to : **: Nov-2006**

(a) 0 (b) 1 (c) log 2 (d) log 3

Solution: $7\log\left(\frac{16}{15}\right)+5\log\left(\frac{25}{24}\right)+3\log\left(\frac{81}{80}\right)$

$$\Rightarrow 7(\log 16-\log 15)+5(\log 25-\log 24)+3(\log 81-\log 80)$$

$$\Rightarrow 7[4\log 2-(\log 3+\log 5)]+5[2\log 5-(\log 3+3\log 2)]+3[4\log 3-(4\log 2+\log 5)]$$

$$\Rightarrow 28\log 2-7\log 3-7\log 5+10\log 5-5\log 3-15\log 2+12\log 3-12\log 2-3\log 5 \Rightarrow \log 2$$

34. Find the value of $\left[log_{10}\sqrt{25}-log_{10}(2^3)+log_{10}(4)^2\right]^x$ **: Dec-2009**

(a) x (b) 10 (c) 1 (d) None

Solution:

$$\left[\log_{10}\sqrt{25}-\log_{10}(23)+\log_{10}(4)^2\right]^x$$

$$\Rightarrow\left[\frac{\log 5}{\log 10}-\frac{3\log 2}{\log 10}+\frac{4\log 2}{\log 10}\right]^x \Rightarrow\left[\frac{\log 5-3\log 2+4\log 2}{\log 10}\right]^x \Rightarrow\left[\frac{\log 5+\log 2}{\log 10}\right]^x$$

$$\Rightarrow\left[\frac{\log 10}{\log 10}\right]^x \Rightarrow 1$$

Solution:

$$\frac{\log b}{\log a}+\frac{\log c}{\log a}=0 \quad =\frac{\log b+\log c}{\log a}=0 \quad \text{=log b + log c = 0} \quad \text{= log bc = 0 = log1 = bc =1 b =}\frac{1}{c}$$

Advanced

35. If $x=\frac{e^n-e^{-n}}{e^n+e^{-n}}$, then the value of n is : **: Feb-2008**

(a) $\frac{1}{2}log_e\frac{1+x}{1-x}$ (b) $log_e\frac{1+x}{1-x}$ (c) $log_e\frac{1-x}{1+x}$ (d) $log_e\frac{1-x}{1+x}$

Solution:

$$\frac{x}{1}=\frac{e^{-n}}{e^n+e^{-n}} \Rightarrow\frac{1}{x}=\frac{e^n+e^{-n}}{e^n-e^{-n}} \Rightarrow\frac{1+x}{1-x}=\frac{e^n+e^{-n}+e^n-e^{-n}}{e^n+e^{-n}-e^n+e^{-n}} \Rightarrow\frac{1+x}{1-x}=\frac{2e^n}{2e^{-n}} \Rightarrow\frac{1+x}{1-x}=e^{2n}$$

$\Rightarrow$ Take log

$$\left(\frac{1+x}{1-x}\right)=\log e^{2n}=2n\log e \Rightarrow\log\left(\frac{1+x}{1-x}\right)=2n \Rightarrow\frac{1}{2}\log\left(\frac{1+x}{1-x}\right)=n$$

36. If n = m! where ('m' is a positive integer > 2) then the value of : $\frac{1}{log_2^n}+\frac{1}{log_3^n}+\frac{1}{log_4^n}+\cdots+\frac{1}{log_m^n}$

June-2011

(a) 1 (b) 0 (c) –1 (d) 2

Solution: m is an(+) ve integer, n= $\angle m$

$$\frac{1}{\log_2 n}+\frac{1}{\log_3 n}+\frac{1}{\log_4 n}+.....+\frac{1}{\log_m n} \Rightarrow\log_n{}^2+\log_n{}^3+\log_n{}^4+.....+\log_n{}^m$$

$$\Rightarrow\log_n(2+3+4+.....m) \Rightarrow\log_n\angle m \Rightarrow\log_n{}^n=1$$

37. Given that $\log_{10} x=m+n-1$ and $\log_{10} y=m-n$, the value of $\log_{10}\left(\frac{100x}{y2}\right)$ expressed in term of m and n is: June 2023

(a)1-m+3n (a)1-m+3n (a)1-m+3n (a)1-m+3n

Answer:

(a) Given $\log_{10} x = m + n - 1$ and $\log_{10} y = m - n$

then $\log_{10}\left(\frac{100x}{y^2}\right) = \log_{10} 100x - \log_{10} y^2$

$= \log_{10} 100 + \log_{10} x - 2\log_{10} y$

$= 2 + \log_{10} x - 2\log_{10} y$

$= 2 + m + n - 1 - 2(m - n)$

$= 2 + m + n - 1 - 2m + 2n$

$= 1 - m + 3n$

38. The value of $\{\log_6 \{3\log_{10} 100\}\}$: June 2023

(a)1 (b)2 (c)10 (d)100

Answer:

(a) $[\log_6 \{3\log_{10} 100\}] = \log_6 \{3\log_{10} 10^2\}$

$= \log_6 \{3 \times 2\log_{10} 10\}$

$= \log_6 \{6 \times 1\}$

$= \log_6 6$

$= 1$

Answer Key

1.	-	2.	a	3.	a	4.	b	5.	a	6.	d	7.	a	8.	a	9.	b	10.	b
11.	b	12.	d	13.	b	14.	a	15.	b	16.	c	17.	c	18.	c	19.	c	20.	a
21.	-	22.	c	23.	b	24.	c	25.	c	26.	-	27.	b	28.	-	29.	b	30.	c
31.	a	32.	a	33.	c	34.	c	35.	a	36.	a	37.	a	38.	a				

CHAPTER
QUADRATIC EQUATIONS

BASIC

6. What will be the value of k, if the roots of the equation $(k - 4)x^2 - 2k\,x + (k + 5) = 0$ are equal **Dec 2022**

(a) 18 (b) 20 (c) 19 (d) 21

Solution:Given, Q.E
$(K-4)x^2 - 2kx + (k+5) = 0$
Computing from $ax^2 + bx + c=0$
We get a= (k-4), b= -2k,c=(k+5)
If roots of Q.E. are equal
Then D=0
$B^2-4ac = 0$
$(-2k)^2 -4(k-4)(k+5)=0$
$4k^2-4(k^2+5k-4k-20)=0$
$4k^2-4k^2-4k+80=0$
4k=80
$K= \frac{80}{4}=20$

8. The difference between the roots of the equation $x^2 - 7x - 9 = 0$ is: **Dec-2017**

(a) 7 (b) $\sqrt{85}$ (c) 9 (d) $2\sqrt{85}$

Solution:
If a,β are the roots of Q.E
$X^2-7x-9=0$
Computing from $ax^2+bx+c=0$
We get a=1,b=-7,c=-9
Then $a+\beta=\frac{-b}{a} = \frac{-(-7)}{1} =7$
a. $\beta = \frac{c}{a} = \frac{-9}{1} = -9$
a- $\beta = \sqrt{(a+\beta)^2 - 4a\beta}$
$= \sqrt{(7)^2 - 4 \times (-9)}$
$=\sqrt{49 + 36}$
$=\sqrt{85}$

9. Find the value of K in $3x^2 - 2kx + 5 = 0$ **Nov-2019**
if x = 2

(a) 17/4 (b) -7/14 (c) 4/17 (d) -4/17.

Solution:
$3x^2-2kx+5=0$ {given equation} as it is given x=2
∴ then put in place of x="2"
3×4-2k(2) +5=0
12-4k+5=0
-4k=-12-5
-4k=-17
$k= \frac{17}{4}$

10. If $2x^2 - (a + 6)\,2x + 12a - 0$, then the roots are: **Nov – 2020**

(a) 6 and a (b) 4 and a^2 (c) 3 and 2a (d) 6 and 3a

Solution:

Given Q.E.

$2x^2-(a+6)2x+12a=0$

$2x^2-2ax-12x+12a=0$

$2x(x-a)-12(x-a)=0$

$(x-a)2x-12)=0$

If x-a=0 if 2x-12=0

x=a | 2x=12 | X=6

EQUATION UPTO INFINITY

24. If $b^2 - 4ac$ is a perfect square but not equal to zero than the roots are : **Dec - 2013**

(a) Real and Equal (b) Real, Irrational and Equal

(c) Real, Rational and Unequal (d) Imaginary.

Solution:

If $b^2-4ac\neq0$ and have perfect square i.e. D>0 and have perfect square

So, Roots of Q.E are real unequal and Rational

ROOTS GIVEN FORM EQUATION

First kind Sum of Roots and Product of Roots

Then use x^2 – (sum of roots) x + Product of roots = 0

33. If and $\alpha + \beta = -2$ and $\alpha\,\beta = -3$, then α, β are the roots of the equation, which is : **Dec-2015, May 2018**

(a) $x^2 - 2x - 3 = 0$ (b) $x^2 + 2x - 3 = 0$ (c) $x^2 + 2x + 3 = 0$ (d) $x^2 - 2x + 3 = 0$

Solution:

If $a+\beta=-2$

Q.E. IS

$x^2-(a+\beta)x+a.\beta=0$

$x^2-(-2)x+(-3)=0$

$x^2+2x-3=0$

$\propto, \beta$ Question

36. Roots of equation $2x^2 + 3x + 7 = 0$ are α and β. The value of $\alpha\beta^{-1} + \beta\alpha^{-1}$ is **Dec - 2012**

(a) 2 (b) 3/7 (c) 7/2 (d) –19/14

Given equation

$2x^2+3x+7=0$

On comparing with $ax^2+bx+c=0$

We get , a=2,b=3,c=7

If a,β are the roots of Q.E then

$a+\beta=\frac{-b}{a}=\frac{-3}{2}$

$a.\beta=\frac{c}{a}=\frac{7}{2}$

$a\beta^{-1}+\beta a^{-1}=\frac{a}{\beta}+\frac{\beta}{a}=\frac{a^2+\beta^2}{a\beta}=\frac{(a+\beta)^2-2a\beta}{a\beta}$

$=\frac{\left(\frac{-3}{2}\right)^2-2\left(\frac{7}{2}\right)}{\frac{7}{2}}$

$=\frac{-19}{14}$

37. If α and β be the roots of the quadratic equation $2x^2 - 4x = 1$, the value of $\frac{\alpha^2}{\beta} + \frac{\beta^2}{\alpha}$ is _.

June-2015

(a) -11 (b) 22 (c) -22 (d) 11

Given Q.E.

$2x^2-4x=1$

$2x^2-4x-1=0$

Comparing from

$ax^2+bx+c=0$

we get a=2,b=-4,c=-1

$a+\beta=\frac{-b}{a}=\frac{-(-4)}{2}=2$

$a.\beta=\frac{c}{a}=\frac{-1}{2}$

$\frac{a^2}{\beta}+\frac{\beta^2}{a}=\frac{a^3+\beta^2}{a\beta}$

$=\frac{(a+\beta)^3-3a\beta(a+\beta)}{a\beta}$

$=\frac{(2)^3-3\times(\frac{-1}{2})(2)}{(-\frac{1}{2})}$

$=\frac{8+3}{(-\frac{1}{2})}=\frac{11}{-1/2}$ = -11×2= -22

38. If α, β are the roots of the equation $x^2 + x + 5 = 0$ then $\frac{\alpha^2}{\beta}+\frac{\beta^2}{\alpha}$ is equal to: **June-2017, May 2018**

(a) 16/5 (b) 2 (c) 3 (d) 14/5

Solution:

Given Q.E.

$x^2+x+5=0$

a=1,b=1,c=5

if a & β are the root of Q.E.

$a+\beta=\frac{-b}{a}=\frac{-1}{1}=-1$

$a.\beta=\frac{c}{a}=\frac{5}{1}=5$

$\frac{a^2}{\beta}+\frac{\beta^2}{a}=\frac{a^3+\beta^3}{a\beta}$

$=\frac{(a+\beta)^3-3a\beta(a+b)}{a\beta}$

$=\frac{(-1)^3-3\times5\times(-1)}{5}$

$=\frac{-1+15}{5}$

$=\frac{14}{5}$

39. Let α and β be roots of equation $x^2 - 7x + 12 = 0$. Then the value of $\left(\frac{\alpha^2}{\beta} + \frac{\beta^2}{\alpha}\right)$ will be **Nov-2018**

(a) $\frac{7}{12} + \frac{12}{7}$ (b) $\frac{49}{144} + \frac{144}{49}$ (c) $\frac{91}{12}$ (d) None of the above

Solution:

If a + β are the roots of Q.E.

$x^2 + 7x + 12 = 0$

then $a+\beta = \frac{-b}{a} = \frac{-7}{1} = -7$

$a\times\beta = \frac{c}{a} = \frac{12}{1} = 12$

$\frac{a^2}{\beta} + \frac{\beta^2}{a} = \frac{a^3+\beta^3}{a\beta}$

$= \frac{(a+\beta)^3 - 3a\beta(a+\beta)}{a\beta}$

$= \frac{(-7)^3 - 3\times12\times(-7)}{12}$

$= \frac{-343+252}{12}$

$= \frac{-91}{12}$

40. If roots of equation $x^2 + x + r = 0$ are '$\propto$' and 'β' and $\propto^3 + \beta^3 = -6$. Find the value 'r' ? **June-2011**

(a) -5/3 (b) 7/3 (c) -4/3 (d) 1

Given : 'a' and 'β' are roots of $x^2+x+r=0$

Here a=1, b=1 and c=r

∴ Sum of roots : $a+\beta = \frac{-b}{a} = -1$

and product of roots : $a-\beta = \frac{c}{a} = r$

also,

∴ $a^3 + \beta^3 = (a+\beta)^3 - 3a\beta(a+\beta)$

On putting the values,

$-6 = (-1)^3 - 3r(-1)$

Or r=-5/3

RELATION BETWEEN ROOTS GIVEN

42. Positive value of 'k' for which the roots of equation $12x^2 + kx + 5 = 0$ are in ratio 3:2, is **Dec-2010**

(a) 5/12 (b) 12/5 (c) $\frac{5\sqrt{10}}{2}$ (d) $5\sqrt{10}$

$12x^2+kx+5=0$

Here, a=12;b=k;c=5

Let the roots be 3y and 2y respectively.

We know that:

Sum of roots = $\frac{-b}{a}$

∴ $3y+2y=\frac{-k}{12}$

→ $5y = \frac{-k}{12}$

→ $y = \frac{-k}{12\times5}$

→ y = $\frac{-k}{60}$----------eq.(1)

Also, we know that:
Product of roots = $\frac{c}{a}$
→ 3y×2y=$\frac{5}{12}$

→ $6y^2 = \frac{5}{12}$

→ $y^2 = \frac{5}{12\times6}$

→ $y^2 = \frac{5}{72}$----------eq.(2)

Putting the value of y = $\frac{-k}{60}$ in the above equation:
$\left(-\frac{k}{60}\right)^2 = \frac{5}{72}$
→ $\frac{k^2}{3600} = \frac{5}{72}$

→$k^2 = \frac{5\times3,600}{72}$
→ k= $\sqrt{\frac{5\times3,600}{72}}$
→ k= 15.811
On going through the option on calculator, we find that $5\sqrt{10}\beta$
=15.811. Therefore, answer is option (d)→ $5\sqrt{10}$

43. If one root of Equation $px^2 + qx + r = 0$ is r then other root of the Equation will be : **Dec-2011**

(a) 1/q (b) 1/r (c) 1/p (d) 1/p+q

Solution:
The roots of the equation
Px^2+qx + r = 0 are a & β
Given a= r given,
Sum of roots a +β =$\frac{-b}{a}$
r+ β =$\frac{-q}{p}$----------(1)
Product of roots
a.β=$\frac{c}{a}$
r.p = $\frac{r}{p}$

$\boxed{\beta = \frac{1}{p}}$

44. If the ratio of the roots of the Equation $4x^2 - 6x + p = 0$ is 1:2 then the value if p is **Dec-2011**

(a) 1 (b) 2 (c) – 2 (d) – 1

Solution:
Let the roots of Q.E $4x^2$-6x + p=0 is a,β
Here
a=4, b=-6,c=p
a:β=1:2
a=k, β=2k
a+β=$\frac{-b}{a}$

k+2k=-$\left(\frac{-6}{4}\right)$

3k = $\frac{3}{2}$

k= $\frac{1}{2}$……(1)

and a.β=$\frac{c}{a}$

k.2k=$\frac{p}{4}$

$2k^2$= $\frac{p}{4}$

K= 1/2

∴ 2. $\left(\frac{1}{2}\right)^2 = \frac{p}{4}$

P= 2 × $\frac{1}{4}$ × 4

P= 2

45. Find the condition that one roots is double the other of $ax^2 + bx + c = 0$ **June-2019**

(a) $2b^2 = 3ac$ (b) $b^2 = 3ac$ (c) $2b^2 = 9ac$ (d) $2b^2 > 9ac$

Here, given Q.C. IS

ax^2 +bx + c = 0

given, β =2a

n=2

then the condition is

$\frac{b^2}{ac} = \frac{(n+1)^2}{n}$

$\frac{b^2}{ac} = \frac{(2+1)^2}{2}$

$\frac{b^2}{ac} = \frac{9}{2}$ →$2b^2$ = 9ac

47. If difference between the roots of the equation $x^2 - kx + 8 = 0$ is 4, then the value of k is : **June-2016**

(a) 0 (b) ± 4 (c) $\pm 8\sqrt{3}$ (d) $\pm 4\sqrt{3}$

Solution:

Given Q.E

X^2-kx +8=0

If a and β = -b/a = $\frac{(-k)}{1}$= k

a+ β =k----------(1)

a. β = $\frac{c}{a}$

a. β = $\frac{8}{1}$

a. β = 8----------(2)

Given a- β=4----------(3)

Adding (1) & (3)

a+ β =k

$\frac{a-\beta=4}{2a=k+4}$

a=$\frac{(k+4)}{2}$ in eg. (1)

$\frac{k+4}{2}$ +β=k

β = k- $\frac{(k+4)}{2}$

β = $\frac{2k-k-4}{2}$

β= $\frac{k-4}{2}$

Putting the value of a and β in equation (2)

$\left(\frac{k+4}{2}\right)\left(\frac{k-4}{2}\right)$ =8

$(k+4)(k-4) = 8\times4$
$k^2-16=32$
$k^2=48$
$k = \pm\sqrt{48}$
$k = \pm 4\sqrt{3}$

50. Roots of the equation $3x^2 - 14x + k = 0$ will be reciprocal of each other if: **June - 2010**

(a) $k = -3$ (b) $k = 0$ (c) $k = 3$ (d) $k = 14$.

Since roots are reciprocal of each other,
Roots of equation will be $\infty, \frac{1}{\infty}$
Product of roots will be $1 = +\frac{c}{a}$
$\frac{k}{3} = 1$
$\therefore k=3$

51. The value of p for which the difference between the root of equation $x^2 + px + 8 = 0$ is 2 **Jan – 2021**

(a) ± 2 (b) ± 4 (c) ± 6 (d) ± 8

Solution:
If a and β are roots of Q.E.
$x^2 + px + 8=0$
then $a+\beta = \frac{-b}{a} = \frac{-p}{1} = -p$

$a.\beta = \frac{c}{a} = \frac{8}{1} = 8$

and given $a-\beta=2$
we know that
$(a+\beta)^2 = (a+\beta)^2+4a\beta$
$(a+\beta)^2 = 2^2+4\times8$
$(a+\beta)^2 = 4+32$
$(a+\beta)^2 = 36$
$a+\beta = \pm\sqrt{36}$
$a+\beta = \pm6$

52. If one root is half of the other of a quadratic equation and the difference in roots is a, then the equation is **Dec 2021**

(a) $x^2 + ax + 2a^2 = 0$ (b) $x^2 - 3ax - 2a^2 = 0$ (c) $x^2 - 3ax + 2a^2 = 0$ (d) $x^2 + 3ax - 2a^2 = 0$

Let one root be a, and another root be β.
Since one root is half of the other root, we have $\beta = \frac{1}{2}\times a = \frac{a}{2}$
Since the difference of the roots is a, we have:
$a-\frac{a}{2} = a$
$\rightarrow \frac{2a-a}{2} = a$

$\rightarrow \frac{a}{2} = a$

$\rightarrow a = 2a$

Therefore, $\beta = \frac{a}{2} = \frac{2a}{2} = a$
Sum of roots $=2a+a=3a$
Product of roots $= 2a\times a = 2a^2$
When the roots are known, the equation is given by:
$x^2 -$(sum of roots)x + product of roots $=0$
therefore, the equation is:
$x^2 - 3ax + 2a^2=0$

54. If the second root of the given equation is reciprocal of first root then value of 'k' in the equation $5x^2 - 13x + k = 0$ **June 2022**

(a) 3 (b) 2 (c) 1 (d) 5

Solution:

given q.e $5x^2-13x+k=0$

on comparing $ax^2+bx+c=0$

we get, $a=5, b=-13, c=k$

if one root is reciprocal to other

roots then $c=a$

$k=5$

55. If the roots of the equation $x^2 - px + q = 0$are in the ratio 2 : 3, then: **Dec 2022**

(a) $p^2 = 25q$ (b) $p^2 = 6q$ (c) $6p^3 = 5q$ (d) $6p^2 = 25q$

Solution:

If a & β are the roots of Q.E.

$x^2-px+q=0$

given, a: β=2:3

let a= 2k, β=3k and a =1, b=-p,c=q

we know that:

$a+\beta = \frac{-b}{a}$

$2k + 3k = \frac{-(-p)}{1}$

$5k=p$

$K= \frac{p}{5}$----------(i)

And $a.\beta=\frac{c}{a}$

$2k.3k = \frac{q}{1}$

$6k^2=q$

$6\left(\frac{p}{5}\right)^2=q$[putting k = p/5 from eq.(1)]

$6\frac{p^2}{25}=q$

$6p^2=25q$

NUMBER SYSTEM (FROM HERE NOT IN CMA)

56. The sum of two numbers is 13 and the sum of their squares is 85 Find the numbers. **(Dec 2017)**

(a) 7, 6 (b) 8, 10 (c) 5, 4 (d) None of these

Solution:

Let two numbers are x & y

Given x+y =13 -------(1)

$x^2 +y^2=85$------(2)

from equation (1)

x+y=13

putting y=13-x in equation (2)

$x^2 +(13-x)^2 =85$

$x^2+ 169 + x^2 -26x =85$

$x^2+ 26x+169-85=0$

$x^2+ 2x+84=0$

$2(x^2-13x+42)=0$

$x^2+ 13x+42 =0$

$x^2+ 7x-6x +42 =0$

$x(x-7)-6(x-7)=0$

$(x-7)(x-6)=0$

If x-7=0 if x-6=0

X=7 x-6

Putting x=7 in equation (1) we get y=6

Putting x=6 in equation (2) we get x=7

62. If the square of a number exceeds twice of the number by 15. Then number that satisfies the condition is **Dec 2021**

(a) -5 (b) 3 (c) 5 (d) 15

Solution:
Let the number be x.
As per the question, $x^2-2x=15$
Now, try the options.
Option(a) → -5
LHS = $(-5)^2-2(-5)=25+10=35\neq$RHS
Option (b) → 3
LHS = $(3)^2-2(3)=9-6=3\neq RHS$
Option (C) →5
LHS=$(5)^2-2(5)=25-10=15$=RHS
Therefore ,option (c) is the answer

63. The sum of square of any real positive quantities and its reciprocal is never less than: **July – 2021**

(a) 4 (b) 1 (c) 3 (d) 4

"Real positively quantity" ranges from 0 to infinity
Let the number be 0.1
Now, $0.1^2+\frac{1}{0.1}=10.01$
Let the number be 0.5.
Now, $0.5^2+\frac{1}{0.5}=2.25$
Let the number be 1.
Now, $1^2+\frac{1}{1}=1+1=2$
Let the number be 2
Now. $2^2+\frac{1}{2}=4+\frac{1}{2}=4.5$
Let the number be 3.
Now, $3^2+\frac{1}{3}=9+\frac{1}{3}=9.33$
Clearly, the sum will never be less than 2.

MISCELLANEOUS QUESTIONS

77. $If\ \sqrt[3]{a}+\sqrt[3]{b}+\sqrt[3]{c}=0$ then the value of $(\frac{a+b+c}{3})^3$ is equal to : **June 2023**

(a)abc (b)9abc (c)1/abc (d)1/9abc

78. If α and β are the roots of Quadratic equation $x^2-2\times-3=0$ then the equation whose roots are α+β and α-β is : **June 2023**

(a) $x^2-6x-8=0$ (b) $x^2-6x+8=0$ (c) $x^2+6x+8=0$ (d) $x^2+6x-8=0$

Answer :

(b) Given Q.E. $X^2-2X-3=0$

$X^2-3X+X-3=0$

$X(X-3)+1(X-3)=0$

$(X-3)(X+1)=0$

If X–3=0 and If X+1=0

X=3 X= –1

Here $\alpha=3$, and $\beta=-1$

New Roots are $(\alpha+\beta)$ & $(\alpha-\beta)$

= [3+(–1)] & [3–(–1)]

= (3 – 1) & (3+1)

= 2 & 4

Sum of Roots (S) = 2 + 4 = 6

Product of Roots (P) = 2×4=8

Q is given by

$x^2 - 5x + p = 0$

$x^2 - 6x + 8 = 0$

79. If α and β are roots of the equation $x^2-(n^2+1)\times+\frac{1}{2}(n^4+n^2+1)=0$. Then the value of $\alpha^2+\beta^2$ is **June 2023**

(a) 2n (b) n^2 (c) $2n^2$ (d) n^3

Answer:

(b) Given, Q.E

$x^2 - (n^2 + 1)x + \frac{1}{2}(n^4 + n^2 + 1) = 0$

On Comparing $ax^2 + bx + c = 0$

We get a = 1, b = $-(n^2 + 1)$, c = $\frac{1}{2}(n^4 + n^2 + 1)$

If α & β are the Root of Q.E

$\alpha + \beta = \frac{-b}{a} = \left|\frac{-(n^2+1)}{1}\right| = (n^2 + 1)$

$\alpha.\beta = \frac{c}{a} = \frac{1}{2}\left|\frac{(n^4+n^2+1)}{1}\right| = \frac{1}{2}(n^4 + n^2 + 1)$

$\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$

$= (n^2 + 1^2) - \cancel{2} \times \frac{1}{\cancel{2}}(n^4 + n2 + 1)$

$= \cancel{n^4} + \cancel{1} + 2n^2 - \cancel{n^4} - n^2 - \cancel{1}$

$= n^2$

80. The solution of cubic equation $x^3-23x^2+142x-120=0$ is given by the triplet : **dec 2023**

(a) (1,10,12) (b) (1,-10,12) (c) (1,-10,-12) (d) (1,10,-12)

Answer :

(a) Given cubic equation

$x^3 - 23x^3 + 142x\text{-}120 = 0$

Option (a) (1,10,12) satisfied the equations

So , option (a) is correct. (By Hits/ Trials)

81. The roots of the equation $x^3 +x^2-x-1=0$ are : **dec 2023**

(a) x=1, x=-1,x=-1 (b)x=1, x=1, x=-1 (c)x=-1, x=-1, x=-1 (d)x=1, x=1, x=1

Answer :

(a) Given equation,

$x^3 + x^2 - x - 1 = 0$

$x^2(x + 1) - 1(x + 1) = 0$

$(x + 1)(x^2 - 1) = 0$

$(x + 1)(x + 1)(x - 1) = 0$

If x+1 = 0 . If x+1= 0 , If x-1 =0

x= –1 , x = –1 , x = 1

The roots of given equation are :

1 , –1 , –1

82. If α and β are the roots of the equation $x^2-4x+1=0$, then value of $\alpha^3 +\beta^3$ will be : **dec 2023**

(a) -76 (b) 76 (c) -52 (d) 52

Answer :

(d) Given , q .e $x^2 - 4x + 1 = 0$

comparing from

$ax^2+bx+c = 0$

we get , a = 1 , b = –4 , c = 1

if α& β are the roots of q.e

$\alpha + \beta = \frac{-b}{a} = -\frac{(-4)}{1} = 4$

$\alpha - \beta = \frac{c}{a} = \frac{1}{1} = 1$

$\alpha^3 + \beta^3 = (\alpha + \beta)^3 - 3\alpha\beta(\alpha + \beta)$

$= (4)^3 - 3 \times 4 \times 1$

= 64 – 12
= 52

Answer Key

1.	-	2.	b	3.	a	4.	d	5.	a	6.	b	7.	-	8.	b	9.	a	10.	a
11.	b	12.	d	13.	a	14.	a	15.	d	16.	b	17.	b	18.	c	19.	c	20.	a
21.	b	22.	b	23.	c	24.	c	25.	-	26.	a	27.	c	28.	b	29.	d	30.	b
31.	a	32.	a	33.	b	34.	b	35.	-	36.	d	37.	c	38.	d	39.	c	40.	a
41.	d	42.	d	43.	c	44.	b	45.	c	46.	d	47.	d	48.	c	49.	a	50.	c
51.	c	52.	c	53.	c	54.	d	55.	d	56.	a	57.	a	58.	b	59.	a	60.	-
61.	a	62.	c	63.	b	64.	c	65.	c	66.	c	67.	c	68.	a	69.	b	70.	a
71.	c	72.	c	73.	c	74.	c	75.	b	76.	c	77.							

CHAPTER
TIME VALUE OF MONEY - APPLICATIONS

PAST YEAR QUESTIONS

SIMPLE INTEREST BASICS

1. ₹ 8,000 becomes ₹ 10,000 in two years at simple interest. The amount that will become ₹ 6,875 in 3 years at the same rate of interest is : **Nov-2006**

(a) ₹ 4,850 (b) ₹ 5,000 : (c) ₹ 5,500 (d) ₹ 5,275

Solution :

Simple Interest = P × n × r

2,000 = 8000 × 2 × r r = 0.125 = 12.5% simple

Let required principal is x Amount = principal + P × n × r

6875 = x + x×3×0.125 Solving = x = 5,000

2. A certain sum of money amounts to ₹ 6,300 in two years and ₹ 7,875 in three years nine months at simple interest. Find the rate of interest per annum : **May-2007**

(a) 20% (b) 18% (c) 15% (d) 10%

Solution :

In 2 years amount = 6300

In 3.75 years Amount = 7875

	Amount		**Principal + P × n × r**
In 2 Years	6,300	=	p + p × n × r
In 3.75 Years	7875	=	p + p ×1.75 × r
	1575		1.75 × r

Pr = 900

6300 = P + P × r × 2 6300 = P + 900 × 2 P = 4500 R = 20%

3. What is the rate of simple interest if a sum of money amounts to ₹ 2,784 in 4 years and ₹ 2,688 in 3 years ? **June - 2009**

(a) l% p.a. (b) 4% p.a. (c) 5% p.a. (d) 8% p.a.

Answer:

(b) S.I. = $\frac{P \times R \times T}{100}$

A = P + S.I

A = P + $\frac{P \times R \times T}{100}$

A =P$(1 + \frac{RT}{100})$

A = P$(1 + \frac{4R}{100})$

∴2784 = P$(1 + \frac{4R}{100})$

2,78,400 = 100P +4 PR

And, 2,688 = P$(1 + \frac{3R}{100})$ …….(1)

2,68,000 = 100 P +3 PR …….... (2)

Subtracting (2) from (1), we get

2,78,400 = 100 P +4 PR

2,68,800 = 100 P +3PR

(-) (-) (-)

9,600 = PR

Substituting PR = 9,600 in (1)

2,78,400 = 100 P + 4x 9600

2,78,400 = 100P + 38,400

2,78,000 – 38,400 = 100 P
2,40,000 = 100 P
P = 2400
Now, PR = 9600 & P = 2400
2400 R = 9600
R = $\frac{96000}{2400}$ = 4 % p.a.

4. In how much time would the simple interest on a certain sum be 0.125 times the principal at 10% per annum? **June-2008**

(a) $1\frac{1}{4}$ years (b) $1\frac{3}{4}$ years (c) $2\frac{1}{4}$ years (d) $2\frac{3}{4}$ years

Solution :
S.I = P × t × r
0.125 × P = P × t × 0.10 t = 1.25

5. The S.I. on a sum of money is $\frac{4}{9}$ of the principal and the no. of years is equal to the rate of interest per annum. Find the rate of interest per annum ? **June-2012**

(a) 5% (b) 20/3% (c) 22/7% (d) 6%

Solution :
Simple Interest = $\frac{4}{9} \times principal$ P × t × $\frac{r}{100}$ = $\frac{4}{9}$ × P
here t = r r × $\frac{r}{100}$ = $\frac{4}{9}$ $r^2 = \frac{400}{9}$ r = $\frac{20}{3}$%

6. A sum of money doubles itself in 8 years at simple interest. The number of years it would triple itself is **June-2015**

a) 20 years b) 12 years c) 16 years d) None of these

7. In how many years will a sum of money become four times at 12% p.a. simple interest? **Dec-2015**

a) 18 years b) 21 years c) 25 years d) 28 years

Answer:
(C)Let Principal P = 100
A = 400
S.I. = A- P
= 400 – 100
= 300
R = 12%, T =?
S.I. = $\frac{PRT}{100}$
T = $\frac{S.I.\times 100}{PR} = \frac{300 \times \cancel{100}}{\cancel{100} \times 12}$ =25 years

8. A person lends ₹6,000 for 4 years and ₹8,000 for 3 years at simple interest. If he gets ₹2,400 as total interest, the rate of interest is **Dec-2016**

(a) 5% (b) 4% (c) 6% (d) 7%

Answer:
(a) Given P_1 Rs. 6,000 P_2 Rs, 8,000 , Total S.I. = 2,400
R_1 = R% R_2 = R%
T_1 = 4 years, T_2 = 3 years
Total Interest = $(S.I)_1 + (S.I)_2$
2,400 = $\frac{P_1R_1T_1}{100} + \frac{P_2R_2T_2}{100}$
2,400 = $\frac{6,000 \text{ x } R \text{x} 4}{100} + \frac{8,000 \text{ x } R \text{ x } 3}{100}$
2,400 = 240 R + 240 R
2,400 = 480R ➡ R = $\frac{2,400}{480}$ = 5%

9. A certain sum of money Q was deposited for 5 year and 4 months at 4.5% simple interest and amounted to ₹248, then the value of Q is **Nov-2018**

a) ₹200 b) ₹ 210 c) ₹220 d) ₹240

Answer :

(a) Given Principal (P) = X

R = 4.5%

T = 5 years 4 month

$= 5 \text{ years} + \frac{4}{12} \text{years}$

$= 5 \text{ years} + \frac{1}{3} \text{ years}$

$= 5\frac{1}{3} \text{ years}$

$= \frac{16}{3} \text{ years}$

Amount after T years

$A = P + S.I$

$A = P + \frac{PRT}{100}$

$A = X + \frac{x \times 45 \times 16}{1000 \times 3}$

$248 = X + \frac{240x}{100}$

$248 = X + \frac{24x}{100}$

$\frac{248}{1} \quad \frac{100x + 24x}{100}$

$124x = 24{,}800$

$X = \frac{24800}{124} = 200$

10. The certain sum of money became ₹692/- in 2 yrs and ₹800/- in 5 years then the principal amount is _____ **June-2019**

(a) ₹ 520 (b) ₹ 620 (c) ₹ 720 (d) ₹ 820

Answer :

(b) ∵ The amount of any sum in 5 years = Rs. 800

The amount of same sum in 2 years = Rs. 692

S.I of 3 years = 108

$\therefore$ S.I of 1 year $= \frac{108}{3} = 36$

$\therefore$ S.I of 2 years = 36× 2 = 72

For 2 years

Amount (A) = Rs. 692

S.I = Rs. 72

P = A – S.I

= Rs. 692 – 72

= Rs. 620

11. A sum of money amount to ₹ 6,200 in 2 years and ₹ 7,400 in 3 years as per S.I. then the principal is **June-2019**

(a) ₹ 3,000 (b) ₹ 3,500 (c) ₹ 3,800 (d) None

Answer:

(c) The amount of any sum in 3 years = Rs. 7,400

The amount of same sum in 2 years = Rs. 6,200

S.I of 1 year = Rs. 1,200

S.I of 2 years = Rs. 1,200 × 2

= Rs. 2,400

For 2 years

Amount (A) = Rs. 6,200

S.I = Rs. 2,400

P = A – S.I

= Rs. 6,200 – 2,400

= Rs. 3,800

12. P = ₹ 5,000 R = 15% T = $4^{1/2}$ using $I = \frac{PTR}{100}$ then I will be **June-2019**

(a) ₹ 3,375 (b) ₹ 3,300 (c) ₹ 3,735 (d) None

Answer:

(a) P = Rs.500, R = 15%, T= $4\frac{1}{2}$ years

$= \frac{9}{2}$ years

$I = \frac{P.R.T}{100} = \frac{5,000 \times 15 \times 9/2}{100}$

= Rs.3,375

13. In simple interest if the principal is ₹ 2,000 and the rate and time are the roots of the equation $x^2 - 11x + 30 = 0$ then simple interest is **June-2019**

(a) ₹ 500 (b) ₹600 (c) ₹ 700 (d) ₹800

Answer:

(b) Here, principal (P) = Rs. 2,000

given Equ.

$x^2 - 11x + 30 = 0$

$x^2 - 6x - 5x + 30 = 0$

x (x–6) – 5 (x–6) = 0

(x – 6) (x– 5) = 0

If x– 6 = 0 if x – 5 = 0

x = 6 , x= 5

Rate (R) = 6 % , Time (T) = 5 years

$S.I = \frac{P.R.T}{100} = \frac{2\cancel{000} \times 6 \times 5}{1\cancel{00}}$

=Rs.600

14. A man invests ₹ 12,000 at 10% p.a. and another sum of money at 20% p.a. for one year. The total investment earns at 14% p.a. simple interest the total investment is : **Nov-2019**

(a) ₹ 8,000 (b) ₹ 20,000 (c) ₹ 14,000 (d) ₹ 16,000

Answer :`

(b) Let the another sum of money be Rs. X

So total investment Rs. (12,000 + X)

$\because$ SI = $\frac{P \times R \times T}{100}$

According to ques ,

$\frac{12,000 \times 10 \times 1}{100} + \frac{X \times 20 \times 1}{100} = (12,000 + X) \times \frac{14}{100} \times 1$

1,20,000+20X = 1,68,000 + 14X

6X = Rs. 48,000

X = Rs. 8,000

So total investment

= Rs. (12,000 + X)

= Rs. (12,000 + 8,000)

= Rs. 20,000

15. SI = 0.1225 P at 10% p.a. Find time. **Nov 2019**

(a) 1.25 years (b) 25 years (c) 25 years (d) None

Answer:

(a) We know,

SI = $\frac{P \times R \times T}{100}$

Here, SI=0.125P R= 10%

Put these values in the above formula

0.125 P = P × $\frac{10}{100}$ × T

T = $\frac{0.125P \times 100}{10 \times R}$

T = 1.25 years

16. The difference in simple interest of a sum invested of ₹ 1,500 for 3 years is ₹ 18. The difference in their rates is : **Nov-2019**

(a) 0.4 (b) 0.6 (c) 0.8 (d) 0.10

Answer:

(a) Let the two rates of interest be $r_1, \%, r_2\%$

SI = $\frac{P \times R \times T}{100}$

According to ques,

$(SI)_{1-} (SI)_{2=}$ 18

1500 × $\frac{r_1}{(100)}$ × 3 – 1500 × $\frac{r_2}{(100)}$ × 3 =18

$\frac{4500}{(100)} (r_{1-} r_1)$ = 18

$(r_1 - r_2)$ = 0.4

So, the difference in their rates is 0.4.

17. What sum of money will produce ₹42,800 as an interest in 3 years and 3 months at 2.5% p.a. simple interest? **Nov – 2020**

(a) ₹ 3,78,000 (b) ₹ 5,26,769 (c) ₹ 422,000 (d) ₹ 2,24,000

Answer:

(b) I = Pit

$$P = \frac{I}{it} = \frac{42,800}{0.025 \times \left[3+\frac{3}{12}\right]}$$

$$= 5,26,769$$

18. A certain sum amounted to ₹ 575 at 5% in a time in which ₹ 750 amounted to ₹ 840 at 4%. If the rate of interest is simple, find the sum – **Jan - 2021**

(a) 525 (b) 550 (c) 515 (d) 500

Answer:

(d) First, let's find the time in which Rs. 750 amounted to Rs. 840 at 4% p.a. simple interest.

$$t = \frac{A-P}{Pi} = \frac{840-750}{750 \times 0.04} = 3$$

Now, we'll find P

A = P + 1

A = P + Pit

A = P(1 + it)

$$P = \frac{A}{1+it} = \frac{575}{1+(0.05 \times 3)} = 500$$

19. Two equal amounts of money an deposited in two banks each at 15% p.a. fix 3.5 year in the bank and fix 5 years in the either. The difference between the interest amount from the bank in ₹ 144. Find the sum **Jan - 2021**

(a) ₹ 620 (b) ₹ 640 (c) ₹ 820 (d) ₹ 840

Answer :

(b) I = Pit

Interest from the first bank = I_1 = P × 0.15 × 3.5 = 0.525P

Interest from the second bank = I_2 = P × 0.15 × 0.15 × 5 = 0.75P

Given : $I_2 - I_1 = 144$

0.75 P – 0.525 P = 144

P (0.75 – 0.525) = 144

$$P = \frac{144}{0.75-0.525} = 640$$

20. A man invested one-third of his capital at 7% one fourth at 8% and the remainder at 10%. If the annual income is ₹ 561. The capital is – **Jan - 2021**

(a) ₹ 4,400 (b) ₹ 5,500 (c) ₹ 6,600 (d) ₹ 5,800

Answer:

(c) Let the total capital be x.

One third capital is investment at 7% p.a.

Interest from this investment=$\left(\frac{1}{3} \times X\right) \times 0.07 \times 1 = \frac{0.07X}{3}$

One fourth capital is invested at 8% p.a.

Interest from this investment= $\left(\frac{1}{4} \times X\right) \times 0.08 \times 1 = \frac{0.08X}{4}$

Remaining capital is invested at 10% p.a.

Interest from this investment:

$$\left\{\left(1-\frac{1}{3}-\frac{1}{4}\right)\times X\right\}\times 0.10\times 1$$

$$=\left\{\left(\frac{12-4-3}{12}\right)\times X\right\}\times 0.10$$

$$=\frac{5}{12}X\times 0.10=\frac{0.5X}{12}$$

The total interest is Rs. 561.

Therefore, $\frac{0.07X}{3}+\frac{0.08X}{4}+\frac{0.5X}{12}=561$

$$\frac{(4\times 0.07X)(3\times 0.08X)(0.05X)}{12}=561$$

$0.28X+0.24X+0.50X=561\times 12$

$1.02X=6732$

$X=\frac{6732}{1.02}=6{,}600$

Alternatively, try the options

Option(a)→Rs. 4,400

$\left(\frac{1}{3}\times 4{,}400\times 0.07\times 1\right)+\left(\frac{1}{4}\times 4{,}400\times 0.08\times 1\right)+\left(\frac{5}{12}\times 4{,}400\times 0.10\times 1\right)=374\neq 561$

Option(b)→Rs. 5,500

$\left(\frac{1}{3}\times 5{,}500\times 0.07\times 1\right)+\left(\frac{1}{4}\times 5{,}500\times 0.08\times 1\right)+\left(\frac{5}{12}\times 5{,}500\times 0.10\times 1\right)=467.50\neq 561$

Option(c)→Rs. 6,600

$\left(\frac{1}{3}\times 6{,}600\times 0.07\times 1\right)+\left(\frac{1}{4}\times 6{,}600\times 0.08\times 1\right)+\left(\frac{5}{12}\times 6{,}600\times 0.10\times 1\right)=561=561$

Therefore, option (c) is the answer.

21. A certain sum amounts to ₹ 15.748 in 3 Years at simple interest at r% p.a. The same sum amounts to ₹ 16,510 at (r + 2) % p.a. simple interest in the same time. What is the value of r?

July – 2021

(a) 10% (b) 8% (c)12% (d) 6%

Answer:

(b) We know that A=P(1 + it)

Therefore 15,748 = P(1+3i) ..... Eq. (1)

Also,

16,510 = P(1 + 3(i + 0.02) [Note: We added 0.02 because we Need to take the interest in decimal]

→ 16,510 = P(1 + 3)(i + 0.02)

→ 16,510 = P(1.06 + 3) ..... Eq.(2)

Dividing Eq. (1) by Eq. (2), we have:

$\frac{15,748}{16,510} = \frac{P(1+3i)}{P(1.06+3)}$

$\rightarrow \frac{15,748}{16,510} = \frac{1+3i}{1.06+3i}$

$\rightarrow 0.9538 = \frac{1+3i}{1.06+3i}$

Now, try the options,

Option (a) → 10%

RHS = $\frac{1+3(0.10)}{1.06+3(0.10)} = \frac{1.3}{1.36} = 0.9559 \neq 0.9538$

Option (b) → 8%

$\frac{1+3(0.08)}{1.06+3(0.08)} = \frac{1.24}{1.3} = 0.9538 = LHS$

Therefore, option (b) is the answer.

22. Rahul invested ₹ 70,000 in a bank at the rate of 6.5% p.a. simple interest rate. He received ₹ 85,925 after the end of term. Find out the period for which sum was invested by Rahul. **Dec 2021**

(a) 2 years (b) 3 years (c) 3.5 years (d) 2.5 years

Answer:

(c) Here, Principal (P) = 70,000

Rate (R) = 6.5% p.a.

Amount (A) = 85,925, T = ?

S.I. = A – P

= 85,925 – 70,000

= 15,925

T = $\frac{S.I \times 100}{P \times R} = \frac{15.925 \times 1,000}{70,000 \times 6.5}$

= 3.5 year.

23. An amount is lent at R% simple interest R years and the simple interest amount was one-fourth of the principal amount. Then R is _____ **Dec 2021**

(a) 5 (b) 6 (c) $5^{1/2}$ (d) $6^{1/2}$

Answer:

(a) We know that I= Pit

Given: I=$\frac{P}{4}$; i=$\frac{R}{100}$; t=R

I= Pit

=>$\frac{P}{4}$ = P× $\frac{R}{100}$ ×R

=>$\frac{1}{4} = \frac{R^2}{100}$

=> 100= $4R^2$

$\Rightarrow R^2 = \frac{100}{4} = 25$

$\Rightarrow R = \sqrt{25} = 5$

24. A farmer borrowed ₹ 3,600 at the rate of 15 % simple interest per Annum. At the end of 4 years, he cleared this account by paying ₹ 4,000 and a cow. The cost of the cow is: **Dec 2022**

(a) ₹ 1,000 (b) ₹ 1,200 (c) 1,550 (d) ₹ 1,760

Answer:

(d) Here, Principal (P) Rs. 3,600

R=15%, T= 4 years

$S.I = \frac{PRT}{100} = \frac{3,600 \times 15 \times 4}{100} = 2,160$

Amount (A) = P + S.I

= 3,600 + 2,160

=Rs. 5,760

But he paid Rs. 4,000 and a cow to clear his debt , then

4,000 + the cost of cow = 5,760

The cost of cow = 5,760 – 4,000

= Rs. 1,760

SIMPLE INTEREST APPLICATION

25. If ₹ 1,000 be invested at interest rate of 5% and the interest be added to the principal every 10 years, then the number of years in which it will amount to ₹ 2,000 **Aug-2007, May 2018**

(a) $16\frac{2}{3}$ years (b) $6\frac{1}{4}$ years (c) 16 years (d) $6\frac{2}{3}$ years

Answer:

(a) P= 1,000, R= 5% p.a. s.i, T= 10 years

$SI = \frac{PRT}{100=} = \frac{1000 \times 5 \times 10}{100} = 500$

Amount after 10 years

A = P + S.I = 1,000 + 500 = 1,500

Now after 10 years

P = 1,500, R = 5%

A = 2,000, T = ?

S.I = A — P

= 2,000 — 1,500

= 500

$T = \frac{S.I \times 100}{P \times R} = \frac{500 \times 100}{1,500 \times 5} = \frac{20}{3} = 6\frac{2}{3}$ years

Total time taken = 10 years + $6\frac{2}{3}$ years

= $16\frac{2}{3}$ years0

26. A person borrows ₹ 5,000 for 2 years at 4% p.a. simple interest. He immediately lends to another person at $6\frac{1}{4}$% p.a. for 2 years. Find his gain per year : **Nov-2007, May 2018**

(a) ₹ 112.50 (b) ₹ 125 (c) ₹ 225 (d) ₹ 167.50

Answer:

(b) Case – 1

P = 5,000

R = 4% p.a.s.I.

T = 2 years

S.I = $\frac{PRT}{100} = \frac{5,000 \times 4 \times 2}{100} = 400$

Case – 2

P= 5,000

R=6 $\frac{1}{4}$% = $\frac{25}{4}$% p.a.s.i.

T = 2 Years

S.I = $\frac{PRT}{100} = \frac{5,000 \times 25}{100 \times 4} \times 2$=Rs. 625

His gain = 625-400=225

27. Two equal sums of money were lent at simple interest at 11% p.a. for $3\frac{1}{2}$ years and $4\frac{1}{2}$years respectively. If the difference in interests for two periods was ₹ 412.50, then each sum is: **Feb-2008**

(a) ₹ 3,250 (b) ₹ 3,500 (c) ₹ 3,750 (d) ₹ 4,350

Solution : Ans:(c)

Interest of 4.5 – 3.5 = 1 year is 412.50

P × n × r = 4125.5 P×1×0.11= 412.50 P = 3750

28. If a simple interest on a sum of money at 6% p.a. for 7 years is equal to twice of simple interest on another sum for 9 years at 5% p.a.. The ratio will be : **June-2011**

(a) 2 : 15 (b) 7 : 15 (c) 15 : 7 (d) 1 : 7

29. By mistake a clerk, calculated the simple interest on principal for 5 months at 6.5% p.a. instead of 6 months at 5.5% p.a. if the error in calculation was ₹ 25.40. The original sum of principal was _____. **June-2011**

(a) ₹ 60,690 (b) ₹ 60,960 (c) ₹ 90,660 (d) ₹ 90,690

30. If the Simple Interest on ₹ 1,400 for 3 years is less than the simple interest on ₹ 1,800 for the same period by ₹ 80, then the rate of interest is **Dec-2011**

a) 5.67% b) 6.67% c) 7.20% d) 5.00%

31. Mr. X invests ₹ 90,500 in post office at 7.5 % p.a. simple interest. While calculating the rate was wrongly taken as 5.7% p.a. The difference in amounts at maturity is ₹ 9,774. Find the period for which the sum was invested **Dec-2012**

(a) 7 years (b) 5.8 years (c) 6 years (d) 8 years

32. A certain sum of money was invested at simple rate of interest for three years. If the same has been invested at a rate that was seven percent higher, the interest amount would have been ₹ 882 more. The amount of sum invested is: **Dec-2014**

(a) ₹ 12,600 (b) ₹ 6,800 (c) ₹ 4,200 (d) ₹ 2,800

33. A sum of ₹ 44,000 is divided into three parts such that the corresponding interest earned after 2 years, 3 years and 6 years may be equal. If the rates of simple interest are 6% p.a., 8% p.a. and 6% p.a. respectively, then the smallest part of the sum will be **June-2015**

a) ₹ 4,000 b) ₹ 8,000 c) ₹ 10,000 d) ₹ 12,000

COMPUTING INTEREST MORE THAN ONCE A YEAR

34. A person deposited ₹ 5,000 in a bank. The deposit was left to accumulate at 6% compounded quarterly for the first five years and at 8% compounded semiannually for the next eight years. The compound amount at the end of 13 years is : **Nov-2007**

(a) ₹ 12,621.50 (b) ₹ 12,613.10 (c) ₹ 13,613.10 (d) None.

Solution :

5000 ----------→ ----------→

6% compounded for 5 years 8% compounded semi-annually for 8 years

FV after 5 years = PV $\left(1+\frac{r}{k}\right)^{nk} = 5000\left(1+\frac{0.06}{4}\right)^{5\times4}$ = 6734.275

Invested for another 8 years

FV after another 8 years = PV $\left(1+\frac{r}{k}\right)^{nk}$ = 6734.275 $\left(1+\frac{0.08}{2}\right)^{8\times2}$ = 12613.10

Solution :

He requires 40 lakh after 30 years.Commencing now

FV of Annuity immediate = A $\left[\frac{(1+r)^n-1}{r}\right](1+r)$

40,00,000 = A $\left[\frac{(1+0.03)^{30}-1}{0.03}\right](1+0.03)$

A = $\frac{84077}{1+0.03}$ = 81628

35. Mr. X invests 'P' amount at Simple Interest rate 10% and Mr. Y invests 'Q' amount at Compound Interest rate 5% compounded annually. At the end of two years both get the same amount of interest, then the relation between two amounts P and Q is **Dec-2010**

(a) $P = \frac{41Q}{80}$ (b) $P = \frac{41Q}{40}$ (c) $P = \frac{41Q}{100}$ (d) $P = \frac{41Q}{200}$

Solution :

Mr X SI of 2 years = P × t × r = P × 2 × 0.10 = 0.20 P

Mr. Y CI for 2 years = FV – PV = PV$(1 + r)^n$ – PV = Q $(1 + 0.05)^2$ – Q = 0.1025Q

2 Interests are equal 0.20P = 0.1025Q P = $\frac{0.1025}{0.20}Q = \frac{41}{80}Q$

36. The sum invested at 4%per annum compounded Semi-annually amounts to ₹7,803 at the end of one year, is **Dec-2016**

(a) ₹7,000 (b) ₹7,500 (c) ₹7,225 (d) ₹8,000

Answer :

(b) Let, sum (Principal)

P = Rs. X T= 1 year

R = 4% p.a. C.I.

A = Rs. 7,803

Interst is compounded half yearly (Semi Annually)

Then R = $\frac{4}{2}\% = 2\%$

T = 1 × 2 = 2 half yearly

Amount after T years

A = $P\left(1+\frac{R}{100}\right)^T$

7,803 = $X\left(1+\frac{2}{100}\right)^2$

7,803 = X × $(1.02)^2$

7,803 = X × 1.0404

X = $\frac{7,803}{1.0404} = 7,500$

Sum = Rs. 7,500

37. If ₹ 10,000 is invested at 8% per year compound quarterly, then the value of the value of investment after 2 years is [given $(1+0.2)^8$ =1.171659] **Nov-2018**

a) ₹ 11,716.59 b) ₹10,716.59 c) ₹117.1659 d) None

Answer:

(a) Given P = Rs. 10,000 , R= $\frac{8\%}{4}$

R = 2% Quarterly

T = 2 × 4 = 8 Quarter

Value of Investment after 'T' years

$$A = p\left(1+\frac{R}{100}\right)^{T}$$
$$= 10{,}000\left(1+\frac{2}{100}\right)^{8}$$
$$= 10{,}000\,(1+0.02)^{8}$$
$$= 10{,}000\,(1.02)^{8}$$
$$= 10{,}000 \times 1.171659$$
$$= 11{,}716.59$$

38. A bank pays 10% rate of interest, interest being calculated half yearly. A sum of ₹400 is deposited in bank. The amount at the end of 1 year will be **Nov-2018**

a) ₹440 b) ₹ 439 c) ₹ 441 d) ₹442

Answer :

(a) Given Principal (P) = 400
R = 10% p.a.
T = 1 years

Amount after T years

$$A = P\left(1+\frac{R}{100}\right)^{T}$$
$$= 400\left(1+\frac{10}{100}\right)^{1}$$
$$= 400\,(1.1)$$
$$= 440$$

39. A man deposited ₹8,000 in a bank for 3 years at 5% per annum compound interest, after 3 years he will get **Nov-2018**

a) ₹8,800 b) ₹9,261 c) ₹9,200 d) ₹9,000

Answer:

(b) Given P=8,000
R=5% p.a.
T=3 Years

Amount after 'T' years

$$A = P\left(1+\frac{R}{100}\right)^{T}$$
$$= 8{,}000\left(1+\frac{5}{100}\right)^{3}$$
$$= 8{,}000(1.05)^{3}$$
$$= 8{,}000 \times 1.05 \times 1.05 \times 1.05$$
$$= 9{,}261$$

40. If in two years' time a principal of ₹100 amount to ₹121 when the interest at the rate of r % is compounded annually, then the value of r will be **Nov-2018**

a) 10.5 b) 10% c) 15 d) 14

Answer:

(b) Given, Principal (P) =Rs. 100
Amount (A) = Rs. 121
Rate (R) = r% p.a.
Time (T) = 2 years

The Amount after 'T' years

$$A = P\left(1+\frac{R}{100}\right)^{T}$$
$$121 = 100\left(1+\frac{r}{100}\right)^{2}$$
$$\frac{121}{100} = \left(1+\frac{r}{100}\right)^{2}$$
$$\left(\frac{11}{10}\right)^{2} = \left(1+\frac{r}{100}\right)^{2}$$

on comparing

$$\frac{11}{10} = 1 + \frac{r}{100}$$

$$\frac{11}{10} - 1 = \frac{r}{100}$$

$$\frac{11-10}{10} = \frac{r}{100}$$

$$\frac{1}{10} = \frac{r}{100}$$

$$r = \frac{100}{10}$$

$$r = 10\%$$

41. How much will ₹ 25,000 amount to in 2 years at compound interest if the rates for the successive years are 4% and 5% per year **Nov-2018**

(a) ₹27,300 (b) ₹27,000 (c) ₹27,500 (d) ₹27,900

Answer:

(d) Given R = $\frac{7}{4}$% Quarterly = 1.75 %

T = 1×4 Quarter

= 4 Quarter

Effective Rate (E) = $\left[\left(1 + \frac{R}{100}\right)^T - 1\right] \times 100\%$

$= \left[\left(1 + \frac{1.75}{100}\right)^4 - 1\right] \times 100\%$

$= [(1 + 0.0175)^4 - 1] \times 100\%$

$= [(1.0175)^4 - 1] \times 100\%$

= [1.07185 – 1]×100%

= 0.0718 × 100%

= 7.18%

42. ₹ 8,000/- at 10% per annum interest compounded half yearly will become at the end of one year **Nov-2018**

(a) ₹ 8,800 (b) ₹ 8,820 (c) ₹ 8,900 (d) ₹ 9,600

Answer :

(b) Given P = 8,000, R = $\frac{10}{2}$% = 5% , T= 1×2 h .y, T=2

$A = p\left(1 + \frac{R}{100}\right)^T$

$= 8{,}000\left(1 + \frac{5}{100}\right)^2$

$= 8{,}000\left(\frac{21}{20}\right)^2$

$= 8{,}000 \times \frac{21}{20} \times \frac{21}{20}$

$= 20 \times 21 \times 21$

A = RS. 8,820

43. A sum was invested for 3 years as per C.I. and the rate of interest for first year is 9%, 2nd years is 6% and 3rd years is 3% p.a. respectively. Find the sum if the amount in three years is ₹ 550? **June-2019**

(a) ₹ 250 (b) ₹ 300 (c) ₹ 462.16 (d) ₹ 350

Answer:

(c) $A = P\left(1+\frac{R_1}{100}\right)\left(1+\frac{R_2}{100}\right)\left(1+\frac{R_3}{100}\right)$

R_1=9% , R_2=6% , R_3=3% , A=550

$550= P(1+\frac{9}{100})\left(1+\frac{6}{100}\right)\left(1+\frac{3}{100}\right)$

$550=P(1.09)(1.06)(1.03)$

$P=\frac{550}{1.09\times1.06\times1.03}$

$P=\frac{550}{1.190062}=462.16$

44. If $P\ i^2 = 96$ and R = 8% Compound Annually, P = ? **June-2019**

(a) ₹ 14,000 (b) ₹ 15,000 (c) ₹ 16,000 (d) ₹ 17,000

Answer:

(b) if P i^2 = 96, and R = 8% Compound Annuity, P= ?

$P\ i^2 = 96$

$P(\frac{R}{100})^2 = 96$

$P(\frac{8}{100})^2 = 96$

$P \times (0.08)^2 = 96$

$P \times\ 0.0064 = 96$

$P = \frac{96}{0.0064}$ = Rs. 15,000

45. What will be the population after 3 years when present population is ₹ 25,000 and population increases at the rate of 3% in I year, at 4% in II year and at 5% in III year? **Nov-2019**

(a) ₹ 28,119 (b) ₹ 29,118 (c) ₹ 27,000 (d) ₹ 30,000.

Answer:

(a) When population increases at the rate of r_1% in 1st year, r_2% in IInd year and r_3 % in IIIrd year.

Population after "t" years is given by

$A = P[\ 1 + \frac{r_1}{100}]\ [1 + \frac{r_2}{100}]\ [1 + \frac{r_3}{100}]$

Here, P = Rs.25,000

$r_1 = 3\%,\ r_2 = 4\%, r_3 = 5\%$

Population after 3 years = $25{,}000\ [1 + \frac{3}{100}]\ [1 + \frac{4}{100}]\ [1 + \frac{5}{100}]$

= 25,000(1.03) (1.04) (1.05)

= 28119

46. On what sum will the compound interest at 5% per annum for 2 compounded annually be ₹ 3,280. **Nov–2020**

(a) ₹32,000 (b) ₹16,000 (c) ₹48,000 (d) ₹64,000

Answer :

(a) $CI = P\left[\left(1+\frac{i}{NOCPPY}\right)^{t\times NOCPPY} - 1\right]$

$$P = \frac{CI}{\left[\left(1+\frac{i}{NOCPPY}\right)^{t\times NOCPPY} - 1\right]}$$

$$P = \frac{3,280}{\left[\left(1+\frac{0.05}{1}\right)^{2\times 1} - 1\right]}$$

= 32,000

47. An amount P becomes ₹ 5,100.5 and ₹ 5,203 after second and fourth years respectively at 1% of interest per annum compounded annually. Thus values of P and R are: **Nov – 2020**

(a) ₹4,000 and 1.5 (b) ₹5,000 and 1 (c) ₹6,000 and 2 (d) ₹5,500 and 3

Answer :

(b) Try the options .

Option (a) → Rs. 4,000 and 1.5

This means that P = Rs. 4,000 ; i = 0.015; t = 2

$$A = P\left(1 + \frac{i}{NOCPPY}\right)^{t\times NOCPPY}$$

$$= 4,000\left(1 + \frac{0.015}{1}\right)^{2\times 1}$$

= 4,120.9

Therefore , option (a) cannot be the answer .

Option (b) → Rs. 5,000 ; and 1

Here, we have P = Rs. 5,000 ; i = 0.01 ; t=2

$$A=P\left(1 + \frac{i}{NOCPPY}\right)^{t\times NOCPPY}$$

$$=5,000\left(1 + \frac{0.01}{1}\right)^{2\times 1}$$

= 5,100.5

This satisfies. Now , let's try with 4 years.

$$A = P\left(1 + \frac{i}{NOCPPY}\right)^{t\times NOCPPY}$$

$$= 5,000\left(1 + \frac{0.01}{1}\right)^{4\times 1}$$

= 5,203

48. Find the present value of ₹ 1,00,000 to be enquired after 5 years if the interest rate be 9%. Given that $1.09^5 = 1.5386$. **Nov – 2020**

(a) 78,995.98 (b) 64,994.15 (c) 88,992.43 (d) 93,902.12

Answer :

(b) $P = \frac{A}{\left(1+\frac{i}{NOCPPY}\right)^{t\times NOCPPY}}$

$$P = \frac{1,00,000}{\left(1+\frac{0.09}{1}\right)^{5\times 1}}$$

$$= \frac{1,00,000}{1.5386}$$

= 64,994.15

49. R needs money to pay ₹ 5,00,000 in 10 years. He invested a sum in a scheme at 9% rate of interest compounded half-yearly. How much amount (in ₹) he invested? **Dec 2021**
$(1.046^{20} = 2.41171)$
(a) 3,07,321 (b) 2,70,321 (c) 2,07,321 (d) 3,40,321
Answer:

(c) We have a= Rs.5,00,000; t=10 years; i=0.09; NOCPPY=2; P=?

$$A = P\left(1 + \frac{i}{NOCPPY}\right)^{t \times NOCPPY}$$

$$\Rightarrow P = \frac{A}{\left(1+\frac{i}{NOCPPY}\right)^{t \times NOCPPY}}$$

$$\Rightarrow P = \frac{5,00,000}{\left(1+\frac{0.09}{2}\right)^{10 \times 2}}$$

$$\Rightarrow P = \frac{5,00,000}{(1.045)^{20}}$$

$$\Rightarrow P = \frac{5,00,000}{2.41171}$$

$$\Rightarrow P = 2,07,321$$

50. A company needs ₹ 10,000 in five years to replace as equipment. How much (in ₹) should be invested now at an interest rate of 8% p.a. is order to this equipment? **Dec 2021**
(a) 6,000 (b) 6,805 (c) 10,000 (d) 11,000
Answer:

(b) We have A= Rs.10,000; t=5 years; i=0.08; NOCPPY=1; P=?

$$A = P\left(1 + \frac{i}{NOCPPY}\right)^{t \times NOCPPY}$$

$$\Rightarrow P = \frac{A}{\left(1+\frac{i}{NOCPPY}\right)^{t \times NOCPPY}}$$

$$\Rightarrow P = \frac{10,000}{\left(1+\frac{0.08}{1}\right)^{5 \times 1}} = 6,805$$

51. What is the net present value of piece of property which would be valued at ₹ 2 lakh at the end of 2 years? (Annual rate of increase = 5%) **Nov-2018**
(a) ₹ 1.81 lakh (b) ₹ 2.01 lakh (c) ₹ 2.00 lakh (d) None
Answer:

(a) Let, Present Value (P) = P

A = Rs. 2,00,000
R = 5%
T = 2 Years

$$A = P\left(1 + \frac{R}{100}\right)^{T}$$

$$2,00,000 = P\left(1 + \frac{5}{100}\right)^{2}$$

$$2,00.000 = P\,(1.05)^2$$

$$P = \frac{2,00,000}{(1.05)^2}$$

$$= \frac{2,00,000}{1.1025} = 1.81.405.896$$

= 1.81 Lakhs

52. A sum of money compounded annually becomes ₹ 1,140 in two years and ₹ 1,710 in three years. Find the rate of interest per annum **June 2013**
(a) 30% (b) 40% (c) 50% (d) 60%
Solution :

$FV = PV(1+r)^n$ $1140 = P(1+r)^2$ $1710 = P(1+r)^3$ Divide

$$\frac{P(1+r)^3}{P(1+r)^2} = \frac{1710}{1140}$$

$1+r = 1.5$ $r = 50\%$

53. If the nominal rate of growth is 17% and inflation is 9% for the five years. Let P be the Gross Domestic Product (GDP) amount at the present year then the projected real GDP after 6 years is: **July 2021**

(a) 1.587 P (b) 1.921 P (c) 1.403 P (d) 2.51 P

Answer :

(a) Nominal Rate = Real Rate + Inflation Rate

17 % = Real Rate + 9 %

Real Rate = 17% - 9% = 8 %

Present GDP = P

GDP after 6 years = $P\ (1.08)^6 = 1.5869P \approx 1.587P$

54. At what % rate of compound interest (C.I) will a sum of money become 16 times in four years, if interest is being calculated compounding annually. **June 2010**

(a) r = 100% (b) r = 10% (c) r = 200% (d) r = 20%

Solution :

1----------→2----------→4 ----------→ 8 ----------→16

1 year 1 year 1 year 1 year

$FV = PV(1 + r)^n$ $16x = x(1 + r)^4$ By Trial and error r = 100%

COMPOUND INTEREST IN ₹

55. If the simple interest on a sum of money at 12% p.a. for two years is ₹ 3,600. The compound interest on the same sum for two years at the same rate is : **June-2010**

(a) ₹ 3,816 (b) ₹ 3,806 (c) ₹ 3,861 (d) ₹ 3,860

Solution :

Simple Interest = P.t.r = 3600 $P \times 2 \times 0.12 = 3600$ P = 15,000

2 years compound Interest = FV – PV = PV $(1 + r)^n$ – PV = 15,000 $(1 + 0.12)^2$ – 15,000 = 3816

56. The Partners A & B together lent ₹ 3,903 at 4% p.a interest compounded annually. After a span of 7 years, A gets the same amount as B gets after 9 years. The share of A in the sum of ₹3,903/- would have been : **June-2014**

a) ₹ 1,875 b) ₹ 2,280 c) ₹ 2,028 d) ₹ 2,820

Answer:

(c)

Let Principal of A (P_1)	= Rs. x
Rate R_1	= 4 % p.a.
T_1	= 7 years
Principal of B (P_2)	= Rs. (3,903 – x)
R_2	= 4%
T_2	=9 years
A_2	$=A_2$
$P_1(1+\frac{R_1}{100})^{T_2}$	$=P_2(1+\frac{R_2}{100})^{T_2}$
$x(1+\frac{4}{100})^7$	$=(3{,}903-x)(1+\frac{4}{100})^9$
$\frac{x}{3903-x}$	$=\frac{(1.04)^9}{(1.04)^7}$

$\frac{x}{3903 - x}$ $= (1.04)^2$

$\frac{x}{3903 - x}$ $=1.0816$

$=10816(3,903 - x)$

x $= 4221.4848 - 1.0816x$

x $=4,221.4848$

x+1.0816x $=4,221.4848$

2.0816x $=\underline{4,221.4848}$

x 2,0816

$= 2,028$

x $=2,028$

The share of A

57. The simple interest for a certain sum for 2 years at 10% per annum is ₹ 90. The corresponding compound interest is (in ₹) : **Dec-2015**

a) 99 b) 95.60 c) 94.50 d) 108

Answer :

(C) Let Principal (P) = Rs. X

T = 2 years , R = 10% p.a

S.I = Rs. 90

P $= \frac{S.I. \times 100}{R \times T} = \frac{90 \times 100}{10 \times 2}$ = Rs. 450

Now

$$C.I. = P\left[\left(1 + \frac{R}{100}\right)^T - 1\right]$$

$$= 450\left[\left(1 + \frac{10}{100}\right)^2 - 1\right]$$

$$=450[(1 + 0.1)^2 - 1]$$

$$=450 \times [(1.1)^2 - 1]$$

$$= 450 \times (1.21 - 1)$$

$$= 450 \times 0.21$$

$$= 94.50$$

58. If an amount is kept at simple interest, it earns an interest of ₹ 600 in first two years but when kept at compound interest it earns an interest of ₹ 660 for the same period, then the rate of interest and principal amount respectively are: **June-2016**

a) 20%, ₹ 1,200 b) 10%, ₹ 1,200 c) 20%, ₹ 1,500 d) 10%, ₹ 1,500

Answer :

(c) For 2 years

S.I. = 600 and C.I. = 660

$S.I. = \frac{PRT}{100}$

$600 = \frac{PR \times 2}{100}$

$PR = \frac{600 \times 100}{2}$

$PR = 30000 \Rightarrow P = \frac{30000}{R}$ ——————(1)

$$C.I. = P\left[\left(1 + \frac{R}{100}\right)^T - 1\right]$$

$$660 = \frac{30000}{R}\left[\left(1 + \frac{R}{100}\right)^2 - 1^2\right]$$

$$660 = \frac{30000}{R}\left[\left(1 + \frac{R}{100} + 1\right)\left(1 + \frac{R}{100} + 1\right)\right]$$

$660 = \frac{30000}{\cancel{R}}\left[\left(2+\frac{R}{100}\right)\left(\frac{\cancel{R}}{100}\right)\right]$

$660 = 30000\left[\frac{200+R}{100}\right].\frac{1}{100}$

$660 \times 100 \times 100 = 30000(200+R)$

$200 + R = \frac{660\times\cancel{100}\times\cancel{100}}{\cancel{30000}}$

$200 + R = 220$

$R = 20\%$

$R = 20\%$ in equation (1)

$P = \frac{3000\cancel{0}}{2\cancel{0}} = 1500$

59. If an amount is kept at S.I. it earns an interest of ₹ 600 in first two years but when kept at compound interest it earns an interest of ₹ 660 for the same period, then the rate of interest and principal amount respectively are: **May-2018**

a) 20%, ₹1,200 b) 20%, ₹ 1,500 c) 10%, ₹ 1,200 d) 10%, ₹ 1,500

Answer:

Case – 1

Let P = x, R=R.T=2, S.I = 600

S.I. $= \frac{PRT}{100}$

600 $= \frac{XR2}{100}$

XR $= \frac{600\ x\ 100}{2}$

XR = 30,000

X $= [\frac{(30.000)}{R}]$ ----------(1)

Case - 2

P = x, R = R. T = 2. C.I = 660

C.I = P $[\left(1+\frac{R}{100}\right)^2 - 1]$

$660 = \left(\frac{30,000}{R}\right)\left[\left(1+\frac{R}{100}\right)^2-(1)^2\right]$

$660 = \frac{30,000}{R}\ [(1+\frac{R}{100}+1)(1+\frac{R}{100})-1]$

$660 = \frac{30,000}{R}\times\left(2+\frac{R}{100}\right)\times\frac{R}{100}$

$\frac{660}{300} = 2+\frac{R}{100}$

$\frac{R}{100} = \frac{660}{300} - 2$

$\frac{R}{100} = \frac{660-600}{300}$

$\frac{R}{100} = \frac{60}{300}$

$R = \frac{60\times100}{300} = 20\%$

Putting R = 20% in

$X = \frac{30,000}{20}$

X = Rs.1500

Answer: P=X= Rs.1500

R= 20% p.a

60. If compound interest on a sum for 2 years at 4% per annum is ₹ 102, then the simple interest on the same sum for the same period at the same rate will be **Nov-2018**

a. ₹ 99 b. ₹ 101 c. ₹100 d ₹95

Answer:

(c) Given T = 2 Years

C.I. = Rs. 102
R = 4%
P = ?

C.I. = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right]$
102 = $P\left[\left(1+\frac{4}{100}\right)^{2}-1\right]$
102 = $P\left[(1.04)^{2}-1\right]$
102 = $P\left[1.0816-1\right]$
102 = $P\ (0.0816)$
P = $\frac{102}{0.0816}$ = 1,250

Now, S.I. = $\frac{PRT}{100}=\frac{1{,}250\times4\times2}{100}=\frac{10{,}000}{100}=Rs.100$

61. A man invests an amount of ₹ 15,860 in the names of his three sons A, B and C in such a way that they get the same amount after 2, 3 and 4 years respectively. If the rate of interest is 5%, then the ratio of the amount invested in the name of A, B and C is **Nov-2018**

a. 6: 4: 3 b. 3: 4: 6 c. 30: 12: 15 d. None

Answer:

(a) Total Amount invested = Rs. 15,860
Amount invested into three persons (Son's) A, B, C.

Let,
Amount invest in the Name of A = Rs. x
Amount invest in the Name of B = Rs. y
Amount invest in the Name of C = Rs. Z

Then

Case – 1 For A

P_1 = Rs. x, $R_{1=}$ 5%, $T_{1=2\ Years}$

$(S.I)_{1=}\frac{P_{1R_1T_1}}{100}=\frac{x\times5\times2}{100}=\frac{10x}{100}$

Case – 2 For B

$P_{2=Rs.Y}$, $R_{2=5\%}$, T_2 = 3 Years

$(S,I)_{2=}\frac{P_{2R\,2\,T_2}}{100}=\frac{x\times5\times3}{100}=\frac{15x}{100}$

Case – 3 For C

$P_{3=Rs.Z}$, $R_{3=5\%}$, T_3 = 4 Years

$(S.I)_3=\frac{P_{3R_3T_3}}{100}=\frac{Z\times5\times4}{100}=\frac{20Z}{100}$

Given $(S.I)_1 = (S.I.)_2 = (S.I.)_3$

$\frac{10X}{100}=\frac{15Y}{100}=\frac{20Z}{100}$

=> 10X=15Y=20Z=K
10X=k,15Y=k,20Z=k
X=$\frac{K}{10}$,Y=$\frac{K}{15}$, Z=$\frac{K}{20}$
X:Y:Z=$\frac{K}{10}:\frac{K}{15}:\frac{K}{20}$

Type equation here.

$=\frac{1}{10}:\frac{1}{15}:\frac{1}{20}$ = $60\times\frac{1}{10}$: $60\times\frac{1}{15}$:$60\times\frac{1}{20}$
= 6:4:3

62. A sum of money is lent at C.I. Rate 20% p.a. 2 years. It would fetch ₹ 482 more if the interest is compounded half yearly. The sum is: **Jan - 2021**

(a) ₹ 19,800 (b) ₹ 19,900 (c) ₹ 20,000 (d) ₹ 20,100

63. What is the compound interest (in ₹) on a sum of ₹ 12,600 for $1^{1/2}$ years at 20% per annum if the interest is compounded half yearly? **July – 2021**
(Nearest to a rupee).
(a) 4,271 (b) 4,171 (c) 4,711 (d) 4,117

64. A sum of ₹ 7,500 amounts to ₹ 9,075 at 10% p.a., interest being compounded yearly in a certain time. The simple interest (in ₹) on the same sum for the same time and the same rate is: **July – 2021 An**
(a) 1,000 (b) 1,250 (c) 1,800 (d) 1,500
Answer :

(d) For Compound Interset , we have P = 7,500 ; A = 9,075 ; i = 0.10;

NOCPPY = 1 ; t =?

We know that $A = P\left(1 + \frac{i}{NOCPPY}\right)^{t \times NOCPPY}$

$\Rightarrow 9{,}075 = 7{,}500\left(1 + \frac{0.10}{1}\right)^{t \times 1}$

$\Rightarrow (1.10)^t = \frac{9{,}075}{7{,}500} = 1.21$

On calculator , we find that $(1.10)^2 = 1.21$

Therefore , t = 2 years .

Now , for Simple Interest , we have P = 7,500 ; i = 0.10 ; t = 2 years ;

I =?

I = Pit

I = 7,500 × 0.10 ×2 = 1,500

65. A sum of money is put at 20% compound interest rate p.a. At which year the aggregated amount just exceeds the double of the original sum? **Dec 2021**
(a) 6 (b) 5 (c) 4 (d) 3
Answer:

(c) i = 0.20, P = 100, NOCPPY = 1, t = ?

$A = P\left(1 + \frac{i}{NOCPPY}\right)^{t \times NOCPPY}$

Try the options.

Option (a) → 6

$A = 100\left(1 + \frac{0.20}{1}\right)^{6 \times 1} = 298.5894$

Option (b) → 5

$A = 100\left(1 + \frac{0.20}{1}\right)^{5 \times 1} = 248.832$

Option (c) → 4

$A = 100\left(1 + \frac{0.20}{1}\right)^{4 \times 1} = 207.36$

Option (d) → 3

$A = 100\left(1 + \frac{0.20}{1}\right)^{3 \times 1} = 172.8$

Therefore, option (c) is the answer.

66. A certain sum invested at 4% per annum compounded semi-annually amounts to ₹ 1,20,000 at the end of one year. Find the sum: **Nov – 2020**

(a) 1,15,340 (b) 1,10,120 (c) 1,12,812 (d) 1,13,113

Answer :

(a) $A = P\left(1 + \frac{i}{NOCPPY}\right)^{t \times NOCPPY}$

$P = \frac{A}{\left(1+\frac{i}{NOCPPY}\right)^{t \times NOCPPY}}$

$P = \frac{1,20,000}{\left(1+\frac{0.04}{2}\right)^{1 \times 2}}$

$= 1,15,340$

67. Find the compound interest if an amount of ₹ 50,000 is deposited in a bank for one year at the rate of 8% per annum compounded semi-annually. **Nov – 2020**

(a) ₹ 3,080 (b) ₹ 4,080 (c) ₹ 5456 (d) ₹ 7,856

Answer:

(b) $CI = P\left[\left(1 + \frac{i}{NOCPPY}\right)^{t \times NOCPPY} - 1\right]$

$CI = 50,000\left[\left(1 + \frac{0.08}{2}\right)^{1 \times 2} - 1\right]$

$= 4,080$

68. The ratio of principal and the compound interest value for three years (compounded annually) is 216:127 **Nov – 2020**

The rate of interest is:

(a) 0.1567 (b) 0.1777 (c) 0.1667 (d) 0.1588

Answer:

(c) If Principal is Rs. 216, Compound Interest is Rs. 127. Therefore,

Amount =Rs.216 + Rs.127= Rs.343.

$A = P\left(1 + \frac{i}{NOCPPY}\right)^{t \times NOCPPY}$

$343 = 216\left(1 + \frac{i}{1}\right)^{3 \times 1}$

$\frac{343}{216} = (1 + i)^3$

$1.58796 = (1 + i)^3$

Try the options.

Option (a) → 0.1777

RHS = $(1 + 0.1777)^2 = 1.633 = 1.587$

Option (b) → 0.1567

RHS = $(1 + 0.1567)^3 = 1.547 = 1.587$

Option (c) → 0.1666

RHS = $(1 + 0.1666)^3 = 1.587 = LHS$

Therefore, option (c) is the answer.

69. Find the amount of compound interest, if an amount of ₹ 50,000 is deposited in a bank for one year at the rate of 8% per annum compounded semiannually **Jan - 2021**

(a) 3080 (b) 4080 (c) 5456 (d) 7856

Answer:

(b) $CI = P\left[\left(1+\frac{i}{NOCPPY}\right)^{t\times NOCPPY}-1\right]$

$CI = 50{,}000\left[\left(1+\frac{0.08}{2}\right)^{1\times 2}-1\right]$

=4,080

70. The simple on sum at 4% p.a. for 2 years is ₹ 80. Find the CI on the came sum for the same period. **Jan - 2021**

(a) ₹ 81.6 (b) ₹ 80.8 (c) ₹ 83.2 (d) ₹ 82.3

Answer:

(a) I= Pit

$P=\frac{I}{it}=\frac{80}{0.04\times 2}=1{,}000$

$CI= P\left[\left(1+\frac{i}{NOCPPY}\right)^{t\times NOCPPY}-1\right]$

$CI= 1{,}000\left[\left(1+\frac{0.04}{2}\right)^{1\times 2}-1\right]$

= 81.60

DIFFERENCE BETWEEN SI AND CI

71. A compound interest on a sum for 2 years is ₹30 more than the simple interest at the rate of 5% per annum then the sum is **Dec-2016**

(a) ₹11,000 (b) ₹13,000 (c) ₹12,000 (d) ₹15,000

Answear:

(c) Given C.I. – S.I. = 30

T = 2 years

R = 5%

C.I. – S.I = $P\left(\frac{R}{100}\right)2$

30 = $P\left(\frac{5}{100}\right)2$

30 = P(0.05)2

30 = P(0.0025)

$P = \frac{30}{0.0025}$ =Rs. 12,000

72. If the difference between the compound interest compounded annually and simple interest on a certain amount at 10% per annum for two years is ₹ 372, then the principal amount is **Nov-2018**

a. ₹ 37,200 b. ₹ 37,000 c. ₹ 37,500 d. None of the above

Answer:

(a) For two year

C.I. – S.I. = $P\left(\frac{R}{100}\right)^2$

$372 = P\left(\frac{10}{100}\right)^2$

$372 = P\,(0.1)^2$

$P = \frac{372}{(0.1)^2} = \frac{372}{001} \times 100 = 37,200$

73. The difference between CI and SI for 2 years, is 21. If rate of interest is 5% find principal : **Nov-2019**

(a) ₹ 8,400 (b) ₹ 4,800 (c) ₹ 8,000 (d) ₹ 8,200

Answer :

(a) Method 1

Difference between SI and CI for 2 years is given by

$CI - SI = P\left(\frac{R}{100}\right)^2$

$21 = P\left(\frac{5}{100}\right)^2$

$\Rightarrow P = \frac{21 \times 100 \times 100}{5 \times 5} = Rs.\,8400$

Method 2

$CI = P\left[\left(1 + \frac{R}{100}\right)^T - 1\right]$

$CI = P\left[\left(1 + \frac{5}{100}\right)^2 - 1\right]$

$CI = P\,[\,1.1025 - 1]$

$CI = P\,(\,0.1025)$

$CI - SI = 0.1025\,P - 0.1P$

$21 = 0.0025\,P$

$P = Rs.\,\frac{21}{0.0025} = Rs.\,8400$

So principal is Rs. 8400

74. The difference between compound interest and simple interest on a certain sum for 2 years @ 10% p.a. is ₹ 10. Find the sum :

(a) ₹ 1,010 (b) ₹ 1,095 (c) ₹ 1,000 (d) ₹ 990

75. If the difference of S.I and C.I is ₹ 72 at 12% for 2 years. Calculated the amount. **June-2011**

(a) ₹ 8,000 (b) ₹ 6,000 (c) ₹ 5,000 (d) ₹ 7,750.

Solution : Difference $=72 = P(1+r)^n - P - Pnr$ $P(1+0.12)^2 - P - P \times 2 \times 0.12\,P = 5000$

76. On what sum difference between compound interest and simple interest for two years at 7% p.a. interest is ₹ 29.4 **Dec-2013**

(a) ₹ 5,000 (b) ₹ 55,000 (c) ₹ 6,000 (d) ₹ 6,500

Solution :

Rate = 7% p.a., n = 2 years

Difference between S.I and C.I = 29.4

$p\left[(1+r)^n - 1 - nr\right] = 29.4$

$\Rightarrow p\left[(1+0.07)^2 - 1 - 2 \times 0.07\right] = 29.4$

p [1.1449 – 1 – 0.14] = 29.4 p [0.0049] = 29.4 $p = \frac{29.4}{0.0049}$ p = 6000 Ans.

77. A compound interest on a sum for 2 years is ₹30 more than the simple interest at the rate of 5% per annum then the sum is **Dec-2016**

(a) ₹11,000 (b) ₹13,000 (c) ₹12,000 (d) ₹15,000

78. If the difference between the compound interest compounded annually and simple interest on a certain amount at 10% per annum for two years is ₹ 372, then the principal amount is **Nov-2018**

a. ₹ 37,200 b. ₹ 37,000

c. ₹ 37,500 d. None of the above

79. The difference between CI and SI for 2 years, is 21. If rate of interest is 5% find principal : **Nov-2019**

(a) ₹ 8,400 (b) ₹ 4,800 (c) ₹ 8,000 (d) ₹ 8,200

80. What is the difference (in ₹) between the simple interest and the compound interest on a sum of ₹ 8,000 for $2\frac{2}{5}$ years at the rate of 10% p.a. …, when the interest is compounded yearly? **July – 2021**

(a) 135.75 (b) 129.50 (c) 151.75 (d) 147.20

81. The difference between compound interest and simple interest on an amount of ₹ 15,000 for 2 years is ₹ 96. What is the rate of interest per Annum? **Dec 2022**

(a) 9% (b) 8% (c) 11% (d) 10%

EFFECTIVE RATE OF INTEREST

82. The effective rate equivalent to nominal rate of 6% compounded monthly is : **Aug-2007**

(a) 6.05 (b) 6.16 (c) 6.26 (d) 6.07

83. Nominal rate of interest is 9.9% p.a. If interest is Compounded monthly. What will be the effective rate of interest **Dec-2011**

$\left(given\ \left(\frac{4033}{4000}\right)^{12} = 1.1036\ (approx)\right)$?

a) 10.36% b) 9.36% c) 11.36% d) 9.9%

84. The effective rate of interest for one year deposit corresponding to a nominal 7% rate of interest per annum convertible quarterly is **Nov-2018**

a. ₹ 7 % b. ₹ 7.5 % c. ₹ 7.4 % d. ₹ 7.18 %

85. The effective rate of interest does not depend upon **June-2019**

(a) Amount of Principal. (b) Amount of Interest

(c) Number of Conversion Periods (d) None of these

Answer:

(a) The Effective Rate of Interest does not depends upon principal.

86. Find the effective rate of interest on ₹ 10,000 on which interest is payable half yearly at 5% p.a. **Nov-2019**

(a) 5.06% (b) 4% (c) 0.4% (d) 3%

Answer:

(a) Here, R = 5% T = 1 yr

Since interest is payable half yearly

R = $\frac{5}{2}$ % and T = 1 x 2 = 2 year

$\Sigma = [(1 + \frac{R}{100})^T - 1] \times 100$

$\Sigma = \left[\left(1 + \frac{5}{2 \times 100}\right)^2 - 1\right] \times 100$

$\sum = [(1.025)^2 - 1] \times 100$

$\sum = [0.050625] \times 100$

$\sum = 5.0625\%$

$\sum = 5.06\%$ (approx)

87. Find the effective rate of interest at 10% p.a. when interest is payable quarterly. **Nov-2019**

(a) 10.38% (b) 5% (c) 5.04% (d) 4%

Answer:

(a) Here R= 10% T= 1Year

Since interest is payable quarterly

$R = \frac{10\%}{4}$ $T = 1 \times 4$ years

$\sum = [(1 + \frac{R}{100})^T - 1] \times 100$

$\sum = [\left(1 + \frac{10}{4 \times 100}\right)^4 - 1] \times 100$

$\sum = [(1.025)^4 - 1] \times 100$

$\sum = 10.38\%$

88. An amount is lent at a nominal rate of 4.5% per annum compounded quarterly. What would be the gain in rupees over when compounded annually? **Nov – 2020**

(a) 0.56 (b) 0.45 (c) 0.76 (d) 0.85

Answer:

(c) There is an ambiguity in this question. We can determine the gain "in rupees" correctly only when the amount invested is given to us; otherwise, we can only determine the gain in percentage. In this question, however, the amount invested is not given to us. Right now, the rate of interest is 4.5% p.a. compounded quarterly. This means, that effectively, in a year the rate of interest is $E = (1 + \frac{0.045}{4})^{1\times4} - 1 = 4.576\%$.

The question wants to ask us that if the 4.5% p.a. given in the question was compounded annually, what would have been our gain.

So. We can see that if the 4.5% p.a. was compounded annually, we would have gotten 4.5% interest in a year.

However, when this 4.5% p.a. is compounded annually, our effective rate becomes 4.576% p.a. and we get this much interest in a year.

So, gain in interest in a year = 4,576% – 4,5% = 0.076%.

Now, if we consider the principal to be Rs. 1,000, then only the gain in rupees would be 0.076% of Rs.1,000 = Rs. 0.76.

Of course, when such ambiguity will come in the exam, it will not immediately click on your mind to take the principal as Rs.1,000. Do not panic, if this question is ambiguous for you, it is ambiguous for everyone.

89. Which is a better investment 9% p.a. compounded quarterly or 9.1% p.a. simple interest? **Jan - 2021**

(a) 9% compounded (b) 9.1% S.T. (c) Both are same (d) Cannot be said

Answer:

(a) Effective rate of Interest = E = $\left(1+\frac{\text{i}}{\text{NOCPPY}}\right)^{\text{t}\times\text{NOCPPY}}-1$

$=\left(1+\frac{0.09}{4}\right)^{1\times4}-1=9.3085\%$

Since 9.1% p.a. simple interest is less than this, therefore, 9% p.a. compounded quarterly is

a better investment.

90. The effective rate of interest corresponding to a nominal rate of 7% p.a. compounded quarterly is **Jan - 2021**

(a) 7.5% (b) 7.6% (c) 7.7% (d) 7.18%

Answer:

(d) E = $\left(1+\frac{\text{i}}{\text{NOCPPY}}\right)^{\text{t}\times\text{NOCPPY}}-1$

$=\left(1+\frac{0.07}{4}\right)^{1\times4}-1=7.18\%$

91. What 'I' denote the actual rate of interest in decimal, and n denote the number of conversion periods, the formula for computing the effective rate of interest E is given by. **Jan - 2021**

(a) $(1+i)^n$ (b) $(1+i)^n-1$ (c) $1-(1+i)^n$ (d) $(1+i)^{-n}$

Answer:

(b) E = $\left(1+\frac{i}{NOCPPY}\right)^{t\times NOCPPY}-1$

=>E=$(1+i)^n$-1

92. The effective rate of return for 24% per annum convertible monthly is given as: **July – 2021**

(a) 24% (b) 26.82% (c) 18% (d) 24.24%

Answer:

(b) We have i=0.24;NOCPPY=12; t=1 years,E=?

E = $\left(1+\frac{\text{i}}{\text{NOCPPY}}\right)^{\text{t}\times\text{NOCPPY}}-1$

=>E=$\left(1+\frac{0.24}{12}\right)^{1\times12}-1=26.82\%$

93. The effective rate of interest corresponding a nominal rate of 7% p.a. convertible quarterly. **June 2022**

(a) 7% (b) 7.5% (c) 5% (d) 7.18%

Answer:

(d) If Interest is paid Quarterly

R = $\frac{7}{4}\%$ = 1.75%

T = 1 year = 1 × 4 Quarterly

= 4 Quarterly

Effective Rate

E = $\left[(1+\frac{R}{100})^T-1\right]\times100$

= $\left[(1+\frac{1.75}{100})^4-1\right]\times100$

$= [(1 + 0.0175)^4 - 1] \times 100$

$= [(1.0175)^4 - 1] \times 100$

$= [1.0718 - 1] \times 100$

$= 0.0718 \times 100$

$= 7.18\%$

94. The effective annual rate of interest corresponding to normal rate of 6% per annu7m payable half yearly is: **Dec 2022**

(a) 6.06% (b) 6.07% (c) 6.08% (d) 6.09%

Answer:

(d) Given, $R = \frac{6}{2}\% = 3\%$

$R = 3\%, T = 1 \times 2$ half yearly

$T = 2$

Effective Rate of Interest

$E = \left[(1 + \frac{R}{100})^T - 1\right] \times 100\%$

$= \left[(1 + \frac{3}{100})^2 - 1\right] \times 100\%$

$= [1.0609 - 1] \times 100\%$

$= 0.0609 \times 100\%$

$= 6.09\%$

RULE OF 72 & 114

95. Find the numbers of years in which a sum doubles itself at the rate of 8% per annum. **Dec-2008**

(a) $11\frac{1}{2}$ years (b) $12\frac{1}{2}$ years (c) $9\frac{1}{2}$ years (d) $13\frac{1}{2}$ years

Solution : Assuming simple Interest Doubles in $\frac{100}{8} = 12.5$ years

Solution : Doubles in $\frac{\log 2}{\log(1+r)} = \frac{\log 2}{\log(1+0.05)}$ = 14.2 years

96. If a sum triples in 15 yrs at Simple rate of interest, the rate of interest per annum will be : **June-2014**

a) 13.0% b) 13.3% c) 13.5% d) 18.0%

Answer

(b)

Let Principal P	= P
Amount A	= 3P
T	= 15 years
S.I	= A – P
	= 3P – P
	2P
R	$= \frac{S.I \times 100}{P \times T}$
	$= \frac{2P \times 100}{P \times 15}$
	$= \frac{200}{15}$
R	$= \frac{40}{3}$

= 13.3%

97. A sum of money invested of compound interest doubles itself in four years. It becomes 32 times of itself at the same rate of compound interest in **Dec-2014**

a) 12 years b) 16 years c) 20 years d) 24 years

98. A sum of money doubles itself in 10 years. The number of years it would treble itself is : **Feb-2007**

(a) 25 years (b) 15 years (c) 20 years (d) None

Solution :

If S.I assumed

100 --------→200 --------→300 10 years 10 years

Total 20 years If C.I. assumed Rule of 72 Doubles in $\frac{72}{r}$ years

$\frac{72}{r}$ = 10 years r = 7.2%

Assume CI rate 7.2% Rule of 114

Triples in $\frac{114}{r} = \frac{114}{7.2}$ = 15.83 years.

99. The time by which a sum of money is 8 times of itself if it doubles itself in 15 years. **June-2009**

(a) 42 years (b) 43 years (c) 45 years (d) 46 years

Solution :

1 ----------→ 2 ----------→ 4 ----------→8

15 years 15 years 15 years

Assuming Compound Interest Required time 15 + 15 + 15 = 45 years

100. A certain money doubles itself in 10 years when deposited on simple interest. It would triple itself in **Nov-2018**

a) 20 years b) 15 years c) 25 years d) 30 years

Answer:

(a) Case - 1

Let Principal (P)= 100

Amount (A)= 200

R = ?

T = 10 years

S.I. = A - P

= 200 – 100s

= 100

$R = \frac{SI \times 100}{P \times T}$

$= \frac{100 \times 100}{100 \times 10}$

R = 10 %

Case – II

Let Principal (P) = 100

Amount (A) = 300

(T) = ?

R = 10%

S.I. = A – P

= 300 – 100 = 200

$T = \frac{S.I \times 100}{P \times R}$

$= \frac{200 \times 100}{100 \times 10}$ = 20 years

SHORT CUT

10 years 10 years

A → B → C

100 200 300

Total time = 10 years + 10 years = 20 years

WDV

101. The cost of Machinery is ₹ 1,25,000 If its useful life is estimated to be 20 years and the rate of depreciation of its cost is 10% p.a., then the scrap value of the Machinery is **Dec-2010**
(Given that $(0.9)^{20}$=0.1215)
(a) 15,187 (b) 15,400 (c) 15,300 (d) 15,250
Solution : WDV = HC $(1 - r)^n$ = 125000(1 – 0.10)20 = 15187.5 = 125000 × 0.1215 = 15187.5

102. The value of the furniture depreciates by 10% a year, if the present value of the furniture in an office is ₹ 21,870, calculate the value of furniture 3 years ago **Nov-2018**
a. ₹ 30,000 b. ₹ 35,000 c. ₹ 40,000 d. ₹ 50,000

103. The value of scooter is ₹ 10,000 find its value after 7 years if rate of depreciation is 10% p.a. **Nov-2019**
(a) ₹ 4,782.96 (b) ₹ 4,278.69 (c) ₹ 42,079 (d) ₹ 42,000.
Answer:

(a) We know,

$A = P[1 - \frac{R}{100}]^T$

Where A = Scrap Value

P = Present Value

R = Rate of depreciation

T = Time

Here,

P = Rs. 10.000, R = 10%, T = 7 years

$A = 10,000\ [1 + \frac{10}{100})^7$

$A = 10,000\ (0.9)^7$

A = 4782.96

So, value of scooter is Rs. 4782.96 after 7 years.

104. Scrap value of a machine valued at ₹ 10,00,000, after 10 years within depreciation at 10% p.a. : **Nov-2019**
(a) ₹ 3,48,678.44 (b) ₹ 3,84,679.45 (c) ₹ 4,00,000 (d) ₹ 3,00,000
Answer:

(a) We know ,

$A = P\left(1 - \frac{R}{100}\right)^T$

Where A => scrap value after 't' years .

P => Present value R => Rate of depreciation

Here, P = Rs. 10,00,000, R= 10% , T = 10 years

$A = 10,00,000\left(1 - \frac{10}{100}\right)^{10} = \text{Rs. } 348678.44$

105. Present value of scooter is ₹ 7,290 if its value decrease every year by 10% then its value before 3 years is equal to : **Nov-2019**

(a) 10,000 (b) 10,500 (c) 20,000 (d) 20,500

Answer :

(a) Let the value of the scooter be Rs. X . before 3 years

Before three years ,

A (scrap value after 3 year) = Rs. 7,290

R = 10% (dep Rate)

T = 3 years

$A = P\left(1 - \frac{R}{100}\right)^T$

$7,290 = X\left(1 - \frac{10}{100}\right)^3$

X = Rs. 10,000

106. A machine worth ₹ 4,90,740 is depreciated at 15% on its opening value each year. When its value would reduce to ₹ 2,00,75? **Dec 2022**

(a) 5 years 5 months (b) 5 years 6 months

(c) 5 years 7 months (d) 5 years 8 months

Answer:

(b) Here, original value (P) = Rs. 4,90,740

Rate of depreciation (R) = 15%

Scrap value (A) = Rs. 2,00,750

Time (T) = ?

Scrap value after 'T' years

$A=P\left(1 - \frac{R}{100}\right)^T$

$2,00,750 = 4,90,740\left(1 - \frac{15}{100}\right)^T$

$\frac{2,00,750}{4,90,740} = (0.85)^T$

$0.4090 = (0.85)^T$

$(0.85)^{5.5} = (0.85)^T$

We get T =5.5 years

T = 5 year & 6 months

ANNUITY

107. Mr. X Invests ₹ 10,000 every year starting from today for next 10 years suppose interest rate is 8% per annum compounded annually. Calculate future value of the annuity : **Nov-2006**

Given that $(1 + 0.08)^{10} = 2.15892500$]

(a) ₹ 156,454.88 (b) ₹ 1,448,656.25 (c) ₹ 1,56,554.88 (d)None of these

Solution : Ans:(a)

FV of Annuity = $A\left[\frac{(1+r)^n - 1}{r}\right](1 + r)$

= $10,000\ A\left[\frac{(1+0.08)^{10} - 1}{0.08}\right](1 + r) = 14,4865.625 \times (1 + 0.08)$

= 15,6454.875

108. Anshul's father wishes to have ₹ 75,000 in a bank account when his first college expenses begin. How much amount his father should deposit now at 6.5% compounded annually if Anshul is to start college in 8 years hence from now ? **Feb-2008**

(a) ₹ 45,317 (b) ₹ 46,317 (c) ₹ 55,317 (d) ₹ 48,317.

Solution :

He requires 75,000 after 8 years

FV = PV $(1 + r)^n$ 75,000=PV

$(1 + 0.065)^8$ PV =45317

109. Suppose your parent decides to open a PPF(Public Provident Fund) account in a bank towards your name with ₹ 10,000 every year starting from today for next 15 years. When you received and get 8.5% per annum interest rate compounded annually. What is the present value of the annuity? (Give answer in ₹ without any fraction.) **Dec-2015**

(Given P (15,0.085) = 8.304236576)

(a) ₹ 83,042 (b) ₹ 1,66,084 (c) ₹ 9,0101 (d) ₹ 8,30,423

Answer

(c) Annual Installment (A) = Rs. 1000

n = 16 years

R = 8.5% p.a.

i = $\frac{8.5}{100}$ = 0.085

Present Value = A. P(n-1, I) + A

= 10,000.P (15, 0.085) + 10,000

= 83,042.36576 + 10,000

= Rs. 93,042

110. Mr. X invest ₹ 10,000 every year starting from today for next: 10 years suppose interest rate is 8% per annual compounded annually. Calculate future value of the annuity. **May-2018**

(a) ₹ 1,56,454.88 (b) ₹ 1,56,554.88 (c) ₹ 1,44,865.625 (d) None of these

Answer:

(a) Annual Installment (A) = 10,000 R= 8% p.a.c.i.

n = 10 years $A_{(n.1)}$ = ?

i = $\frac{8}{100}$ = 0.08

Future Value of Annuity due

$A_{(n.1)} = \frac{A}{1}[(1 + i)^n]—1](1 + 1)$

$= \frac{10,000}{0.08}[(1 + 0.08)^{10}—1](1+0.08)$

$= \frac{10,000}{0.08}[(1.08)^{10}—1](1.08)$

= 1,56.454.88

111. How much amount is required to be invested every year so as to accumulate ₹ 3,00,000 at the end of 10 years, if interest is compounded annually at 10% **May-2018**

(a) ₹18,823.65 b) ₹18 c) ₹18,828.65 d) ₹18,882.65

Answer:

(a) Annuity(Annual Installment) =A

Future Value $A_{(n.i)}$ = 3,00,000

R = 10%, n = 10 years

I = $\frac{R}{100} = \frac{10}{100}$ = 0.1

$A_{(n.i)} = \frac{A}{i}[1 + i)^n —1]$

$3,00,000 = \frac{A}{0.1}[(1 + 0.1)^{10}—1]$

$3.00,000= \frac{A}{0.1}[1.1)^{10} — 1]$

$$3,00,000 = \frac{A}{0.1}[2.59374 - 1]$$

$$= \frac{A}{0.1} \times 1,59374 \times 10$$

$$3.00,000 = A \times 15,9374$$

$$A = \frac{3,00,000}{15,9374} = \text{Rs. } 18,823.65$$

112. Let a person invest a fixed sum at the end of each month in an account paying interest 12% per year compounded monthly. It the future value of this annuity after the 12^{th} payment is ₹ 55,000 then the amount invested every month is? **June-2019**

(a) ₹ 4,8,37 (b) ₹ 4,637 (c) ₹ 4,337 (d) ₹ 3,337

Answer:

(c) Let A =A

$A_{(n,i)}$=Rs. 55,000

$R = \frac{12\%}{12}$ p.a. = 1% per month

$n=12, i = \frac{R}{100} = \frac{1}{100} = 0.01$

Future Value

$$A_{(n.i)} = \frac{A}{i}[(1+i)^n - 1]$$

$$55,000 = \frac{A}{0.01}[(1+0.01)^{12} - 1]$$

$$55,000 = \frac{A}{0.01}[(1.01)^{12} - 1]$$

$$55,000 = \frac{A}{0.01}[1.126825 - 1]$$

$$55,000 = A \times 12.6825$$

$$A = \frac{55,000}{12.6825}$$

A=4336.68=Rs. 4,337

113. A five year annuity due has periodic cash flow of ₹ 100 each year. If the interest rate is 8% the future value of this annuity is given by: **Nov – 2020**

(a) (₹ 100) × (future value at rate 8% for 5 years) × (0.08)
(b) (₹ 100) × (future value at rate 8% for 5 years) × (1 - 0.08)
(c) (₹ 100) × (future value at rate 8% for 5 years) × (1 + 0.08)
(d) (₹ 100) × (future value at rate 8% for 5 years) × (1/0.08)

Answer :

(c) The formula for Future Value of Annuity Due is :

$$FV = A\left[\frac{\left(1+\frac{i}{NOCPPY}\right)^{t \times NOCPPY} - 1}{\frac{i}{NOCPPY}}\right] \times \left(1 + \frac{i}{NOCPPY}\right)$$

Therefore , clearly , we' ll get Future Value of Annuity Due as follows :

(Rs. 100) × (Future Value at the rate 8% for 5 years) × (1+0.08)

114. A person decides to invest ₹ 1,25000 per year for the next five years in an annuity which gives 5% per annum compounded annually. What is the approx. future value? **Nov – 2020**
(use $1.05^2 = 1.2462$, if needed)

(a) 1,59,535 (b) 6,90,500 (c) 5,90,704 (d) 3,59,535

Answer:

(b) $FV=A\left[\frac{\left(1+\frac{i}{NOCPPY}\right)^{t\times NOCPPY}-1}{\frac{i}{NOCPPY}}\right]$

$FV=1{,}25{,}000\left[\frac{\left(1+\frac{0.5}{1}\right)^{5\times 1}-1}{\frac{0.5}{1}}\right]$

$FV=1{,}25{,}000\left[\frac{(1.05)^5-1}{0.05}\right]$

$FV=1{,}25{,}000\left[\frac{1.2762-1}{0.05}\right]$

Since option (b) is the closest, we'll mark option(b)

115. Which of the following statements is True? (assume that the yearly cash follow? Are identical for both annuities **Nov – 2020**

(a) The present value of annuity due is greater than the present value of ordinary annuity
(b) The present value of ordinary annuity is greater than the present value of annuity due
(c) The future value of an ordinary annuity is greater than the future value of an annuity due
(d) The future value of an annuity due is equal to future value of an ordinary annuity.

Answer:

(a) The present value of an annuity due is greater than the present value of an ordinary annuity.

116. Find the future value of annuity of ₹ 1,000 made annually for 7 year at interest rate of 14% compounded annually(Given that $1.14^7 = 2.5023$) **Jan - 2021**

(a) ₹ 10,730.7 (b) ₹ 5,365.35 (c) ₹ 8,756 (d) ₹ 9892.34

Answer :

(a) $FV = A\left[\frac{\left(1+\frac{i}{NOCPPY}\right)^{t\times NOCPPY}-1}{\frac{i}{NOCPPY}}\right]$

$FV = 1{,}000\left[\frac{\left(1+\frac{0.14}{1}\right)^{7\times 1}-1}{\frac{0.14}{1}}\right]$

$FV = 1{,}000\left[\frac{(1.14)^7-1}{0.14}\right]$

$FV = 1{,}000\left[\frac{25023-1}{0.14}\right]$

$= 10{,}730.7$

117. The future value of annuity of ₹ 2,000 for 5 years at 5% compounded annually is given (in nearest ₹) as: **July – 2021**

(a) 51,051 (b) 21,021 (c) 15,624 (d) 61,254

Answer:

(c) We have A = Rs. 2,000, t = 5 years, i = 0.05, NOCPPY = 1

$FV = A\left[\left[\frac{\left(1+\frac{i}{NOCPPY}\right)^{t\times NOCPPY}-1}{\frac{i}{NOCPPY}}\right]\right]$

$FV = 2{,}000\left[\frac{\left(1+\frac{0.05}{1}\right)^{5\times 1}-1}{\frac{0.05}{1}}\right] = 11{,}051$

Since option (c) is the nearest, we′ll mark option (c).

118. Mr. X wants to accumulated ₹ 50,00,000 at the end of 10 years. Then how much amount is required to be invested every year if interest is compounded annually at 10%? (Given that P(10,0.10) = 15.9374298) **Dec-2021**

(a) ₹ 3, 13, 726.87 (b) ₹ 4, 13, 726.87 (c) ₹ 3, 53, 726.87 (d) ₹ 4, 53, 726.87

Answer:

(a) Given FVAR = Rs. 50,00,000, t = 10 years, i = o.10, NOCPPY = 1;

A = ?

$$FVAR = A\left[\frac{\left(1+\frac{i}{NOCPPY}\right)^{t\times NOCPPY}-1}{\frac{i}{NOCPPY}}\right]$$

$$\rightarrow \quad A = \left[\frac{FVAR}{\frac{\left(1+\frac{i}{NOCPPY}\right)^{t\times NOCPPY}-1}{\frac{i}{NOCPPY}}}\right]$$

$$\rightarrow \quad A = \left[\frac{50,00,000}{\frac{\left(1+\frac{0.10}{1}\right)^{10\times 1}-1}{\frac{0.10}{1}}}\right]$$

$$\rightarrow \quad A = \frac{50,00,000}{15.9374298} = 3,13,726.87$$

119. ₹ 200 is invested at the end of each month in an account paying interest 6% per year compounded monthly. What is the future value of this annuity after 10th payment? **June 2022**

(a) ₹2,044 (b) 12,044 (c) ₹ 2,040 (d) ₹ 12,000

Answer:

(a) Given Annuity (A) = Rs. 200

n = 10, R = 6% p.a.

$i = \frac{6}{12}$ % per month

i = 0.005

Future Value $A(n,i) = \frac{A}{i}[(1+i)^n - 1]$

$= \frac{200}{0.005}[(1+0.005)^{10} - 1]$

$= \frac{200}{0.005}[1.0511 - 1]$

$= 200 \times 10.22$

= Rs. 2,044

120. Ankit invests ₹ 3,000 at the end of each quarter receiving interest @ 7% per annum for 5 years. What amount will be receive at the end of the period? **June 2022**

(a) ₹ 17,200.20 (b) ₹ 71,104.83 (c) ₹ 73,204.83 (d) None

Answer:

(b) Given Annuity (A) =3000

$R = \frac{7}{4}\% = 1.75\%$

$i = \frac{R}{100} = \frac{1.75}{100}$ 0.0175

n = 5 years

$= 5 \times 4$ Quarter

$= 20$ Quarters

Future Value $A_{(n.i)} = \frac{A}{i}[(1 + i)^n - 1]$

$= \frac{3,000}{0.0175}[(1 + 0.0175)^{20} - 1]$

$= \frac{3,000}{0.0175}[(1 + 0.0175)^{20} - 1]$

$= \frac{3,000}{0.0175}[(1.0175)^{20} - 1]$

$= 71,104.83$

121. A company establishes a sinking fund to provide for the payment ₹ 2,00,000 debt maturity in 20 years contribution to the fund are to be made at the end of every year. Find amount of each deposit of interest is 10% per annum? **June 2022**

(a) ₹ 3,592.11 (b) ₹ 3,492.11 (c) ₹ 3,392.11 (d) None

Answer:

(b) Given FVAR = 2,00,000; t = 20; i = 0.10; NOCPPY = 1; A =?

$$FVAR = A\left[\frac{\left(1+\frac{i}{NOCPPY}\right)^{t\times NOCPPY}-1}{\frac{i}{NOCPPY}}\right]$$

$$\Rightarrow A = \frac{FVAR}{\left[\frac{\left(1+\frac{i}{NOCPPY}\right)^{t\times NOCPPY}-1}{\frac{i}{NOCPPY}}\right]}$$

$$\Rightarrow A = \frac{2,00,000}{\left[\frac{\left(1+\frac{0.10}{1}\right)^{20\times 1}-1}{\frac{0.10}{1}}\right]} = \text{Rs. } 3,491.92$$

122. How much amount is required to be invested every year so as to accumulate ₹ 5,00,000 at the end of 12 years if interest is compounded annually at 10% {Where A (12,0.1) = 21.384284} **Dec 2022**

(a) ₹ 23381.65 (b) ₹ 24385.85 (c) ₹ 26381.65 (d) ₹ 28362.75

Answer:

(a) Given,

Future value $A_{(n.i)}$ = Rs.5,00,000

Rate (R) = 10%

n = 12 years

i $= \frac{R}{100} = \frac{10}{100} = 0.1$

Annuity(A) = ?

Future value $A_{(n.i)} = \frac{A}{i}[(1 + i)^n - 1]$

$5,00,000 = \frac{A}{0.1}[(1 + 0.1)^{12} - 1]$

$5,00,000 = \frac{A}{0.1}[(1.1)^{12} - 1]$

$5,00,000 = \frac{A}{0.1} \times 2.1384284$

$$5,00,000 = A \times 21.384284$$

$$A = \frac{5,00,000}{21.384284}$$

$$A = 23381.65$$

123. Raju invests ₹ 20,000 every year in a deposit scheme starting from today for next 12 years. Assuming that rate on this deposit is 7% per annum compounded annually. What will be the future value of this annuity? Given that (1+0.07)12 = 2.25219159 **Dec 2022**

(a) ₹ 540,526 (b) ₹ 382,813 (c) ₹ 643,483 (d) ₹ 357,769

Answer:

(b) Here, annual instalment (A) = Rs. 20,000

$$n = 12$$

$$R = 7\% \text{ p.a.}$$

$$i = \frac{7}{100} = 0.07$$

Future Value $A_{(n.i)}$ = ?

We know that:

$$\text{Future Value } A_{(n.i)} = \frac{A}{i}[(1+i)^n - 1](1+i)$$

$$= \frac{20,000}{0.07}[(1+0.07)^{12} - 1](1+0.07)$$

$$= \frac{20,000}{0.07}[(1.07)^{12} - 1](1.07)$$

$$= \frac{20,000}{0.07}[2.25219159 - 1](1.07)$$

$$= \frac{20,000}{0.07} \times 1.25219159 \times 1.07$$

$$A_{(n.i)} = 3,82,813 \text{ (approx)}$$

124. Mr. A invested ₹ 10,000 every year for next 3 years at the interest rate of 8 percent per annum compounded annually. What is future value of the annuity? **Dec 2022**

(a) ₹ 32,644 (b) ₹ 32,464 (c) ₹ 34,264 (d) ₹ 36,442

Answer:

(b) Annual Installment (A) = Rs.10,000

$$T = 3 \text{ years}$$

$$R = 8\% \text{ p.a.}$$

$$i = \frac{8}{100} = 0.08$$

Future Value:

$$A_{(n.i)} = \frac{A}{i}[(1+i)^n - 1]$$

$$= \frac{10,000}{0.08}[(1+0.08)^3 - 1]$$

$$= \frac{10,000}{0.08}[(1.08)^3 - 1]$$

$$= \text{Rs. } 32,464$$

125. ₹ 5,000 is invested every month end in an account paying interest @ 12% per annum compounded monthly. What is the future value of this annuity just after making 11th payment ? (Given that (1.01) = 1.1156) **Dec 2022**

(a) ₹ 57,800 (b) ₹ 56,100 (c) 56,800 (d) 57,100

Answer:

(a) Here, annual investment (A) = Rs. 5,000

(R) = $\frac{12}{12}\%$ = 1%

I = $\frac{R}{100}\%$ = $\frac{1}{100}$ = 0.01

n = 11

Future value

$A_{(n.i)} = \frac{A}{i} = [(1 + i)^n - 1]$

$= \frac{5,000}{0.01}[(1 + 0.01)^{11} - 1]$

$= \frac{5,000}{0.01} \times [(1.01)^{11} - 1]$

$= \frac{5,000}{0.01} \times [1.1156 - 1]$

$= \frac{5,000}{0.01} \times 0.1156$

= Rs. 57,800

126. Sinking fund factor is the reciprocal of: **Dec 2022**

(a) Present value interest factor of a single cash flow
(b) Present value interest factor of an annuity
(c) future value interest factor of an annuity
(d) Future value interest factor of a single cash flow

Answer:

(b) Sinking fund factor is the reciprocal of present value interest factor of an annuity.

LOAN

127. ₹ 2,500 is paid every year for 10 years to pay off a loan. What is the loan amount if interest rate be 14% per annum compounded annually? **Nov – 2020**

(a) ₹ 15,847.90 (b) ₹ 13,040.27 (c) ₹ 14,674.21 (d) ₹ 16,345.11

Answer:

(b) We need to find out the Present Value of Annuity Regular.

$$PV = A\left[\frac{\left(1+\frac{i}{NOCPPY}\right)^{t\times NOCPPY}-1}{\frac{i}{NOCPPY}\times\left(1+\frac{i}{NOCPPY}\right)^{t\times NOCPPY}}\right]$$

$$PV = 2,500\left[\frac{\left(1+\frac{0.14}{1}\right)^{10\times 1}-1}{\frac{0.14}{1}\times\left(1+\frac{0.14}{1}\right)^{10\times 1}}\right]$$

= 13,040.28

128. A loan of ₹ 1,02,00 is to be paid back in two equal annual instalments. If the rate of interest charged (in ₹) under this installment plan is: **July – 2021**

(a) 6,160 (b) 8,120 (c) 5,980 (d) 7,560

Answer :

(a) We have PV = 1,02,000 ; t = 2 years ; NOCPPY = 1 ; i = 0.04 ; A =?

We know that PV = $A\left[\frac{\left(1+\frac{i}{NOCPPY}\right)^{t\times NOCPPY}-1}{\frac{i}{NOCPPY}\times\left(1+\frac{i}{NOCPPY}\right)^{t\times NOCPPY}}\right]$

Therefore ,

$$A = \frac{PV}{\left[\frac{\left(1+\frac{i}{NOCPPY}\right)^{t\times NOCPPY}-1}{\frac{i}{NOCPPY}\times\left(1+\frac{i}{NOCPPY}\right)^{t\times NOCPPY}}\right]} = \frac{1,02,00}{\left[\frac{\left(1+\frac{0.04}{1}\right)^{2\times1}-1}{\frac{0.04}{1}\times\left(1+\frac{0.04}{1}\right)^{2\times1}}\right]} = 54,080$$

Therefore , total amount paid = 54,080 + 54,080 = 1,08,160

Interest = 1,08,160 – 1,02,000 = 6,160

129. If a person bought a house by paying ₹ 45,00,000 down payment and ₹ 80,000 at the end of each year till the perpetuity. Assuming the rate of interest as 16% the present value of house (in ₹) is given as: **July – 2021**

(a) 47,00,000 (b) 45,00,000 (c) 57,80,000 (d) 50,000

Answer :

(d) Value of House = Down Payment + Present Value of Perpetuity

$$\text{Value of House} = 45,00,000 + \frac{80,000}{0.16}$$

Value of House = 45,00,000 + 5,00,000 = 50,00,000

130. ₹ 2,500 is paid every year for 10 years to pay off a loan. What is the loan amount if interest rate be 14% per annum compounded annually? **June 2022**

(a) 15,841.90 (b) ₹ 13,040.27 (c) ₹ 14,674.21 (d) ₹ 14,010.90

131. Anshika took a loan of ₹ 1,00,000 @ 8% for 5 year. What amount will she pay if she wants to pay the whole amount in five equal installments? **June 2022**

(a) ₹ 25,045.63 (b) ₹ 26,045.68 (c) ₹ 28,045.50 (d) None

Answer:

(a) V = 100000

R = 8%

$i = \frac{8}{100} = 0.08$

A = ?, n = 5

Present Value

$$V = \frac{A}{i}\left[\frac{(1+i)^n-1}{(1+i)^n}\right]$$

$$100000 = \frac{A}{0.08}\left[\frac{(1+0.008)^n-1}{(1+0.008)^n}\right]$$

$$100000 \times 0.08 = A\left[\frac{(1.08)^5-1}{(1.08)^5}\right]$$

$$8000 = \frac{A\times0.469328}{1.469328}$$

$8000 = A \times 0.319417$

$A = \frac{8,000}{0.319417}$

= 25,045.63

PERPETUITY

132. Determine the present value of perpetuity of ₹ 50,000 per month @ rate of interest 12% p.a. is _____ **June-2019**

(a) ₹ 45,00,000 (b) ₹50,00,000 (c) ₹ 55,00,000 (d) ₹60,00,000

Answer:

(b) Given, Annual instalment (A) = Rs. 50,000

R = $\frac{12}{12}$% monthly

= 1% monthly

I = $\frac{R}{100} = \frac{1}{100} = 0.01$

For Perpetuity n = $\propto$

V = $\frac{A}{i}$ [1 – $(1+i)^{-n}$]

V = $\frac{A}{i}$ [1 – $(1+i)^{-\propto}$)]

V = $\frac{A}{i}$ [$\because (1+i)^{-\propto} = 0$]

V = $\frac{50,000}{0.01}$ = Rs. 50,00,000

133. Determine the present value of perpetuity ₹ 10 per month for infinite period at an effective rate of interest of 14% p.a.? **Nov – 2020**

(a) ₹ 657 (b) ₹ 757 (c) ₹ 857 (d) ₹ 957

134. Assuming that the discount rate is 7% p.a. how much would pay to receive ₹ 200 growing a 5% annually for ever? **Jan - 2021**

(a) ₹ 2,500 (b) ₹ 5,000 (c) ₹ 7,500 (d) ₹ 10,000

Answer:

(d) PV = $\frac{A}{i-g} = \frac{200}{0.07-0.05}$ = 10,000

135. If discount rate is 14% per annum, then hour much a company has to pay to receive ₹ 280 growing at 9% annually forever? **July – 2021**

(a) ₹ 5,600 (b) ₹ 2,800 (c) 1,400 (d) 4,200

Answer :

(a) We have A = 280 ; i = 0.14 ; g = 0.09 ; PV = ?

We know that P = $\frac{A}{i-g}$

P = $\frac{280}{0.14-0.09} = 5,600$

136. Assuming that the discount rate is 7% p.a. how much would you pay to receive ₹ 200, growing at 5% annually for ever? **June 2022**

(a) ₹ 2,500 (b) ₹ 5,000 (c) ₹ 7,500 (d) ₹ 10,000

Answer :

(d) Discount rate (i) = 7% p.a. = 0.07

Growing rate (g) = 5 % Annually = 0.05

(R) = Rs. 200

Present value of growing perpetuity

PVA = $\frac{R}{i-g}$

= $\frac{200}{0.07-0.05}$

$= \frac{20,000}{002}$

= 10,000

NPV

137. If the cost of capital be 12% per annual, then the net present value (in nearest ₹) from the given cash flow is given as: **July – 2021**

Years	0	1	2	3
Operating profit (in Lakh ₹)	(100)	60	40	50

(a) 31048 (b) 34185 (c) 51048 (d) 24187

Answer :

(c) Net Present Value = Present Value of Inflows – Present Value of Outflows

Present Value of Inflows = $\frac{60,000}{(1.12)} + \frac{40,000}{(1.12)^2} + \frac{50,000}{(1.12)^3}$ = 1,21,048

Present Value of Outflows = 1,00,000

Therefore , Net Present Value = 1,21,048 – 1,00,000 = Rs. 21,048

LEASE

138. A person wants to lease out a machine costing ₹ 5,00,000 for a 10 year period. It has fixed a rental of ₹51,272 per annum payable annually starting from the end of first year. Suppose rate of interest is 10% per annum, compounded annually on which money can be invested. To whom this agreement is favourable? **June-2019**

(a) Favour for Lessee (b) Favour for Lessor
(c) Not for both (d) Can't be determined

Answer:

(**a**) Let's analyse this problem from the point of view of the lessor.

If he sells the machine today ,he would receive Rs. 5,00,000.

If he leases this machine out,he would receive Rs. 51,272 per year for 10 years.

PV = Annuity × Sum of Discounting Factory

We have –

Annuity (A) = Rs. 51,272

I =0.10

t = 10 years

No. of Conversion Periods Per Year (NOCPPY)=1

i/NOCPPY=0.10/1=0.10

n=t× NOCPPY = 10×1=10

Discount Rate = 0.10

Factor of Discount Rate =1.10

PV = Annuity × Sum of Discounting Factors

$= \text{Annuity}\frac{(\text{Factor of Discount Rate})^n - 1}{\text{Discount Rate} \times (\text{Factor of Discount Rate})^n}$

$= 51{,}272 \times \frac{(1.10)^{10}-1}{0.10\times(1.10)^{10}} =$ Rs. 3,15,044

Clearly, leasing is not favourable to lessor. If the lessee purchases this machine today, his cash outflow

would be Rs.5,00,000.

If he leases it, his cash outflow every year would be Rs.51,272

PV=Rs. 3,15,044

Therefore clearly, the leases is favourable to lessee

139. ABC Ltd. wants to lease out an asset costing ₹ 3,60,000 for a five year period. It has a fixed rental of ₹ 1,05,000, per annum payable annually starting from the end of first year. Suppose rate of interest is 14% per annum compounded annually on which money can be invested by the company. Is this agreement favourable to the company. **June 2022**

(a) yes (b) No

(c) If depends (d) None of the above

Answer:

(a) The agreement would be favourable to the company if the

Present value of lease rentals is more than the cost.

To calculate the present value of lease rentals, we have A=

Rs. 1,05,000 ; i = 0.14 ; NOCPPY =1; t = 5 years .

$$PVAR = A\left[\frac{\left(1+\frac{i}{NOCPPY}\right)^{t\times NOCPPY}-1}{\frac{i}{NOCPPY}\times\left(1+\frac{i}{NOCPPY}\right)^{t\times NOCPPY}}\right]$$

$$\Rightarrow PVAR = 1{,}05{,}000\left[\frac{\left(1+\frac{0.14}{1}\right)^{5\times1}-1}{\frac{0.14}{1}\times\left(1+\frac{0.14}{1}\right)^{5\times1}}\right] = 3{,}60{,}473$$

Since the present value of lease rentals is more than the cost,

leasing is preferable.

140. If ₹ 1,000 be invested at interest at interest rate of 5% and the interest be added to the principal every 10 years, than the number of years in which it will amount to ₹ 2,000 is : **Aug 2007, May 2018**

(a) $16\frac{2}{3}$ Year (b) $6\frac{1}{4}$ Year (c) 16 Year (d) $6\frac{2}{3}$ Year

141. A person borrows ₹ 5,000 for 2 years at 4% per annual simple interest . He immediately lends to another person at $6\frac{1}{4}$%. Per annual for 2 years find his gain in the transaction for year: **May 2018**

(a) ₹ 112.50 (b) ₹ 225 (c) ₹ 125 (d) ₹ 107.50

MISCELLANEOUS QUESTIONS

142. The Nominal rate of interest is 10% per annum . the interest is compounded quarterly .The effective rate of interest per annum will be . June 2023

(a) 10% (b) 10.40% (c) 10.25% (d) 10.38%

Answer:

(d) If interest is compounded Quarterly

$R = \frac{10}{4}\% = 2.5\%$

T = 1 years = 1 x 4 Quarter

= 4 Quarter

Effective Rates of Interest

$$E = \left[\left(1+\frac{R}{100}\right)^{T}-1\right]\times 100$$
$$= \left[\left(1+\frac{2.5}{100}\right)^{4}-1\right]\times 100$$
$$= [(1+0.025)^{4}-1]\times 100$$
$$= [(1.025)^{4}-1]\times 100$$
$$= [1.1038-1]\times 100$$
$$= 0.1038\times 100$$
$$= 10.38\%$$

143. A car is available for ₹ 4,98,200 cash payment on ₹ 60,000 cash down payment followed by three equal annual installment of the rate of interest charged is 14% per annum compounded yearly . these total interest changed is the instalment plans is (Given P (3,0.14)=2.32163) June 2023

(a) ₹1,46,314 (b) ₹1,46,137 (c) ₹1,28,040 (d) ₹1,58,040

Answer :

(c) Total Cost of Car = 4,98,200

Down Payment = 60,000

Remaining Balance = 4,38,200

Here Present Value (V) = 4,38,200

A = ?

R = 14 %

i $= \frac{14}{100} = 0.14$

No. of Installment n = 3

Present Value V = A.P (n,i)

4,38,200 = A.P (3, 0.14)

4,38,200 = A × 2.32163

$A = \frac{438200}{2.32163}$

A = 1,88,746.7

Total money to be paid for car

= 3 × 1,88,746.7 + 60,000

= 6,26,240

Interest to be paid = 6,26,240 – 4,98,200 = 1,28,040

144. If the discount rate is 10% per annum . How much amount would you pay to receive ₹2,500 growing at 8% annually forever ? June 2023

(a) ₹1,25,000 (b) ₹2,50,000 (c) ₹1,50,000 (d) ₹2,00,000

Answer :

(a) Receive Amount (R) = 2,500

Discount rate $i_d = \frac{10}{100} = 0.10$

Growing rate $i_g = \frac{8}{100} = 0.08$

Then

$PVA = \frac{R}{i_d - i_g}$

$= \frac{2500}{0.10-0.08}$

$= \frac{2500}{0.02}\times 100$

= 1,25,000

145. The compound interest on ₹15,625 for 9 months at 16% per annum compounded quarterly is June 2023

(a)₹1,851 (b)₹1,941 (c)₹1,951 (d)₹1,961

Answer :

(c) P = Rs. 15,625 , R = 16 % p.a. , T = 9 month

If interest is compound quarters

$R = \frac{R}{4}\% = \frac{16}{4}\% = 4\ \%$

$T = 9$ month $= \frac{9}{12}$ years $= \frac{9}{12} \times 4$quarters $= 3$ quarters

$C.I = P\left[\left(1 + \frac{R}{100}\right)^T - 1\right]$

$= 15{,}625\left[\left(1 + \frac{4}{100}\right)^3 - 1\right]$

$= 15{,}625\ [(1.04)^3 - 1]$

$= 15{,}625\ [1.124864 - 1]$

$= 15{,}625 \times 0.124864$

$= 1{,}951$

146. Mr. Sharad got his retirement benefit amounting to ₹50,00,000 . He wants to receiver a fixed monthly sum of amount for his rest of life , starting after one month and there after he want to pass on the same to future generation . He expects to earn an interest of 9% compounded annually .Determine how much perpetuity amount he will receive every month ? June 2023

(a)₹9,500 (b)₹38,500 (c)₹37,500 (d)₹36,600

Answer :

(c) Present Value (V) = 50,00,000

A = ?

n = ∞(for perpetuity)

R = 9 % p.a. then i $= \frac{9}{12 \times 100} = 0.0075$

Present value of perpetuity

$V = \frac{A}{i}$

$50{,}00{,}000 = \frac{A}{0.0075}$

$A = 50{,}00{,}000 \times 0.0075$

$A = 37{,}500$

147. Jonny wants to have ₹2,00,000 in his saving account after three years . The rate of interest offered by bank is 8% per annum compounded annually . How much should he invest today to achieve his target amount ?

June 2023

(a) ₹1,47,489.10 (b) ₹1,58,766.44 (c) ₹1,71,035.59 (d) ₹1,84,417.96

Answer :

(b) Given Amount (A) = 2,00,000 , R = 8 % p.a. , T = 3 years , P = ?

We know that $A = P\left(1 + \frac{R}{100}\right)^T$

$2{,}00{,}000 = P\left(1 + \frac{8}{100}\right)^3$

$2{,}00{,}000 = P\ (1.08)^3$

$P = \frac{200000}{(1.08)^3} = \frac{200000}{1.259712} = 1{,}58{,}766.44$

148. Suppose you have decided to make a systematic investment plan (SIP) inn a mutual fund with ₹1,00,000 every year from today for next 10 years at the rate of 10% per annum compounded annually . What is the future value of this annuity ? Given $1.1^{10}=2.59374$

June 2023

(a) ₹17,35,114 (b) ₹17,53,411 (c) ₹17,35,411 (d) ₹17,53,114

Answer :

(d) Given Annual Installment (A) = 1,00,000

n = 10 years

R = 10 % p.a.c. l

$i = \frac{10}{100} = 0.1$

Future value of Annuity due

$A(n,i) = \frac{A}{i}[(1+i)^n - 1](1+i)$

$= \frac{100000}{0.1}[(1+0.1)^{10}-1](1+0.1)$
$= \frac{100000}{0.1}[(1.1)^{10}-1](1.1)$
$= 10{,}00{,}000[2.59374-1][1.1]$
$= 10{,}00{,}000 \times 1.59374 \times 1.1$
$=$ Rs. 17,53,114

149. A machine depreciates at 10% of its value at the beginning of a year . The cost and scrap value realized at the time of sale being ₹23,240 and ₹9,000 respectively . For how many years the machine was put to use ?
June 2023
(a) 7 (b)8 (c)9 (d)10
Answer :
(c) Original cost of machine (P) = 23,240
Scrap value of machine (A) = 9,000
Rate of depreciation R = 10 %
T =?

$A = P\left(1-\frac{R}{100}\right)^T$
$9{,}000 = 23{,}240\left(1-\frac{10}{100}\right)^T$
$\frac{9{,}000}{23{,}240} = (1-0.1)^T$
$0.38726 = (0.9)^T$
T = 9 years (apex)

150. Mr. Ram invested a total of one lakh in two bags for the fixed parcel .The first bank fields as interest of 9% per annum and 2nd bank field 11% per annum . If the toral interest at the end year is 9.75% per annum . then the annum . then the amount invested in these bank respectively? June 2023
(a) ₹52,500,₹47,500 (b) ₹62,500,₹37,500 (c) ₹57,500,₹42,500 (d) ₹67,500,₹32,500
Answer:
(b) Total Money Ram invested

1st Bank
$P_1 = x$
$R_1 = 9\%$
$T_1 = 1$ year
For one years (S.I. = C.I)
$(S.I)_1 = \frac{P_1R_1T_1}{100}$,
$= \frac{x\times9\times1}{100}$

2nd Bank
$P_2 = (1{,}00{,}000 - x)$
$R_2 = 11\%$
$T_2 = 1$ year
$(S.I.)_2 = \frac{P_2R_2T_2}{100}$
$= \frac{(1{,}00{,}000-x)\times11\times1}{100}$

Total interest at the end of one year
$S.I. = (S.I)_1 + (S.I)_2$
9.75% of $1{,}00{,}000 = \frac{x\times9\times1}{100} + \frac{(1{,}00{,}000-x)\times11\times1}{100}$
$\frac{9.75\times1{,}00{,}000}{100} = \frac{9x}{100} + \frac{(1{,}00{,}000-x)\times11}{100}$
$9{,}75{,}000 = 9x + 11{,}00{,}000 - 11x$
$9{,}75{,}000 - 11{,}00{,}000 = -2x$
$-1{,}25{,}000 = -2x \Rightarrow x =$ Rs. 62,500
$P1 = x =$ Rs. 62,500
and $P_2 = 1{,}00{,}000 - x = 1{,}00{,}000 - 62{,}500$
$= 37{,}500$

151. A company wants to replace its existing warm out machinery in 10 years the expected cost of machine would be 10 lakh . If the management create a sinking fund . How much

provision needs to be made each year. Which can care at the rate of 10% compound annually . (Given A(10,0.1)=15.937425 June 2023

(a) ₹74,625 (b) ₹72,514 (c) ₹62,745 (d) ₹67,245

Answer:

(c) Here A = 10,00,000

A(10.0.1) = 15.937425

n = 10

P = ?

For sinking find

A = P.A (n,i)

10,00,000 = P.A (10, 0.1)

10.00.000 = P × 15.937425

$P = \frac{10,00,000}{15.937425}$ = Rs. 62,745

152. The difference between compound interest and simple interest on a certain sum of money invest for three years at 6% per annum is 11016. Then principal is . June 2023

(a) ₹3,000 (b) ₹3,700 (c) ₹12,000 (d) ₹10,000

Answer:

(d) Given C.I – S.I= 110.16

T = 3 years

R = 6%

P = ?

$C.I - S.I = P\left[\left(\frac{R}{100}\right)^3 + 3\left(\frac{R}{100}\right)^2\right]$

$110.16 = P\left[\left(\frac{6}{100}\right)^3 + 3\left(\frac{6}{100}\right)^2\right]$

$110.16 = P[(0.06)^3 + 3(0 \cdot 06)^2]$

$110.16 = P[\ 0.000216 + 3\times0.0036\ ]$

$110.16 = P[0.000216 + 0.0108]$

$110.16 = P[0.011016]$

$P = \frac{110 \cdot 16}{0.011016}$

P = Rs. 10,000

153. The population of a town increases every year by 2% of the population of beginning of the year. The approximate no. of years by which the total increase of population will be 40% is : June 2023

(a) 15 years (b) 17 years (c) 19 years (d) 20 years

Answer :

(b) Let Present Population of a town (P) =100

Population after 'T' years (A) = 100 + 40

= 140

Increase Rate % R = 2 %

T = ?

$A = P\left(1 + \frac{R}{100}\right)^T$

$140 = 100\left(1 + \frac{2}{100}\right)^T$

$\frac{140}{100} = (1.02)^T$

$1.4 = (1.02)^T$

T = 17 years

154. Govinda's mother decides to gift him ₹50,000 every year starting from today for the next 5 year. Govinda deposits this amount in a bank . As and when he receives and gets 10% per annum interest rate compounded annually .What is the present value of this annuity? Given P(4,0.10)=3.16987 June 2023

(a) ₹2,80,493.5 (b) ₹2,08,993.5 (c) ₹2,08,943.5 (d) ₹2,58,493.5

Answer :

(c) Here , A= Rs.50,000 , R=10% p.a, i= $\frac{10}{100}$ = 0.1 , n =4

Present Value V = $A.P_{(n,i)}$+ A

= 50,000 × $P_{(4,0.10)}$+ 50,000

= 50,000 × 3.16987 + 50,000

= 1,58,943.5 + 50,000 = 20,8943.5

155. Mr. Paul invested ₹ 1,00,000 in a mutual fund scheme . She got a dividend of ₹ 10,000 for first year ₹ 12,000 for second year , ₹16,000 is compounded Annual Growth Rate (CAGR) on dividend return ? June 2023

(a) 20.38% (b) 18.59% (c) 16.36% (d) 15.89%

Answer:

(a) Initial Dividend (Vo) = 10000

Final Dividend (Vn) = 21000

Difference b/w time . $(t_n - t_o)$=5–1=4

$$C.A.G.R = \left[\left(\frac{V_n}{V_o}\right)^{\frac{1}{t_n - t_o}} - 1\right] \times 100$$

$$= \left[\left(\frac{21000}{10000}\right)^{\frac{1}{4}} - 1\right] \times 100$$

$$= \left[(2.1)^{\frac{1}{4}} - 1\right] \times 100$$

= [1.2038 – 1]×100

= 0.2038 × 100

=20.38%

156. How much amount is required to be invested every year so as to accumulate ₹ 30,000 at the end of 10 years if the interest compounded annually at 10%. Given A (100.1) =15.9374. dec 2023

(a) ₹ 1882.36 (b) ₹ 1828.30 (c) ₹ 1832.65 (d) ₹ 1853.65

Answer :

(d) Given A = Rs.30,000 , R = 10% and n = 10 years

i= $\frac{R}{100} = \frac{10}{100}$ = 0.1

P = ?

A = P × $A_{(n,i)}$

Rs. 30,000 = P × $A_{(10,0\cdot1)}$

Rs. 30,000 = P × 15.9374

P = $\frac{30,000}{15.9374}$

P = Rs. 1,882.36

157. Suppose Mr. X invested ₹ 5,000 every year starting from today in mutual fund for next 10 year. Assuming that average return compounded annually is at 18% per annum. What is future value ? dec 2023

(a) ₹ 1,83,677.68 (b) ₹ 1,38,678.85 (c) ₹ 1,83,776.53 (d) ₹ 1,38,774.54

Answer:

(d) Annual Installment (A) = Rs. 5,000

n = 10 years

R = 18% p.a.c.i

i = $\frac{18}{100}$ = 0.18

Future value of annuity due

$A_{(n,i)} = \frac{A}{i}[(1+i)^n - 1](1+i)$

$= \frac{5,000}{0.18}[(1+0.18)^{10} - 1](1+0.18)$

$= \frac{5,000}{0.18}[(1.18)^{10} - 1](1.18)$

= 1,38,774.55

158. A person wants to open a shop have two options to acquire a commercial space either by leasing for 10 years at annual rent of ₹ 2,00,000 or by purchasing the space for ₹ 12,00,000. If person can borrow money at 14% compounded per annum. Which alternate is most suitable ? Given P(100.14) = 5.21611 dec 2023

(a) Leasing (b) Purchase (c) Can't say (d) Data insufficient

Answer:

(a) Present value V = A × $P_{(n,i)}$

= 2,00,000 × $P_{(10,0.14)}$

= 2,00,000 × 5.21611

= 10,43,222

Which is less than purchase price. Hence leasing is preferable.

159. What is the effective rate of intertest when principal amount of ₹ 50,000 deposited in a nationalized bank for one year, corresponding to a nominal rate interest 8% per annum compounded quartertly, given $(1.02)^4$=1.0824. dec 2023

(a) 10.38 % (b) 8.08 % (c) 8.16 % (d) 8.24 %

Answer :

(d) R = $\frac{8\%}{4} = 2\%$(for compound quarterly)

T = 1year = 1 × 4 quarter = 4 quarter

Effective Rate (E) = $\left[\left(1+\frac{R}{100}\right)^T - 1\right] \times 100\%$

= $\left[\left(1+\frac{2}{100}\right)^4 - 1\right] \times 100\%$

=$[(1.02)^4 - 1] \times 100\%$

= (1.0824 – 1) × 100%

= 0.0824 × 100%

= 8.24 %

160. Manoj invests ₹ 12,000 at 6% per annum simple interest to obtain a total amount of ₹ 14,880.What is the time for which the amount was invested ? dec 2023

(a) 3 years (b) 4 years (c) 2 years (d) 5 years

Answer :

(b) P = 12,000 , R = 6% , A= Rs. 14,880,T = ?

A = P + S.I

14,880 = 12,000 + S.I

S.I = 14,880 – 12,000 = 2,880

T = $\frac{S.I\times100}{P\times R} = \frac{2,880\times100}{12,000\times6} = 4$years

161. Mr. X makes a deposit of ₹ 50,000 in the bank for a period of $2\frac{1}{2}$ years. If the rate of interest is 12% per annum compounded half yearly,then the maturity value of the money deposited by Mr. X is :[Where $(1.06)^5$ = 1. 3382] dec 2023

(a) ₹ 66,910 (b) ₹ 66,123 (c) ₹ 67,925 (d) ₹ 65,550

Answer :

(a) Here, P= Rs.50,000 , R = $\frac{12}{2}\% = 6\%, T = 2.5$ years

= 2.5 × 2 half yearly

= 5 half yearly

Amount after 'T' years

A= P$\left(1+\frac{R}{100}\right)^T$

A = Rs. 50,000$\left(1+\frac{6}{100}\right)^5$

= Rs. 50,000 $(1.06)^5$

= Rs. 50,000 × 1.3382

= Rs. 66,910

162. What will be the future value of an annuity of ₹ 2,500 made annually for 12 years at intertest rate of 5% compounded annually if $(1.05)^{12} = 1.7958$ dec 2023

(a) ₹ 37,588.58 (b) ₹ 39,790.00 (c) ₹ 40,873.13 (d) ₹ 42,603.68

Answer :

(b) Given A = Rs. 2,500 , n = 12 , R = 5% p.a. c-1

$$i=\frac{5}{100}=0.05$$

Future value ,

$$A_{(n,i)}=\frac{A}{i}[(1+i)^n-1]$$

$$=\frac{2,500}{0.05}[(1+0.05)^{12}-1]$$

$$=\frac{2,500}{0.05}[(1.05)^{12}-1]$$

$$=\frac{2,500}{0.05}[1.7958-1]$$

$$=\frac{2,500}{0.05}\times 0.7958=\text{Rs. } 39,790$$

163. If the initial investment of ₹ 4,00,000 becomes ₹ 6,00,000 in 24 months, then the Compound Annual Growth Rate (CAGR) is : dec 2023

(a) 30.33% (b) 22.4 % (c)19.46% (d)14.47%

Answer :

(b) Initial Revenue (V_1)= 4,00,000

Final Revenue (V_2)= 6,00,000

time(t_2-t_1)= 24months =2years

$$\text{C.A.G.R.}=\left[\left(\frac{V_2}{V_1}\right)^{\frac{1}{t_2-t_1}}-1\right]\times 100\%$$

$$=\left[\left(\frac{6,00,000}{4,00,000}\right)^{\frac{1}{2}}-1\right]\times 100\%$$

$$=\left[(1.5)^{\frac{1}{2}}-1\right]\times 100\%=22.4\%$$

164. Mr. X invests in an annuity immediately that promises annual payments of ₹ 50,000 for the next 16 years. If the interest rate is 6% compounded annually then the approximate present value of this annuity is ————— where $(1.06)^{15} = 2.3965$. dec 2023

(a) ₹ 5,51,217.75 (b) ₹ 5,75,900.00 (c) ₹ 5,05,288.08 (d) ₹ 5,35,612.45

Answer :

(d) Given A = Rs. 50,000 , n = 16 years , R = 6%

$$i=\frac{6}{100}=0.06$$

Present value of Annuity due

$$V=\frac{A}{i}\left[\frac{(1+i)^n-1}{(1+i)^n}\right]+A$$

$$=\frac{Rs.50,000}{0.06}\left[\frac{(1+0.06)^{16}-1}{(1+0.06)^{16}}\right]+50,000$$

$$=\frac{Rs.50,000}{0.06}\left[\frac{(1.06)^{16}-1}{(1.06)^{16}}\right]+50,000$$

$$=\frac{Rs.50,000}{0.06}\left[\frac{2.3965-1}{2.3965}\right]+50,000$$

= Rs. 5,35,604.005 (Approx)

165. A machine costing ₹ 1,00,000 has useful life of 10 years. If the rate of depreciation is 12%, what is scrap value of the machine at the end of life ?Given $(0.88)^{10} = 0.27850$ dec 2023

(a) ₹ 25,850 (b) ₹ 26,850 (c) ₹ 27,850 (d) ₹ 28,850

Answer :

(c) Original value (P) = Rs. 1,00,000

(T) = 10 years

Rate of depreciation (R) = 12 % p.a.

Scrap value (A) = ?

Scrap value after 'T' years

$A=P\left(1-\frac{R}{100}\right)^{T}$

$= 1{,}00{,}000\left(1-\frac{12}{100}\right)^{10}$

$= 1{,}00{,}000(1-0.12)^{10}$

$= 1{,}00{,}000(0.88)^{10}$

$= 1{,}00{,}000 \times 0.27850$

= Rs. 27,850

166. Computer the compound interest on ₹ 6,000 for $1\frac{1}{4}$ years at 8% per annum. Interest will be compounded quarterly. Dec 2023

(a) 642 (b) 630.78 (c) 634.68 (d) 624.48

Answer :

(d) Given , P= Rs. 6,000 , R = $\frac{8}{4}\% = 2\%$

T =$1\frac{1}{4}$ years

T = $\frac{5}{4} \times 4$ Quarter

T = 5 Quarter

$C.I = P\left[\left(1+\frac{R}{100}\right)^{T}-1\right]$

$= 6{,}000\ \left[\left(1+\frac{2}{100}\right)^{5}-1\right]$

$= 6{,}000\ \ [(1.02)^{5}-1]$

= 624.48

167. The population of a city increases at the rate of 5% every year. What will be the population of the city in the year 2023,if its population in 2021 was 1,00,000 ? dec 2023

(a) 1,05,500 (b) 1,10,250 (c) 1,15,240 (d) 1,20,550

Answer :

(b) Given present Population (P) = 1,00,000

Increased Rate % (R) = 5%

Population after 'T' year (A) = ?

Time (T) = 2023 – 2021 = 2 years

We know that

$A = P\left(1+\frac{R}{100}\right)^{T}$

$= 1{,}00{,}000\left(1+\frac{5}{100}\right)^{2}$

$= 1{,}00{,}000(1.05)^{2}$

= Rs. 1,10,250

168. Mr. XYZ invested ₹ 60,000 in a nationalized bank in the form of fixed deposit at the rate of 7.5% per annum simple interest rate. He received ₹ 73,500 after the end of the term of fixed deposit. Calculate the period for which ₹ 60,000 was invested in fixed deposit. dec 2023

(a) 3years (b) 3.5 years (c) 4 years (d) 4.5 years

Answer :

(a) Here, P = Rs. 60,000 , R=7.5% p.a. ; S.I

A = Rs.73,500 , T = ?

S.I = A–P

= 73,500 – 60,000

= Rs. 13,500

$T = \frac{S.I \times 100}{P \times R}$

$= \frac{13{,}500 \times 1{,}000}{60{,}000 \times 7.5}$

T = 3 years.

169. Calculate the present value of ₹ 2,000 to be required after 10 years Compounded annually at 5% per annum given $(1.05)^{10} = 1.62889$ dec 2023

(a) 1,227.82 (b) 1,282.48 (c) 1,328.35 (d) 1,822.65

Answer :

(a) Amount (A) = Rs. 2,000

Present value (P) = ?

T = 10 years

R = 5% P.a.c.l

$A = P\left(1 + \frac{R}{100}\right)^T$

$2{,}000 = P\left(1 + \frac{5}{100}\right)^{10}$

$2{,}000 = P(1.05)^{10}$

$P = \frac{2{,}000}{(1.05)^{10}} = \frac{2{,}000}{1.62889}$

P = Rs. 1,227.82

ANSWER KEY

1.	b	2.	a	3.	b	4.	a	5.	b	6.	c	7.	c	8.	a	9.	a	10.	b
11.	c	12.	a	13.	b	14.	b	15.	a	16.	a	17.	b	18.	d	19.	b	20.	c
21.	b	22.	c	23.	a	24.	d	25.	a	26.	a	27.	c	28.	c	29.	b	30.	b
31.	c	32.	c	33.	b	34.	b	35.	a	36.	b	37.	a	38.	a	39.	b	40.	b
41.	a	42.	b	43.	c	44.	b	45.	a	46.	a	47.	b	48.	b	49.	c	50.	b
51.	a	52.	c	53.	a	54.	a	55.	a	56.	c	57.	c	58.	c	59.	b	60.	c
61.	a	62.	c	63.	b	64.	d	65.	c	66.	a	67.	b	68.	c	69.	b	70.	a
71.	c	72.	a	73.	a	74.	c	75.	c	76.	c	77.	c	78.	a	79.	a	80.	d
81.	b	82.	b	83.	a	84.	d	85.	a	86.	a	87.	a	88.	c	89.	a	90.	d
91.	b	92.	b	93.	d	94.	d	95.	b	96.	b	97.	c	98.	c	99.	c	100.	a
101.	a	102.	a	103.	a	104.	a	105.	a	106.	b	107.	a	108.	a	109.	c	110.	a
111.	a	112.	c	113.	c	114.	b	115.	a	116.	a	117.	c	118.	a	119.	a	120.	b
121.	d	122.	a	123.	b	124.	b	125.	a	126.	b	127.	b	128.	a	129.	d	130.	b
131.	a	132.	b	133.	c	134.	d	135.	a	136.	d	137.	d	138.	a	139.	a	140.	a
141.	b																		

CHAPTER
PERMUTATIONS & COMBINATIONS

PAST YEAR QUESTIONS

1. The number of triangles that can be formed by choosing the vertices from a set of 12 points, seven of which lie on the same straight line, is: **Nov-2006**

(a) 185 (b) 175 (c) 115 (d) 105

Solution :

n = 12 p = 7

∴ no. of triangles $= {}^{n}C_3 - {}^{p}C_3 = {}^{12}C_3 - {}^{7}C_3 = \frac{12\times11\times10}{3\times2\times1} - \frac{7\times6\times5}{3\times2\times1} = 220 - 35 = 185$

2. A code word is to consist of two distinct English alphabets followed by two distinct numbers between 1 and 9. How many such code words are there? **Nov-2006**

(a) 6,15,800 (b) 46,800 (c) 7,19,500 (d) 4,10,800

Solution :

Code Number = Two English alphabets / Two distinct number 1 and 9

∴ Two English alphabet → any 26 × 25 Two distinct number → any 9 × 8

∴ Code Words = 26 × 25 × 9 × 8 = 46800

3. An examination paper consists of 12 questions divided into two parts A and B. Part A contains 7 questions and part B contains 5 questions. A candidate is required to attempt 8 questions selecting at least 3 from each part. In how many maximum ways can the candidate select the questions? **Feb-2007**

(a) 35 (b) 175 (c) 210 (d) 420

Solution :

Attempt → 8 question selecting at least 3 from each part.

Possible combinations

$${}^{7}C_3 \times {}^{5}C_5 = 35$$

$${}^{7}C_4 \times {}^{5}C_4 = 175$$

$${}^{7}C_5 \times {}^{5}C_3 = 210$$

Total = 420

4. A Supreme Court Bench consists of 5 judges. In how many ways, the bench can give a majority decision? **Feb-2007**

(a) 10 (b) 5 (c) 15 (d) 16

Solution :

The bench can give majority division when 3 judges, 4 judges and 5 judges

Required combination = ${}^{5}c_3 + {}^{5}c_4 + {}^{5}c_5$ 10 + 5 + 1 = 16

5. Given : P (7, k) = 60 P(7, k - 3). Then : **Feb-2007**

(a) k = 9 (b) k = 8 (c) k = 5 (d) k = 0

Solution :

$${}^{7}P_k = 60 \times {}^{7}P_{k-3}$$

Or, $\frac{7!}{(7-k)!} = 60.\frac{7!}{(10-k)!}$ Or, (10 – k)! = 60.(7 – k)!

Or, (10 – k) (9 – k) (8 –k) (7 – k)! = 60.(7 – k)!

Or, (10 – k) (9 – k) (8 – k) = 5 × 4 × 3

∴ 10 – k = 5 | 9 – k = 4 | 8 – k = 3

k = 5 | k = 5 | k = 5

6. In how many ways can the letters of the word FAILURE be arranged so that the consonants may occupy only odd positions? **May-2007**

(a) 576 (b) 476 (c) 376 (d) 276

Solution :

'FAILURE'

F (1) __ (2) L (3) __ (4) R (5) __ (6) __ 7

∴ There are 3 consonants out of 4

∴ possible permutation = ${}^4P_3$ = 24 ways

Remaining place = 4 Total vowels = 4

Possible permutation = ${}^4P_4$ = 4! = 24 ways

∴ total permutation = (24 × 24) ways = 576

7. In how many ways can a party of 4 men and 4 women be seated at a circular table, so that no two woman are adjacent? **May-2007**

(a) 164 (b) 174 (c) 144 (b) 154

Solution :

4 men can be seated in a circular table. So no, of ways = (n – 1)! = 3! = 6 ways

∴ There are 4 places for 4 women

∴ No of ways = 4! = 24 ways

8. The value of $\sum_{r=1}^{5} {}^5C_r$ is : **May-2007**

(a) 29 (b) 31 (c) 35 (d) 26

Solution :

$$\sum_{r=1}^{5} {}^5C_r = {}^5C_1 + {}^5C_2 + {}^5C_3 + {}^5C_4 + {}^5C_5 = 2^5 - 1 = 31$$

9. If ${}^6P_r = 24\ {}^6C_r$, then find r : **Aug-2007**

(a) 4 (b) 6 (c) 2 (d) 1

Solution : ${}^6P_r = 24\ {}^6P_r$

Or, $\frac{6!}{(6-r)!} = 24.\frac{6!}{r!(6-1)!}$ Or, r! = 24 Or, r! = 4! Or, r = 4

10. How many words can be formed with the letters of the word 'ORIENTAL' so that A and E always occupy odd places: **Aug-2007**

(a) 540 (b) 8640 (c) 8460 (d) 8450

Solution :

A (1) __ (2) E (3) __ (4) __ (5) __ (6) __ (7) __ (8)

Possible permutation when A and E always Occupy odd places = ${}^4P_2$ = 12 ways

And possible permutation for remaining letters $= {}^6P_6 = 720$ ways

∴ total permutation = (720 × 12) ways = 8640 ways

11. If ${}^{1000}C_{98} = {}^{999}C_{97} + {}^{x}C_{901}$, find x : **Nov-2007**

(a) 999 (b) 998 (c) 997 (d) 1000

Solution : ${}^{100}C_{98} = {}^{999}C_{97} + {}^{x}C_{901}$ ${}^{100}C_{902} = {}^{999}C_{902} + {}^{x}C_{901}$ x = 999

12. A building contractor needs three helpers and ten men apply. In how many ways can these selections take place? **Nov-2007**

(a) 36 (b) 15 (c) 150 (d) 120

Solution : ${}^{10}C_3 = \frac{10!}{7 \times 3!}$ = 120 ways

13. There are three blue balls, four red balls and five green balls. In how many ways can they be arranged in a row? **Feb-2008**

(a)26720 (b) 27720 (c) 27820 (d) 26,620

Solution : ∴ Required arrangement = $\frac{12!}{3! \times 4! \times 5!}$ = 27720 ways

14. If C(n, r): C(n, r +1) = 1 : 2 and C (n, r + 1): C (n, r + 2) = 2:3, determine the value of n and r : **Feb-2008**

(a) (14, 4) (b) (12, 4) (c) (14, 6) (d) None

Solution :

$\frac{n_{C_r}}{n_{C_{r+1}}} = \frac{1}{2}$

or, $\frac{n_{C_{r+1}}}{n_{C_r}} = 2$ $\left[\frac{n_{C_r}}{n_{C_{r-1}}} = \frac{n-r+1}{r}\right]$ or, $\frac{n-(r+1)+1}{r+1} = 2$

or, $\frac{n-r}{n+r} = 2$ or, n – r = 2r + 2

or, n – 3r = 2 ……(i) × 2 $\frac{n_{C_{r+1}}}{n_{C_{r+2}}} = \frac{2}{3}$

or, $\frac{n_{C_{r+2}}}{n_{C_{r+1}}} = \frac{3}{2}$ $\left[\frac{n_{C_r}}{n_{C_{r-1}}} = \frac{n-r+1}{r}\right]$ or, $\frac{n-(r+2)+1}{r+2} = \frac{3}{2}$

or, $\frac{n-r-1}{r+2} = \frac{3}{2}$ or, 2n – 2r – 2 = 3r + 6

or, 2n – 5r = 8 ……(ii)

2n – 6r = 4 ∴ 2n – 5r = 8

2n + 5r or, 2n – 20 = 8

−r = − 4 or, 2n = 28

r = 4 or, n = 14

15. Six seats of articled clerks are vacant in a 'Chartered Accountant Firm'. How many different batches of candidates can be chosen out of ten candidates ? **June-2008**

(a) 216 (b) 210 (c) 220 (d) None

Solution : Different batches of candidates $= {}^{10}C_6$ ways = 210 ways

16. How many six digit telephone numbers can be formed by using 10 distinct digits? **Dec-2008**

(a) 10^6 (b) 6^{10} (c) $^{10}C_6$ (d) $^{10}P_6$

Solution : (d) $^{10}P_6$

17. In how many ways a committee of 6 members can be formed from a group of 7 boys and 4 girls having at least 2 girls in the committee. **Dec-2008**

(a) 731 (b) 137 (c) 371 (d) 351

Solution :

	7 Boys	4 Girls		
Select	4	2	in	$^7C_4 \times {}^4C_2$
	3	3	in	$^7C_3 \times {}^4C_3$
	2	4	in	$^7C_2 \times {}^4C_4$
			Total	371

18. Number of ways of painting a face of a cube by 6 colours is _____ **June-2009**

(a) 36 (b) 6 (c) 24 (d) 1

Solution : ⌊6 = 720

19. If $^{18}C_r = {}^{18}C_v + 2$ find the value of $^rC_5$ **June-2009**

(b) 50 (b) 50 (c) 56 (d) None of these

Solution :

$^{18}C_r = {}^{18}C_r + 2$

∴ r + r + 2 = 18 r = 8

∴ the value of $^rC_5 = {}^8C_5 = {}^8C_3 = 56$

20. 7 books are to be arranged in such a way so that two particular books are always at first and last place. Final the number of arrangements. **June-2009**

(a) 60 (b) 120 (c) 240 (d) 480

Solution :

2 particular books are always at first and last place so arranged in 2! ways

So, remaining books i.e. 5 books can be arranged in 5 ways i.e. 5!

Finally the number of arrangements = 5! × 2! = 240 ways

21. Find the number of arrangements in which the letters of the word 'MONDAY' be arranged so that the words thus formed begin with 'M' and do not end with 'N'. **June-2009**

(a) 720 (b) 120 (c) 96 (d) None.

Solution :

begin with M arrangements are (6 -1)! i.e. 5! = 120 ways

begin with 'M' and end with 'N' arrangements is (6 – 2)! = 4! = 24 ways.

∴ Required ways are (120 – 24) ways = 96 ways

22. In how many ways can 17 billiard balls be arranged if 7 of them are black, 6 red and 4 white ? **June-2009**

(a) 4084080 (b) 1 (c) 8048040 (d) None of these

Solution : Possible ways = $\frac{17!}{7! \times 6! \times 4!}$ = 4084080

23. Out of 4 gents and 6 ladies, a committee is to be formed find the number of ways the committee can be formed such that it comprises of at least 2 gents and at least the number of ladies should be double of gents. **Dec-2009**

(a) 94 (b) 132 (c) 136 (d) 104

Solution :

	4 Gents	6 Ladies		
Select	2	4	in	${}^4C_2 \times {}^6C_4 = 90$
	2	5	in	${}^4C_2 \times {}^6C_5 = 36$
	2	6	in	${}^4C_2 \times {}^6C_6 = 6$
	3	6	in	${}^4C_3 \times {}^6C_6 = 4$
			Total	136

24. What is the probability that when the letters of 'REGULATION' be arranged so that the vowels come at odd places? **Dec-2009**

(a) 1/252 (b) 1/144 (c) 144/252 (d) None of these

Solution :

Vowels = 5 Consonants = 5

E U A I O

(1) (2) (3) (4) (5) (6) (7) (8) (9) (10)

5 vowels in 5 places in ${}^5P_5 = 120$ 5 consonants in 5 places ${}^5P_5 = 120$

Required ways (cases favourable) = 120 × 120 = 14400

∴ total cases = 10!

Probability = $\frac{14400}{10!} = \frac{1}{252}$

25. Six points are on a circle. The number of quadrilaterals that can be formed are: **June-2010**

(a) 30 (b) 360 (c) 15 (d) None of the above

Solution : ${}^nC_4 = {}^6C_4 = \frac{6 \times 5}{2} = 15$

26. The number of ways of arranging 6 boys and 4 girls in a row so that all 4 girls are together is : **June-2010**

(a) 6!. 4! (b) 2 (7!. 4!) (c) 7!. 4! (d) 2. (6!. 4!)

Solution :

Total number of boys and girls = 6 + 4 = 10

∴ possible ways when 4 girls are together = 7! [by taking 4 girls as 1]

And in which 4 girls can be arranged in 4! ∴ total possible ways = 7! × 4!

27. How many numbers not exceeding 1000 can be made from the digits 1,2,3,4,5, 6, 7, 8, 9 if repetition is not allowed. **June-2010**

(a) 364 (b) 585 (c) 728 (d) 819

Solution :

- in ${}^9P_1 = 9$ - - in ${}^9P_1 . {}^8P_1 = 72$

- - - in ${}^9P_1 . {}^8P_1 . {}^7P_1 = 504$ Total = 585

28. A garden having 6 tall trees in a row. In how many ways 5 children stand, one in a gap between the trees in order to pose for a photograph ? **Dec-2010**

(a) 24 (b) 120 (c) 720 (d) 30

Solution :

* (1) * (2) * (3) * (4) * (5) *

→ Total children = 5

∴ no of ways in which 5 children can stand one in a gap between trees in order to pose for a photograph 5 places for 5 children = ${}^{5}P_{5} = 120$.

29. ${}^{15}C_3 + {}^{15}C_2$ is equal to; **Dec-2010**

(a) ${}^{16}C_3$ (b) ${}^{3}C_{16}$ (c) ${}^{15}C_{16}$ (d) ${}^{15}C_{15}$

30. How many ways a team of 11 players can be made out of 15 players if one particular player is not to be selected in the team. **Dec-2010**

(a) 364 (b) 728 (c) 1,001 (d) 1,234

Solution :

1 particular Player is not selected Out of Remaining 14 players 11 can be Selected

${}^{14}C_{11} = 364$

31. Find the number of arrangements of 5 things taken out of 12 things, in which one particular thing must always be included. **June-2011**

(a) 39,000 (b) 37,600 (c) 39,600 (d) 36,000

Solution :

12 things

1 particular Thing must include	Remaining 11 thing Can be arranged
${}_{5}p_{1}$	${}_{11}p_{4}$

∴ no of arrangements = ${}_{5}p_{1} \times {}_{11}p_{4}$

= 5 × 11 × 10 × 9 × 8 = 39600

32. Exactly 3 girls are to be selected from 5 Girls and 3 Boys. The probability of selecting 3 Girls will be _____. **June-2010**

(a) 5/28 (b) 1/56 (c) 15/28 (d) None.

Solution :

Total cases = ${}_{8}c_{3} = \frac{8!}{3! \times 5!} = \frac{8 \times 7 \times 6 \times 5!}{3 \times 2 \times 5!} = 56$

∴ favorable cases

5 girls	3 boys	
${}_{5}c_{3}$	${}_{3}c_{0}$	= 10 × 1 = 10

Required probability = $\frac{10}{56} = \frac{5}{28}$

33. In how many ways 3 prizes out of 5 can be distributed amongst 3 brothers Equally? **Dec-2011**

a) 10 b) 45 c) 60 d) 120

Solution :

Number of ways in which 3 prizes out of 5 can be distributed amongst 3 brothers equally = ${}_{5}p_{3} = \frac{5!}{2!} = \frac{5 \times 4 \times 3 \times 2!}{2!} = 60$ ways

34. There are 12 questions to be Answered Yes or No. How many ways can these be Answered? **Dec-2011**

a) 1024 b) 2048 c) 4096 d) None

Solution :

2 ways yes Or no	2 ways yes Or no	2 ways yes Or no	2 ways yes Or no	2 ways yes Or no	2 ways yes Or no	2 ways yes Or no	2 ways yes Or no	2 ways yes Or no	2 ways yes Or no	2 ways yes Or no

$= 2^{12} = 4096$

35. A team of 5 is to be selected from 8 boys and three girls. Find the probability that it includes two particulars girls. **Dec-2011**

a) 2/30 b) 1/5 c) 2/11 d) 8/9

Solution :

Total cases = ${}_{11}c_{5} = \frac{11!}{5! \times 6!} = \frac{11 \times 10 \times 9 \times 8 \times 7 \times 6!}{5 \times 4 \times 3 \times 2 \times 6!} = 462$

Cases favourable = ${}^{2}C_{2} \times {}^{9}C_{B} = \frac{9.8.7}{3.2.1}$

Required Probability = $\frac{84}{462}$

36. The letters of the word "VIOLENT" are arranged so that the vowels occupy even place only. The number of permutations is _____. **June-2012**

(a) 144 (b) 120 (c) 24 (d) 72

Solution :

I O E

(1) (2) (3) (4) (5) (6) (7)

There are 3 vowels and 3 place. So they arranged in 3! = 6 ways

Remaining 4 consonants and 4 place. So they arranged in 4! = 24 ways

∴ Total permutation = (6 × 24) ways = 144 ways.

37. If ${}^{n}P_{4} = 20\left({}^{n}P_{2}\right)$ then the value of 'n' is _____. **June-2012**

(a) – 2 (b) 7 (c) – 2 and 7 both (d) None of these.

Solution :

n(n – 1) (n – 2) (n – 3) = 20 n(n – 1)

(n – 2) (n – 3) = 20 = 5 × 4

n – 2 = 5 n – 3 = 4

n = 7 n = 7

38. A man has 3 sons and 6 schools within his reach. In how many ways he can send them to school, if no two of his sons are to read in the same schools? **Dec-2012**

(a) ${}^{6}P_{2}$ (b) ${}^{6}P_{3}$ (c) 6^{3} (d) 3^{6}

Solution :

1st son in any of 6 school 2nd son in any of 5 schools 3rd son in any of 4 schools

Required ways = 6 × 5 × 4 = ${}^{6}P_{3}$

39. How many permutations can be formed form the letters of the word "DRAUGHT", if both vowels may not be separated? **Dec-2012**

(a) 720 (b) 1,440 (c) 140 (d) 1,000

Solution :

Taking AU together we have 6 letters (AU) DRG HT in 6! Ways =

And two vowels can be arranged in 2! Ways = 2 ways

∴ Required permutation = (720 × 2) ways = 1440 ways

40. If ${}^{13}C_{6} + 2\,{}^{13}C_{5} + {}^{13}C_{4} = {}^{15}C_{x}$ then, x = _____ **Dec-2012**

(a) 6 (b) 7 (c) 8 (d) 9

Solution :

$13_{C_6} + 2.13_{C_5} + 13_{C_4} = 15_{C_x}$

or, $13_{C_6} + 13_{C_5} + 13_{C_5} + 13_{C_4} = 15_{C_x}$ or, $14_{C_6} + 14_{C_5} = 15_{C_x}$

or, $15_{C_6} = 15_{C_x}$ x = 6

41. A polygon has 44 diagonals then the number of its sides are : **June-2013**

a) 8 b) 9 c) 10 d) 11

Solution :

No. of diagonals = n_{C_2} – n 44 = n_{C_2} – n $44 = \frac{n(n-1)}{2} - n$

$44 = \frac{n^2 - n - 2n}{2}$ $n^2 - 3n = 88$ n(n – 3) = 88 = 11 × 8 n = 11

42. The number of words that can be formed out of the letters of the word "ARTICLE" so that vowels occupy even place is: **June-2013**

a) 36 b) 144 c) 574 d) 754

Solution :

A I E

(1) (2) (3) (4) (5) (6) (7)

3 vowels in 3 places = ${}^3P_3 = 6$ ways 4 consonants in 4 places = ${}^4P_4 = 24$ ways

required permutation = (6 × 24) ways = 144 ways

43. Number of ways of shaking hands in a group of 10 persons shaking hands to each other are: **June-2013**

a) 45 b) 54 c) 90 d) 10

Solution : Number of ways of shaking hands = ${}_{n}c_2 = {}_{10}c_2 = 45$

44. If ${}^{15}C_{3r} = {}^{15}C_{r+3}$, then 'r' is equal is . **Dec-2013**

(a) 2 (b) 3 (c) 4 (d) 5

Solution : 3r + r + 3 = 15 Solving r = 3

45. How many different words can be formed with the letters of the word "LIBERTY" **Dec-2013**

(a) 4050 (b) 5040 (c) 5400 (d) 4500

Solution : 7 letters in ${}^7P_7 = 5040$ ways

46. If ${}^{1000}C_{98} = {}^{999}C_{97} + {}^{x}C_{901}$, then the value of x will be **June-2014**

a) 999 b) 998 c) 997 d) None

47. If ${}^6P_r = 360$, then the value of 'r' is : **Dec-2014**

a) 5 b) 3 c) 4 d) None of these

Solution :

${}^6P_r = 360$

Using hit & Trial Taking r = 4

${}^6P_4 = \frac{6!}{2!} = \frac{6\times5\times4\times3\times\cancel{2}}{\cancel{2}!} = 360$ $\therefore r = 4$ (Ans.)

48. There are 5 books on English, 4 Books on Tamil & 3 books on Hindi. In how many ways can these books be placed on a shelf if the books on the same subjects are to be together? **Dec-2014**

a) 1,36,800 b) 1,83,600 c) 1,03,680 d) 1,63,800

Solution :

Take x Take y Take z

5 Books English , 4 Books Tamil , 3 Books Hindi

Books on the same subject are to be together.

x, y, z

3 things 3 ways to arrange = ${}^3P_3 = 6$

Now,

5 English Books = x 5 ways to arrange = ${}^5P_5 = 120$

Now,

4 Tamil Books = y 4 ways to arrange = ${}^4P_4 = 24$

Now,

3 Hindi Books = z 3 ways to arrange = ${}^3P_3 = 6$

∴Required ways = 6 × 120 × 24 × 6 = 1, 03, 680 (Ans.)

49. 5 Men and 4 Women to sit in a row in such a manner that the woman always occupy the even places. The number of such arrangement will be : **Dec-2014**

a) 126 b) 1056 c) 2080 d) 2880

Solution :

5 Men 4 Women

_ | _ | _ | _ | _ | _ | _ | _ | _

W W W W

${}^5P_1 \times {}^4P_1 \times {}^4P_1 \; {}^3P_1 \; {}^3P_1 \; {}^2P_1 \; {}^2P_1 \; {}^1P_1 \; {}^1P_1$

Required ways = 5 × 4 × 4 × 3 × 3 × 2 × 2 × 1 × 1 = 2880 (Ans.)

50. The four digit numbers that can be formed out of the seven digits 1, 2, 3, 5, 7, 8, 9 such that no digit is repeated in any number and are greater than 3000 are **June-2015**

a) 120 b) 480 c) 600 d) 840

Solution :

1, 2, 3, 4, 5, 7, 8, 9

3	------	------	------	→ Any of the 6 digit = ${}^6P_3$
5	------	------	------	→ Any of the 6 digit = ${}^6P_3$
7	------	------	------	→ Any of the 6 digit = ${}^6P_3$
8	------	------	------	→ Any of the 6 digit = ${}^6P_3$
9	------	------	------	→ Any of the 6 digit

Required ways $= {}^6P_3 \times 5 = \frac{6!}{3!} \times 5$

= 6 × 5 × 4 × 5 = 600 (Ans.)

51. A person has 10 friends of whom 6 are relatives. If he invites 5 guests such that three of them are his relatives, then the total number of ways in which he can invite them are: **June-2015**

a) 30 b) 60 c) 120 d) 75

Solution :

Total 10 friends 6 Relative

Total No. of ways he can invite 5 guest in which 3 are relative =

$${}^6C_3 \times {}^4C_2 = \frac{6!}{3! \times 3!} \times \frac{4!}{2! \times 2!} = 120$$ (Ans.)

52. A student has three books on computer, three books on Economics and five books on Commerce. If these books are to be arranged subject wise, then these can be placed on a shelf in the number of ways **June-2015**

a) 25290 b) 25920 c) 4230 d) 4320

Solution :

3 Books on Computer 3 Books on Economics 5 Books on Commerce

$= {}^3P_3 \times {}^3P_3 \times {}^5P_5 = 4320$

∴Total ways it can be arranged.

If subject wise arrangement is to be done, No. of ways

Computer	*Economics*	*Commerce*
Commerce	*Economics*	*Computer*
Economics	*Commerce*	*Computer*
Computer	*Commerce*	*Economics*
Economics	*Computer*	*Commerce*
Commerce	*Computer*	*Economics*

→ *Total* 6 *ways*

Required ways = 6 × 4,320 = 25,920 (Ans.)

53. An examination paper with 10 questions consists of 6 questions in statistic part. At least one question from each part is to be attempted in how many ways can this be done? **Dec-2015**

a) 1024 b) 945 c) 1005 d) 1022

Solution :

Out of 6 statistic questions, atleast one is to be done.

$$= {}^6C_1 + {}^6C_2 + {}^6C_3 + {}^6C_4 + {}^6C_5 + {}^6C_6$$

$$= 2^6 - 1 = 63$$

Out of remaining 4 questions, atleast one is to be done.

$$= 4C_1 + {}^4C_2 + {}^4C_3 + {}^4C_4 = 2^4 - 1 = 15$$

∴ Total questions = 63 × 15 = 945

54. If ${}^{n}p_r = 720$ and ${}^{n}c_r = 120$, then value of 'r' is: **Dec-2015**

a) 4 b) 5 c) 6 d) 3

Solution :

$${}^{n}p_r = 720$$

$${}^{n}c_r = 120$$

$${}^{n}c_r = \frac{{}^{n}p_r}{\angle r}$$

$$\Rightarrow 120\frac{720}{\angle r}$$

$$\Rightarrow \angle r = 6 \therefore r = 3$$

55. There are 6 men and 4 women in a group, then the number of ways in which a committee of 5 persons can be formed of them, if the committee is to include at least 2 women are : **Dec-2015**

a) 180 b) 186 c) 120 d) 105

Solution :

6 Men	4 Women	
3	2	---------- 5
2	3	---------- 5
1	4	---------- 5

∴ The no. of ways $= \left({}^{6}C_3 \times {}^{4}C_2\right) + \left({}^{6}C_2 \times {}^{4}C_3\right) + \left({}^{6}C_1 \times {}^{4}C_4\right)$

= 186

56. In how many ways can a selection of 6 out of 4 teachers and 8 students be done so as to include at least two teachers? **June-2016**

a) 220 b) 672 c) 596 d) 968

Solution :

4 Teachers	8 Students	
6 - 2	4 - ${}^{4}C_2 \times {}^{8}C_4$	(+)
6 - 3	4 - ${}^{4}C_3 \times {}^{8}C_3$	(+)
6 - 4	4 - ${}^{4}C_4 \times {}^{8}C_2$	(+)
	672	

57. There are 10 students in a class including 3 girls. The number of ways to arrange them in a row when any two girls out of three never comes together : **June-2016**

a) ${}^{8}P_3 \llcorner 7$ b) ${}^{3}P_3 \llcorner 7$ c) a) ${}^{8}P_3 \llcorner 10$ d) None of these.

Solution :

No. of arrange to arrange them in a row = ${}^{8}P_3 \ \angle 7$

58. The maximum number of points of inter section of 10 circles will be **June-2016**

a) 2 b) 20 c) 90 d) 180

Solution :

Points of intersection of 10 circles = $= {}^{n}P_2 = {}^{10}P_2 = \frac{\angle 10}{\angle 8} = 10 \times 9 = 90.$

59. If ${}^{n+1}C_{r+1} : {}^{n}C_r : {}^{n-1}C_{r-1} = 8:3:1$, then n is equal to **Dec -2016**

a) 20 b) 16 c) 10 d) 15

60. An examination paper with 10 questions consists of 6 questions in statistic part. At least one question from each part is to be attempted in how many ways can this be done? **Dec -2016**

a) 1024 b) 945 c) 1005 d) 1022

Solution : Same as (64).

61. The number of numbers between 1,000 and 10,000, which can be formed by the digits 1,2,3,4,5,6 without repetition is **Dec -2016**

(a)720 (b)180 (c)360 (d)540

Solution :

Number of numbers between 1000 and 10000 which can be formed by digits 1, 2, 3, 4, 5, 6 without repetition is

$^{6}P_1 \times ^{5}P_1 \times ^{4}P_1 \times ^{3}P_1 = 360$

62. The number of ways in which 4 persons can occupy 9 vacant seats is: **Dec -2016**

(a) 6048 (b) 3024 (c)1512 (d) 4536

Solution :

No. of ways in which 4 persons can occupy 9 vacant places

$= {}^{9}P_1 \times {}^{8}P_1 \times {}^{7}P_1 \times {}^{6}P_1 = 3024$

63. If $^{10}C_3 + 2.\ ^{10}C_4 + {}^{10}C_5 = {}^{n}C_5$ then value of n is: **June-2017**

a) 10 b) 11 c) 12 d) 13

Solution :

$^{10}C_3 + {}^{210}C_4 + {}^{10}C_5$

$\Rightarrow {}^{10}C_3 + {}^{10}C_4 + {}^{10}C_4 + {}^{10}C_5$

$= {}^{10}C_4 + {}^{11}C_5 = {}^{12}C_5$

$^{12}C_5 = {}^{n}C_5 \quad \therefore n = 12$

64. The number of parallelograms, formed from a set of six parallel lines intersecting another set of four parallel lines is: **June-2017**

a) 360 b) 90 c) 180 d) 45

Solution :

No. of parallelograms formed from a set of six parallel lines intersecting another set of four parallel lines _____

$$^{6}P_2 \times {}^{4}P_2 = \frac{{}^{3}\cancel{6} \times 5}{2 \times 1} \times \frac{{}^{2}4 \times 3}{2 \times 1} = 15 \times 6 = 90.$$

65. The no. of words which can be formed by letters of the word "ALLAHABAD' is: **June-2017**

a) 7560 b) 3780 c) 30240 d) 15120

Solution :

The no. of words which can be formed with the letters of "ALLAHABAD"

$= \frac{\lfloor 9}{\lfloor 2 \times \lfloor 4} = 7560$

66. If $^{n}P_{13} : {}^{(n+1)}P_{12} = 3:4$ hen 'n' is _____: **Dec-2017**

(a) 13 (b) 15 (c) 18 (d) 31

Answer:

(b) Given $^{n}P_{13} : {}^{n+1}P_{12} = 3:4$

$$\frac{n!}{(n-13)!} : \frac{(n+1)!}{(n+1-12)!} = 3:4$$

$$\frac{n!}{(n-13)!} \times \frac{(n-11)!}{(n+1)!} = 3:4$$

$$\frac{n!}{(n-13)!} \times \frac{(n-11)(n-12)(n-13)!}{(n+1)n!} = \frac{3}{4}$$

$$\frac{(n-11)(n-12)}{(n+1)} = \frac{3}{4}$$

$$\frac{n^2 - 12n - 11n - 132}{n+1} = \frac{3}{4}$$

$4(n^2 - 23n + 132) = 3(n + 1)$

$4n^2 - 92n + 528 = 3n + 1$

$4n^2 - 92n - 3n + 528 - 3 = 0$

$4n^2 - 95n + 525 = 0$

$4n^2 - 60n - 35n + 525 = 0$

$4n(n - 15) - 35(n - 15) = 0$

$(n - 15)(4n - 35) = 0$

If $n - 15 = 0$ if $4n - 35 = 0$

$\rightarrow n = 15 \qquad n = \frac{35}{4}$ (Impossible)

67. The number of triangle that can be formed by choosing the verticals from a set of points, seven of which lie on the same straight line, is: **May-2018**

(a) 185 **(b) 175** **(c) 115** **(d) 105**

Answer

(a) Here n = 12, k = 7

No. of triangle are formed from 'n' point.

In which (k) points are collinear =

$= {}^{12}C_3 - {}^{7}C_3$

$= \frac{12 \times 11 \times 10}{3 \times 2 \times 1} - \frac{7 \times 6 \times 5}{3 \times 2 \times 1}$

$= 220 - 35$

$= 185$

68. If ${}^{1000}C_{98} = {}^{999}C_{97} + {}^{X}C_{901}$, find x: **May-2018**

(a) 999 (b) 998 (c) 997 (d)1,000

Answer:

(a) If ${}^{1000}C_{98} = {}^{999}C_{97} + {}^{x}C_{901}$

$\because = {}^{n}C_r + {}^{n}C_{r-1} = {}^{n+1}C_r$

Then X = 999 [${}^{999}C_{901} = {}^{999}C_{98}$]

69. A bag contains 4 red,3 black and 2 white balls. In how many ways 3 balls can be drawn from this bag so that they include at least one black ball? **Nov-2018**

(a) 64 (b) 46 (c) 85 (d) none of the above

Answer:

(a) No. of Total Balls = 4 Red + 3 Black + 2 White

= 9 Balls.

If 3 balls are drawn from this bag getting at least one black balls.

It may be following cases

(a) 1 B & 2 other = ${}^{3}C_1 \times {}^{6}C_2 = 3 \times 15 = 45$

(b) 2 B & 1 other = ${}^{3}C_2 \times {}^{6}C_1 = 3 \times 6 = 18$

(c) 3 B & 0 other = ${}^{3}C_3 \times {}^{6}C_0 = 1 \times 1 = 1$

Total ways = 45 + 18 + 1

= 64

70. The number of words from the letters of the word BHARAT, in which B and H will never together, is **Nov-2018**

(a) 360 (b) 240 (c) 120 (d) none of the above

Answer:

(b) Given Word

B H A R A T

1 2 3 4 5 6

Total No. of ways arrange the letter of the word = $\frac{61}{21} = \frac{720}{2} = 360$

If letter 'B' and 'H' are always together

Then No. of ways = $\frac{51 \times 21}{21} = \frac{120 \times 2}{2} = 60 \times 2 = 120$

Then No. of ways if 'B' and 'H' are neven taken together

$= 360 - 120$

$= 240$

71. If ${}^{n}P_r = 720$ and ${}^{n}C_r = 120$, then r is **Nov-2018**

a. 3 b. 4 c. 5 d. 6

Answer:

(a) Given ${}^{n}P\ r = 720$, ${}^{n}Cr = 120$

We know that

$$\frac{{}^{n}C_{r}}{{}^{n}P_{r}} = \frac{1}{\lfloor r}$$

$$\frac{120}{720} = \frac{1}{\lfloor r}$$

$$\frac{1}{6} = \frac{1}{\lfloor r}$$

$$\lfloor r = 6$$

$$\lfloor r = 3 \times 2 \times 1$$

$$\lfloor r = \lfloor 3$$

72. If these are 40 guests in a party. If each guest takes a shake hand with all the remaining guests. Then the total number of hands shake is_____: **June-2019**

(a) 780 (b) 840 (c) 1,560 (d) 1,600

Answer:

(a) For shaking hands

No. of ways =nC2

Here, n = 40

No. of ways = 40C2

$= \frac{40 \times 39}{2 \times 1}$

$= 20 \times 39$

$= 780$

73. If $11_{c_x} = 11_{c_{2x-4}}$ and $x \neq 4$ than value of 7_{c_x} = **June-2019**

(a) 20 (b) 21 (c) 22 (d) 23

Answer:

(b) We know that if ${}^{n}C_{x} = {}^{n}C_{y,\text{ then}}$ **x + y = n**

Therefore, in the case of ${}^{11}C_{x} = {}^{11}C_{2x-4,}$ x + 2x – 4 = 11

$\rightarrow$ 3x – 4 = 11

$\rightarrow$ 3x = 11 + 4

$\rightarrow$ 3x = 15

$\rightarrow$ $x = \frac{15}{3} = 5$

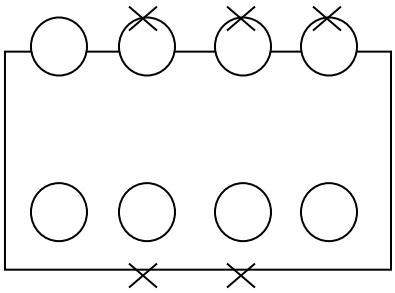
Therefore, ${}^{7}C_{5} = {}^{7}C_{2} = \frac{7 \times 6}{1 \times 2} = 21$

74. In how many ways that the crew of an eight oared be arranged so that if 3 crew can row only on a stoke side and 2 row on the other side is ____. **June-2019**

(a) 1728 (b) 256 (c) 164 (d) 126

Answer:

(a)



Since it is an eight–oared boat, it is safe to assume that there are 8 rowers.

First, lets arrange the 2 persons who will row on one side. There are 4 seats, and 2 persons are to be arranged. This can be done in ${}^{4}P_{2}$ ways.

Now, lets arrange the 3 rowers for the other side. There are 4 sets and 3 persons are to be arranged. This can be done in ${}^{4}P_{3}$ ways. Now 3 rowers

and 3 seats remain. These 3 persons can be arranged in there 3 seats in ${}^3P_3$ ways.

Therefore, total no. of ways =

$$= {}^4P_2 \times {}^4P_3 \times {}^3P_3$$

$$= 12 \times 24 \times 6$$

$$= 1{,}728$$

75. Three girls and five boys are to be seated in a row so that no two girls sit together. Total no. of ways of this arrangement are : **Nov-2019**

(a) 14,400 (b) 120 (c) ${}^5p_3$ (d) $3! \times 5!$

Answer:

(a) First, let's arrange the five boys. The boys can be arranged in 5! ways.

_B1_B2_B3_B4_B5

The three girls can be arranged in the empty spaces shown above. There are 6 empty .

spaces and 3 girls. Therefore, 3 spaces are to be selected out of these 6, and then the three

girls are to be arranged in as many ways as possible. This can be done in

${}^6C_3 \times 3! = \frac{6\times5\times4}{1\times2\times3} \times 3 \times 2 \times 1 = 120$ ways.

So, total number of ways$= 5! \times 120 = 14{,}400$

76. How many numbers can be formed with the help of 2, 3, 4, 5, 6, 1 which is not diwisible by 5, given that it is a five digit no. and digits are not repeating? **Nov-2019**

(a) 600 (b) 400 (c) 1200 (d) 1400

Answer:

(a) The number to be formed is__ __ __ __ __

The units place can be filled either with 2,or 3,or 4,or 6,or 1.

Therefore, the unit's place is filled in 5 ways.

Assuming that the unit's place is filled with 1, the ten's place can be filled either with 2,or

3,or 4,or 5,or 6.Therefore,the ten's place can be filled in 5 ways. Thereafter, the Hundred's

Place can be filled in 4 ways, the Thousand's place can be filled in 3 ways, and the Ten

Thousand's place can be filled in 2 ways.

Therefore, total number of ways$= 2 \times 3 \times 4 \times 5 \times 5 = 600$

77. How many different groups of 3 people can be formed from a group of 5 people? **Nov-2019**

(a) 5 (b) 6 (c) 10 (d) 9

Answer:

(c) We have to select 3 people out of 5 people.

This can be done in ${}^5C_3 = {}^5C_2 = \frac{5\times4}{1\times2} = 10$ ways

78. In how many ways can 4 people be selected at random from 6 boys and 4 girls if there are exactly 2 girls? **Nov-2019**

(a) 90 (b) 360 (c) 92 (d) 480

Answer:

(a) Two girls can be selected from 4 girls in ${}^4C_2 = \frac{4 \times 3}{1 \times 2} = 6$ ways

Two boys can be selected from 6 boys in ${}^6C_2 = \frac{6 \times 5}{1 \times 2} = 15$ ways

Therefore, total number of ways = 6 × 15 = 90

79. ${}^nP_3 : {}^nP_2 = 2:1$ **Nov-2019**

(a) 4 (b) 7/2 (c) 5 (d) 2/7

Answer:

(a) Try the options.

Option (a) → 4

If n = 4, LHS = ${}^nP_3 : {}^nP_2 = {}^4P_3 : {}^4P_2 = \frac{4 \times 3 \times 2}{4 \times 3} = 2 = \text{RHS}$

Therefore option (a) is the answer.

80. A fruity basket contains 7 apples, 6 bananas, and 4 mangoes. How many selections of 3 fruit can be made so that all 3 are apples? **Nov – 2020**

(a) 35 ways (b) 120 ways (c) 165 ways (d) 70 ways

Answer:

(a) Since all three have to be apples, we need to select 3 apples from

7 apples.

Therefore, ${}^7C_3 = \frac{7 \times 6 \times 5}{1 \times 2 \times 3} = 35$

81. Out of 7 boys and 4 girls a team of a debate club of 5 is to be chose. The number of teams such that each team includes at least one girls is: **Nov – 2020**

(a) 439 (b) 429 (c) 419 (d) 441

Answer:

(d) No. of teams such that each team includes at least one girl = Total no. of ways –

No. of teams such that each team includes no girl

No. of Boys = 7

No. of girls = 4

Total No. of People = 7 + 4 = 11

Therefore, total number of ways of forming a team

$= {}^{11}C_3 = \frac{11 \times 10 \times 9 \times 8 \times 7}{1 \times 2 \times 3 \times 4 \times 5} = 462$

No. of ways such that the team includes no girl at all

$= {}^7C_5 = {}^7C_{7-5} = {}^7C_1 = 21$

Therefore, no. of ways of selecting a team such that the team

Includes at least one girl = 462 – 21 = 441

82. If $n_{P_4} = 20\, n_{P_4}$ where p denotes the number of permutations/n = **Nov – 2020**

(a) 4 (b) 1 (c) 5 (d) 7

Answer:

(d) Try the options:

Options (a) → 4

LHS = $^4P_4 = 41 = 24$

RHS = $20 \times {}^4P_2 = 20 \times 4 \times 3 = 240$

Since LHS = RHS, option (a) cannot be the answer.

Option (b) → 2

This cannot be the answer as n always has to be either equal to, or greater than r,

In this question, we have r = 4 in the LHS, so n cannot be 2.

Option (c) → 5

LHS = $^5P_4 = 5 \times 4 \times 3 \times 2 = 120$

RHS = $20 \times {}^5P_2 = 20 \times 5 \times 4 = 400$

Since LHS = RHS, option (c) cannot be the answer.

Option (d) → 7

LHS = $^7P_4 = 7 \times 6 \times 5 \times 4 = 840$

RHS = $20 \times 7P2 = 20 \times 7 \times 6 = 840$

Since LHS = RHS, therefore, option (d) is the answer.

83. From a group of 8 men and 4 women, 4 persons are to be selected to form a committees so that at least 2 women are there in the committee in how many ways can it be done? **Nov – 2020**

(a) 168 (b) 201 (c) 202 (d) 220

missing

84. Eight Chairs are numbered from 1 to 8. Two women and three men are to be seated by allowing one Chair for each. First, the women choose the chairs from the chairs numbered 1 to 4 and then men select the chairs from the remaining. **Jan - 2021**

The number of possible arrangement is

(a) 120 (b) 288 (c) 32 (d) 1440

Answer:

(d) Chair Selection by Women:

2 chairs can be selected from 4 chairs = $^4C_2 = \frac{4 \times 3}{1 \times 2} = 6$

After selecting the chairs, we also need to arrange the women.

This can be done in 21 ways.

Therefore, women can be arranged in $6 \times 2! = 12$ ways.

After that, there are 6 chairs left. Three chairs are to be selected, and then the three men are to be arranged. This can be done in $^6C_3 \times 3! = \frac{6 \times 5 \times 4}{1 \times 2 \times 3} \times 3 \times 2 \times 1 = 120$ ways.

Therefore, total number of ways = 12 × 120 = 1,440.

85. 'n' locks and 'n' corresponding keys are available but the actual combination is not known. The maximum number of trials that are needed to assigns the keys to the corresponding locks is **Jan - 2021**

(a) $(n-1)C_2$ (b) $(n+1)C_2$ (c) $\sum_{k-2}^{n}(k-1)$ (d) $\sum_{k-2}^{n} k$

Answer:

(c) Assume that there are 3 locks and 3 corresponding keys.

The maximum number of trials to assign key to the first lock will be 2. This is because if the first keys are incorrect, then obviously, the third key is the key for the first lock.

Similarly, the number of trials to assign key to the second lock will be 1.

This would automatically assign the third key to the third lock, so the number of trials to assign a key to the third lock will be 0.

Therefore, the maximum number of trials to assign keys to all three locks = 2 + 1 = 3

Now, try the options:

Options (a) $\rightarrow {}^{(n+1)}C_2 = {}^{(3-1)}C_2 = {}^{2}C_2 = 1$

Therefore, option (a) cannot be the answer.

Option (b) $\rightarrow {}^{(n+1)}C_2 = {}^{(3-1)}C_2 = {}^{4}C_2 = \frac{4 \times 3}{1 \times 2} = 6$

Therefore, option (b) cannot be the answer.

Option (c) $\rightarrow \sum_{k=2}^{n}(k - 1) = (2-1) + (3-1) = 1 + 2 = 3$

Therefore, option (c) is the answer.

86. There are ten flights operating between city A and city B. The number of ways in which a person can travel from city A to city B and return by different flight is **Jan - 2021**

(a) 90 (b) 895 (c) 80 (d) 78

87. How many odd numbers of four digit can be formed with digit 0,1,2,3,4,7 and 8? **Jan - 2021**

(a) 150 (b) 300 (c) 120 (d) 210

Answer:

(b) TH H T U

The unit's place can be filled either with 1, or 3, or 7. Therefore, the unit's place can be____filled in 3 ways.

Assuming that the unit's place is filled with the digit 1, the thousand's place can be filled either 2, or 3, or 4, or 7, or 8.

Therefore, the thousand's place can be filled in 5 ways.

Assuming that the thousand's place is filled with 2, the remaining digits are 0, 3. 4. 7, and 8.

We need to select any two of these 5 digits digits and arrange them in as many ways as possible. This can be done in ${}^{5}C_2 \times 2! = \frac{5 \times 4}{1 \times 2} \times 2 \times 1 = 20$ ways.

Therefore, the total number of ways = 5 × 20 × 3 = 300

88. In how many different ways can the letters of the word 'DETAIL' be arranged in such a way that the vowels occupy only the odd numbered positions **Jan - 2021**

(a) 32 (b) 36 (c) 48 (d) 60

Answer:

(b) Vowels – E, A, I

No. of vowels = 3

Consonants – D, T, L

No. of consonants = 3

There are 6 places to be filled

1 2 3 4 5 6

There are three odd places – 1, 3, 5.

Three vowels can be arranged in three odd places in 31 = 6 ways.

Three consonants can be arranged in three even places in 31 = 6 ways.

Total number of ways = 6 × 6 = 36

89. $n_{C_p} + 2\, n_{C_{p-1}} + n_{C_{p-2}}$? **Jan - 2021**

(a) $n +_{C_p}$ (b) $n + 2_{C_p}$ (c) $n + 1_{C_{p+1}}$ (d) $n + 2_{C_{p-1}}$

Answer:

(b) ${}^nC_p + 2{}^nC_{p-1} + {}^nC_{p-2}$

$= {}^nC_p + {}^nC_{p-1} + {}^nC_{p-1} + {}^nC_{p-2}$

$= ({}^nC_p + {}^nC_{p-1}) + ({}^nC_{p-1} + {}^nC_{p-2})$

$= ({}^{n+1}C_p) + ({}^{n+1}C_{p-1})$ ..... [Since $({}^{n+1}C_r = {}^nC_r + {}^nC_{r-1})$]

$= {}^{n+1}C_p + {}^{n+1}C_{p-1}$

$= {}^{n+1+1}C_p$ ..... [Since $({}^{n+1}C_r = {}^nC_r + {}^nC_{r-1})$]

$= {}^{n+2}C_P$

90. A business houses wishes to simultaneously elevate two of its six branch heads. In how man ways these elevation can take place? **Jan - 2021**

(a) 12 (b) 3 (c) 6 (d) 15

Answer:

(d) We have to select two branch heads out of six branch heads.

This can be done in ${}^6C_2 = \frac{6 \times 5}{1 \times 2} = 15$ ways.

91. If ${}^np_6 = 20{}^np_4$ then the value of n is given by: **July – 2021**

(a) n = 5 (b) n = 3 (c) n = 9 (d) n = 8

Answer:

(c) Try the options**,**

Option (c) → n = 9

LHS = ${}^9P_6 = 9 \times 8 \times 7 \times 6 \times 5 \times 4 = 60{,}480$

RHS = $20 \times {}^9P_4 = 20 \times 9 \times 8 \times 7 \times 6 = 60{,}480$

92. How many numbers of seven digit numbers which can be formed from the digits 3, 4, 5, 6, 7, 8, 9 no digits being repeated are not divisible by 5? **July – 2021**

(a) 4320 (b) 4690 (c) 3900 (d) 3890

Answer:

(a) We have seven spaces to fill.

— — — — — — —

Since the number should not be divisible by 5, the seventh place cannot be filled with 5.

Therefore, the seventh place can be filled in 6 ways.

The sixth place can be filled in 6 ways.

The fifth place can be filled in 5 ways.

The fourth place can be filled in 4 ways.

The third place can be filled in 3 ways.

The second place can be filled in 2 ways.

The first place can be filled in 1 way.

Therefore, total number of ways = 1 × 2 × 3 × 4 × 5 × 6 × 6

= 4,320

93. A person can go from place 'A' to 'B' by 11 different modes of transport but is allowed to return back to "A" by any mode other than the one earlier. The number of different ways, the entire journey can be complete is: **July – 2021**

110 (b) 10^{10} (c) 9^5 (d) 10^9

Answer:

(a) Number of ways he can go from A to B = 11

Number of ways he can return to A = 10

Total number of ways = 11 x 10 = 110

94. The number of ways 5 boys and 5 girls can be seated at a round table, so no two boys are adjacent is_____ **July – 2021**

(a) 2,550 (b) 2,880 (c) 625 (d) 2,476

95. The number of 4 letter words can be formed using letters of word DECTIONARY **Dec-2021**

(a) 5040 (b) 720 (c) 90 (d) 30240

Answer:

(a) There are 10 letters in the word DECTIONARY, 4 letters can be selected and arranged out of these 10 letters in $^{10}C_4 \times 41$ ways.

Therefore,

$^{10}C_4 \times 41 = \frac{10 \times 9 \times 8 \times 7}{1 \times 2 \times 3 \times 4} \times 41 = 5{,}040$

96. The number of words that can be formed using the letters of the "PETROL" such that the words do not have "P" in the first position, is **Dec-2021**

(a) 720 (b) 120 (c) 600 (d) 540

Answer:

(c) We have 6 places to fill:

— — — — — —

The first place can be filled either with E, T, R, O, or L, i,e., in 5 ways.

Suppose you fill the first plsce with T. Now, the second place can be filled either with P, E, R. O, or L, i,e., in 5 ways.

Suppose you fill the second place with P. Now, the third place can be filled either with E,R,O, or L, i.e., in 4 ways.

Suppose you fill the third place with E. Now, the fourth place can be filled either with R,O, or L,i.e., in 3 ways.

Suppose you fill the fourth place with R. Now, the fifth place can be filled either with O, or L, i.e., in 2 ways.

Suppose you fill the fifth place with O. Now, the sixth place can be filled either with L, i.e., in 1 way.

Therefore, the number of words that can be formed = 5 × 5 × 4 × 3 × 2 × 1 = 600.

97. If ${}^{n}p_2 = 12$, then the value of n is **Dec-2021**

(a) 2 (b) 3 (c) 4 (d) 6

Answer:

(c) Try the options.

Option (a) → 2

${}^{2}P_2 = 2$

Option (b) → 3

${}^{3}P_2 = 3 \times 2 = 6$

Option (c) → 4

4P2 = 4 × 3 = 12.

98. The number of different ways the letters of the word "DETAIL" can be arranged in such a way that the vowels can occupy only the odd position is **Dec-2021**

(a) 32 (b) 36 (c) 48 (d) 60

Answer:

(b) Vowels: E, A, I

Consonants: D, T, L

There are six places to be filled:

1 2 3 4 5 6

There are three odd positions, i,e., 1, 3, and 5. Also, there are three vowels.

Therefore, three vowels can be arranged in 3 places in 3! ways.

Similarly, the 3 consonants can be arranged in the positions 2, 4, and 6 in 3! ways.

Therefore, total number of ways = 3! × 3! = 6 × 6 = 36

99. Six boys and five girls are to be seated for a photograph in a row such that no two girls sit together and no two boys sit together. Find the number of ways **Dec-2021**

(a) 74,200 (b) 96,900 (c) 45,990 (d) 86,400

Answer:

(d) No. of Boys = 6

No. of Girls = 5

$\mathbf{B_1 \times B_2 \times B_3 \times B_4 \times B_5 \times B_6}$

No. of ways = ${}^{5}P_5 \times 6!$

= 5! × 6!

= 120 × 720

= 86,400

100. If a man travels from place A to B in 10 ways then by how many ways can he come back by another train? **June 2022**

(a) 94 (b) 110 (c) 90 (d) 99

Answer:

(c) No. of ways = 10 × 9

= 90

101. If four words are taken with or without meaning from the word 'Logaritham' without repetition. How many words will be formed? **June 2022**

(a) 5040 (b) 2520 (c) 120 (d) 40320

Answer:

(c) Here, n = 9; r = 4

4 letters are to be selected from 9 letters. This can be done in $^9C_4$ ways.

Since arrangement is also required, this will be multiplied with 4!

Therefore, $^9C_4 \times 4! = {}^9P_4 = 9 \times 8 \times 7 \times 6 = 3024$

102. If $\frac{n!}{10} = \frac{(n-1)!}{(n-1-n+3)!}$, find 'n' **June 2022**

(a) 4 (b) 5 (c) 6 (d) 7

Answer:

(b) **If** $\frac{n!}{10} = \frac{(n-1)!}{(n-1-n+3)!}$

$\frac{n(n-1)!}{10} = \frac{(n-1)!}{2!}$

$\frac{n}{10} = \frac{1}{2} \rightarrow 2n = 10$

n = 5

103. 7 boys and 4 girls from which a team of 5 is to be selected, each team should have atleast one girl is: **June 2022**

(a) 429 (b) 439 (c) 419 (d) 441

Answer:

(d)

Boys	Girls
7	4
	(5)

If at least one girl is selected then it may be following cases.

(a) 1 Girl and 4 Boys $= {}^4C_1 \times {}^7C_4 = 4 \times 35 = 140$

(b) 2 Girls and 3 Boys $= {}^4C_2 \times {}^7C_3 = 6 \times 35 = 210$

(c) 3 Girls and 2 Boys $= {}^4C_3 \times {}^7C_2 = 4 \times 21 = 84$

(d) 4 Girls and 1 Boy $= {}^4C_4 \times {}^7C_1 = 1 \times 7 = 7$

Total No of ways = 140 + 210 + 84 + 7

= 441

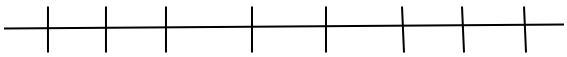
104. 8 People are seated in a row in a meeting among them the president and vice president are to be seated always in the center. What is the arrangement? **June 2022**

(a) 7!2! (b) 6!2! (c) 6! (d) 1!

Answer:

(a) The correct answer is (a) → 7!2!

1	2	3	4	5	6	7
A	B	C	D	E	F	G	H



Vice Presented

Presented

No. of ways = 7!2!

105. There are 5 questions each have four options. Then in how many different ways can we answer the questions? **June 2022**

(a) 20 (b) 120 (c) 1024 (d) 60

106. If there are 6 points in a line and 4 points in another line. Find the number of parallelogram formed? **June 2022**

(a) 80 (b) 90 (c) 90 (d) 100

Answer:

(c) No. of Parallelogram = ${}^{m}C_2 \times {}^{n}C_2$

Here , m = 6 , n = 4

$= {}^{6}C_2 \times {}^{4}C_2$

$= 15 \times 6$

$= 90$

107. If ${}^{11}C_x = {}^{11}C_{2x-4}$ and $x \neq 4$, then value of ${}^{7}C_x$ **June 2022**

(a) 20 (b) 21 (c) 22 (d) 23

Answer:

(b) If ${}^{11}C_x = 11C_{2x-4}$ $\left[\because if\ n_{C_x} = n_{C_y}, then\ n = n + y\right]$

Then , X + 2n – 4 = 11

3n = 11 + 4

3n = 15

$n = \frac{15}{3} = 5$

${}^{7}C_n = {}^{7}C_5 = {}^{7}C_2 = \frac{7 \times \cancel{6}^{3}}{\cancel{2} \times 1} = 21$

108. There are 20 points in a plane area. How many triangles can be formed by these points if points are collinear? **Dec 2022**

(a) 550 (b) 560 (c) 1130 (d) 1140

Answer:

(c) Here, Total No. of points in a plane (n) = 20

No. ofcollinear points (k) = 5

No. of triangle are formed from 'n' points.

In which 'k' points are collinear = ${}^{n}c_3 - {}^{k}c_3$

$= {}^{20}c_3 - {}^{5}c_3$

$= 1140 - 10$

$= 1130$

109. The number of ways 4 boys 3 girls can be seated in a row so that they are alternate **Dec 2022**

(a) 12 (b) 288 (c) 144 (d) 256

Answer:

(c) Total Boys = 4, Total girls = 3

B /G B G B G B

No. of ways = 4! × 3!

= 24 × 6

= 144

110. If $^nP_r = 3024$ and $^nC_r = 126$, then find n and r? **Dec 2022**

(a) 9, 4 (b) 10, 3 (c) 12, 4 (d) 11, 4

Answer:

(a) If $^nP_r = 3{,}024$ and $^nC_r = 126$

We know that

$$\frac{n_{C_r}}{n_{P_r}} = \frac{1}{\lfloor r}$$

$$\frac{126}{3{,}024} = \frac{1}{\lfloor r}$$

$$\lfloor r = \frac{3{,}024}{126}$$

$$\lfloor r = 24$$

$$\lfloor r = \lfloor 4 \Rightarrow r = 4$$

Here $^nP_r = 3{,}024$

$$\frac{n!}{\lfloor(n-r)} = 3{,}024$$

hits and trails = n = 9 and r = 4

$$\frac{\lfloor 9}{\lfloor(9-4)} = \frac{\lfloor 9}{\lfloor 5} = \frac{9\times8\times7\times6\lfloor 5}{\lfloor 5} = 3{,}024$$

It is satisfied so n = 9, r = 4

111. How many 3 digit odd numbers can be formed using the digits 5,6,7,8,9, if the digits can be repeated? **Dec 2022 Ans: (b)**

(a) 55 (b) 75 (c) 65 (d) 85

Answer:

(b) H T U

5 5 × 5 × 1 5 = 25

6 5 × 5 × 1 7 = 25

7

8

9 5 × 5 × 1 9 = 25

Total ways = 75

112. In the next world cup these will be 12 teams, divided equally into two equal groups. Team of each group will play a match against other From each group 3 top teams will quality for next round. In this round each team will play against each other. Four top teams of his round will qualify for the semi-final round, when each team will play against the others once. Two top teams of this round will go to final round where they will paly the best of three matches. The minimum number of matches in the next world cup will be: **Ans: (b) June 2023**

a) 56 b) 53 c) 37 d) 43

Answer:

(b) SoI: - Matches in First Round = ${}^6C_2 + {}^6C_2$

$= 15 \times 15$

$= 30$

Matches in 2nd Round $= {}^6C_2 = 15$

Matches in semi finals $= {}^4C_2 = 6$

Final is best of three so if one team win First match and second match then there

will not be third match.

The total minimum matches = 30 + 15+ 6 + 2

$= 53$

113. A committee of 3 women and 4 men is to be formed out of 8 women and 7 men. Mrs. Kajal refuses to serve in a committee in which Mr. Yash is a member. The number of such committee can be. Ans: d) June 2023

(a) 1530 (b) 1500 (c) 1520 (d) 1540

Answer:

(d)

Women	Men
8	7
3	4

No. of ways = ${}^8C_3 \times {}^7C_4 - {}^7C_2 \times {}^6C_3$

$= 56 \times 35 - 21 \times 20$

$= 1960 - 420$

$= 1540$

114. Of ${}^6P_{2r} = 12 \; x \; {}^6_{Pr}$, then r is equal to: **Ans: b) June 2023**

(a) 1 (b) 2 (c) 3 (d) 4

Answer:

(b) Given ${}^6P_{2r} = 12. {}^6P_r$ ---------- (1)

By Hits and Trials r = 2 Satisfied equation (1)

L.H.S = ${}^6P_{2r}$

$= {}^6P_2 \times 2 = {}^6P_4 = \frac{6!}{(6-4)!} = \frac{6!}{2!} = \frac{6\times5\times4\times3\times\cancel{2!}}{\cancel{2!}} = 360$

R.H.S = $12 . {}^6P_r$

$= 12 . {}^6P_2$

$= 12 \times \frac{6!}{(6-2)!}$

$= 12 \times \frac{6!}{4!} = 12 \times \frac{6\times5\times\cancel{4!}}{\cancel{4!}} = 360$

L.H.S = R.H.S

115. Find the number of ways in which the letters of the word SOFTWARE be arranged such that all the vowels are always together? **Ans: d June 2023**

(a) 720 (b) 1,440 (c) 2,880 (d) 4,320

Answer:

(d)

OAE	S	F	T	W	R
1	2	3	4	5	6

No. of ways if all vowels are always together

= 6! × 3!

= 720 × 6

= 4,320

116. In how many different ways can the letters of the word 'CORPORATION' be arrange so that the vowels always come together ? **Dec 2023**

(a) 810 (b) 1440 (c) 25200 (d)50400

Answer :

(d) OOAIO CRPRIN

1 234567

No of ways = $\frac{7!}{2!} \times \frac{5!}{3!}$

$= \frac{5,040}{2} \times \frac{120}{6}$

= 50400

117. If $^{15}c_{3r} = 15c_{r+3}$ then r is equal to : **Dec 2023**

(a) 5 (b) 4 (c) 3 (d) 2

Answer :

(c) If $^{15}C_{3r} = {}^{15}C_{r-3}$

$3r + r + 3 = 15$ [∵ If $^{n}c_x = {}^{n}c_y$ then n = x + y]

$4r = 15 - 3$

$4r = 12$

$r = 3$

118. Find 'n' if $^{n}P_2 = 72$ **Dec 2023**

(a) 12 (b) 36 (c) 24 (d) 9

Answer :

(d) If $nP_2 = 72$

$\frac{n!}{(n-2)!} = 72$

$\frac{n(n-1)(n-2)!}{(n-2)!} = 72$

$n(n-1) = 9 \times 8$

$n(n-1) = 9 \times (9-1)$

on comparing n = 9

Answer Key

1.	a	2.	b	3.	d	4.	d	5.	c	6.	a	7.	c	8.	b	9.	a	10.	b
11.	a	12.	d	13.	b	14.	a	15.	b	16.	d	17.	c	18.	a	19.	c	20.	c
21.	c	22.	a	23.	c	24.	a	25.	c	26.	c	27.	b	28.	b	29.	a	30.	a
31.	c	32.	a	33.	c	34.	c	35.	c	36.	a	37.	b	38.	b	39.	b	40.	a
41.	d	42.	b	43.	a	44.	b	45.	b	46.	a	47.	c	48.	c	49.	d	50.	c
51.	c	52.	b	53.	b	54.	d	55.	b	56.	b	57.	a	58.	c	59.	d	60.	b
61.	c	62.	b	63.	c	64.	b	65.	a	66.	b	67.	a	68.	a	69.	a	70.	b
71.	a	72.	a	73.	b	74.	a	75.	a	76.	a	77.	c	78.	a	79.	a	80.	a

81.	d	82.	d	83.	b	84.	d	85.	d	86.	a	87.	b	88.	b	89.	b	90.	d
91.	c	92.	a	93.	a	94.	b	95.	a	96.	c	97.	c	98.	b	99.	d	100.	c
101.	a	102.	b	103.	d	104.	b	105.	c	106.	c	107.	b	108.	c	109.	c	110.	A
111.	b	112.	b	113.	d	114.	b	115.	d										

CQCHAPTER A.P. AND G.P.

PAST YEAR QUESTIONS

BASIC

1. The sum of square of first n natural numbers is : **Feb-2007**

(a) $\frac{n(n+1)}{2}$ (b) $\frac{n(n+1)(2n+1)}{6}$ (c) $\frac{n(n-1)(n-2)}{6}$ (d) $\frac{n(n+1)(n+2)}{6}$

2. Σn^2defines: **June-2009**

(a) $\frac{n(n+1)(2n+1)}{6}$ (b) $\frac{n(n+1)}{2}$ (c) $\left[\frac{n(n+1)}{2}\right]^2$ (d) None of these

3. The value of $1^3 + 2^3 + 3^3 + 4^3 + \ldots\ldots + m^3$ is equal to : **June-2014**

(a) $\left[\frac{m(m+1)}{2}\right]^3$ (b) $\frac{m(m+1)(2m+1)}{6}$ (c) $\left[\frac{m(m+1)}{2}\right]^2$ (d) None of these

. Answer:

(c) $1^3 + 2^3 + 3^3 + \ldots\ldots\ldots\ldots\ldots + m^3$

$= \sum m^3$

$= \left[\frac{m(m+1)}{2}\right]^2$

AP BASIC

4. Find the sum of the series: 2 + 7+ 12+---------- 297**Aug-2007**

(a) 8970 (b) 8870 (c) 7630 (d) 9875

Solution :

a = 2 d = 5 $t_n = 297$

$\Rightarrow$ a + (n - 1)d = 297

$\Rightarrow$ 2 + (n - 1)5 = 297

$\Rightarrow$ (n - 1)5 = 295 ℓ = last term = 297

$\Rightarrow$ (n - 1) = 59

$\Rightarrow$ n = 60

$\therefore$ Sum $= \frac{n}{2}(a + \ell)$

$= \frac{60}{2}(2 + 297)$

= 8970

5. (x + 1), 3x, (4x + 2)are in AP Find the value of x **Dec-2008**

(a) 2 (b) 3 (c) 4 (d) 5

Solution :

In A. P. 2b = a + c

$2 \times 3x = 4x + 2x + 1$

$\Rightarrow 6x = 5x + 3$

$\Rightarrow x = 3$

6. If each month ₹ 100 increases in any sum then find out the total sum after 10 months, if the sum of first month is ₹ 2,000 **Dec-2011**

a) ₹ 24,500 b) ₹ 24,000 c) ₹ 50,000 d) ₹ 60,000

Solution :

a = 2000

d = 100

n = 10

$S = \frac{n}{2}[2a + (n-1)d]$

$S = \frac{10}{2}[4000 + 900]$

S = 24500

7. A person pays ₹ 975 in monthly instalments, each instalment is less than former by ₹ 5 The amount of first instalment is ₹100. In what time will the entire amount be paid? Feb-2007

(a) 26 months (b) 15 months (c) Both (a) & (b) (d) 18 months

Solution :

Let the entire amount be paid in n months

First installment (a) = 100

d = - 5

$\therefore t_2 = a + d = 100 - 5 = 95$

Similarly,

The series is 100, 95, 90, 80, ... upto n months

Sum = $\frac{n}{2}[2a + (n-1)d]$

$\Rightarrow \quad 975 = \frac{n}{2}[2 \times 100 + (n-1)(-5)]$

$\Rightarrow \quad 975 = 100n - \frac{n}{2}.5(n-1)$

$\Rightarrow \quad 975 = \frac{200n - 5n^2 + 5n}{2}$

$\Rightarrow \quad 1950 = 200n - 5n^2 + 5n$

$\Rightarrow \quad 5n^2 - 205n + 1950 = 0$

$\Rightarrow \quad n^2 - 41n + 390 = 0$

$\Rightarrow \quad n^2 - 15n - 26n + 390 = 0$

$\Rightarrow \quad n(n - 15) - 26(n - 15) = 0$

$\therefore n = 15, 26$

But we take n = 15 months because after twenty one installments, the installments become negative. So ignored n = 26.

8. The sum of all two Digit odd numbers is **Dec-2011**

a) 2475 b) 2575 c) 4950 d) 5049

Solution :

11, 13, 15, 17 99

a = 11

d = 2

$t_n = a + (n-1)d$

$\Rightarrow 99 + 11 + (n-1)2$

$\Rightarrow \frac{88}{2} = (n-1)$ $\Rightarrow n = 45$

$S = \frac{45}{2}[a + \ell]$

$S = \frac{45}{2}[11 + 99]$

$= 2475$

9. If 8^{th} term of an AP is 15, then sum of its 15 terms is **June-2012**

(a) 15 (b) 0 (c) 225 (d) 225/2

Solution :

$t_8 = a + 7d$ $\quad t_{15} = a + 14d$

15 = a + 7d

$S_n = \frac{n}{2}(a + \ell)$

$S_{15} = \frac{15}{2}(a + a + 14d)$

$= \frac{15}{2}(2a + 14d)$

$= 15(a + 7d)$

$= 15(15) = 225$

10. If third term and seventh term of an A.P are eighteen and thirty respectively, then sum of first twenty terms will be: **June-2015**

a) 540 b) 610 c) 740 d) 810

Answer:

(d) Let 1st term of A.P. is a and common difference is d.

Given: $T_3 = 18$ and $T_7 = 30$

a + 2d = 18 ……..(1) a + 6d = 30 ……(2)

eq (2) = eq (1)
~~a~~ + 6d = 30
~~a~~ + 2d = 18
__-_____-___
4d = 12
d = 3 in equation (1)
a + 6 × 3 = 30
a + 18 = 30
a = 30 – 18 = 12

$S_n = \frac{n}{2}[2a + (n - 1)d]$

$S_{20} = \frac{20}{2}[2 \times 12 + (20 - 1)3]$
$= 10[24 + 19 \times 3]$
$= 10[24 + 57]$
$= 10 \times 81 = 810$

11. If the sum 50 + 45 + 40 + 35 + _____ is zero, then the number of terms is : **Dec-2016**
(a) 22 (b) 20 (c) 21 (d) 25

Solution :

$= 0 \ \frac{n}{2}[50 \times 2 + (n - 1) \times -5]$
$\Rightarrow 0 \ [100 - 5n + 5]$
$\Rightarrow 0 = 105 - 5n$
$\therefore n = 21.$

12. The value c such that a, -3, b, 5, c are in A.P. is: **June-2017**
a) -7 b) 1 c) 13 d) 9

Solution :

a, -3, b, 5, c
d = - - 3 - a
or d = b + 3
or d = c - 5

- 3 - a = + 3
⇒- 3 - = a + b
∴ a + b = - 6 ---- (1)

b + 3 = c - 5
d = 5 - b
$\Rightarrow b - c = -5 - 3$
$\Rightarrow c - b = 8$ ---- (2)

a + ~~b~~ = - 6
c - ~~b~~ = 8

a + c = 2 ----- (3)
⇒ a = 2 - c

are know
c = a + (5 - 1)c
⇒ c = a + 4 (c - 5)
⇒ c = 2 - c + 4c - 20
⇒ c = 2 + 3c - 20
⇒- 2c = - 18 ∴ c = 9.

13. The sum of the series - 8, - 6, - 4, ... n terms is 52. The number of terms n is **Nov-2018**
a) 11 b) 12 c) 13 d) 10

Answer:

(c) Given series
-8, -6, -4, …….n term
Let term (a) = -8
Common difference (d) = (-6) – (-8)
= -6+8
= 2
Sum of 'n' term (S_n) = 52, n=?

We know that

$S_n = \frac{n}{2}[2a + (n-1)d]$

$52 = \frac{n}{2}[2 \times (-8) + (n-1)(2)]$

$52 \times 2 = n(-16 + 2n - 2)$

$104 = n(2n-18)$

$104 = 2n^2-18n$

$2n^2-18n-104 = 0$

$n^2 - 9n - 52 = 0$

$(n-13)(n+4) = 0$

If $n - 13 = 0 \Rightarrow n = 13$ and $n + 4 = 0 \Rightarrow n = -4$

14. The value of K, for which the terms 7K + 3, 4K - 5, 2K + 10 are in A.P., is **Nov-2018**

a) 13 b) - 13 c) 23 d) - 23.

Answer :

(d) If 7K + 3 , 4K –5,2K +10 are in A.P.

Then,

$(4K-5) - (7K + 3) = (2K + 10) - (4K-5)$

$4K - 5 - 7K - 3 = 2K + 10 - 4K + 5$

$-3K - 8 = -2K + 15$

$-8 - 15 = -2K + 3K$

$-23 = K$

15. If 2 + 6 + 10 + 14 + 18 + ... + x = 882 then the value of x **June-2019**

a) 78 b) 80 c) 82 d) 86

Answer:

(c) If $2 + 6 + 10 + 14 + 18 + \ldots\ldots\ldots\ldots + x = 882$

$a = 2, d = 6-2 = 4, n = n$

$s_n = 882, I = x$

$Sn = \frac{n}{2}[2a + (n-1)d]$

$882 = \frac{n}{2}[2 \times 2 + (n-1)4]$

$882 \times 2 = n(4 + 4n - 4)$

$882 \times 2 = 4n^2$

$n^2 = \frac{882 \times 2}{24}$

$n^2 = 441 = n = 21$

Now, $I = a + (n-1)d$

$x = 2 + (21-1) \times 4$

$x = 2 + 80$ $\boxed{x = 82}$

16. If the sum of five terms of AP is 75. Find the third term of the series **Nov-2019**

(a) 35 (b) 30 (c) 15 (d) 20

Answer:

(c) $S_n = \frac{n}{2}[2a + (n-1)d]$

n=5 $S_5 = 75$

$S_5 = \frac{5}{2}[2a + (5-1)d]$

$75 = \frac{5}{2}[2a + 4d]$

$75 = \frac{5 \times 2}{2}[a + 2d]$

$15 = a+2d$ —Eq(1)

$T_3 = a+(3-1)d$

$T_3 = a+2d$

---- From Eq(1)

$T_3 = 15$

17. The 20^{th} term of arithmetic progression whose 6^{th} term is 38 and 10^{th} term is 66 is: **Nov -2020**

(a) 118 (b) 136 (c) 178 (d) 210

Answer:

(b) Let first term of A.P = a

Common difference = d

Given T_6 =38 and T_{10} = 66

a + 5d = 38 ….(i) a + 9d = 66 ….(ii)

Eg. (ii) – (i)

~~a~~ + 9d = 66

~~a~~ + 5d = 38

4d = 28

d = 7

d = 7 in eg. …..(i)

a + 5 × 7 = 38

a + 35 = 38

a = 3

T_{20} = a + 19d

= 3 + 19 × 7

= 3 + 133

= 136

18. The nth terms of the series 3 + 7 + 13 + 21 + 31 + …… is **Jan - 2021**

(a) 4n – 1 (b) $n^2 + 2n$ (c) $n^2 + n + 1$ (d) $n^3 + 2$

Answer:

(c) Given Series

3+7+13+21+31+ ---------- n terms

Shortcut by Hits / Trial Method

(a) $T_n = 4n - 1$

n = 1, $T_1 = 4\times1-1 = 3$

n = 2, $T_2 = 4\times2-1=7$

n = 3, $T_3 = 4\times3-1=11$

Series is 3,7,11 ---------- which is not correct.

(c) $Tn = n^2 + n + 1$

n = 1, $T_1 = 1^2 + 1 + 1 = 3$

n = 2 , $T_2 = 2^2 + 2 + 1 = 4 + 3 = 7$

n = 3 , $T_3 = 3^2 + 3 + 1 = 9 + 4 = 13$

Series is 3,7,13, ---------- which is correct .

19. The number of terms of the series: 5+7+9+…….must be taken so that the sum may be 480. **July – 2021**

(a) 20 (b)10 (c) 15 (d) 25

Answer:

(a) Clearly, the given series is AP.

We have a = 5; d = 2; S_n = 480; n = ?

$S_n = \frac{n}{2} \times (2a + (n-1)d)$

⇨ $480 = \frac{n}{2} \times [(2 \times 5) + (n - 1)2]$

⇨ $480 = \frac{n}{2} \times [10 + (n - 1)2]$

Now, try the options

Option (a) → 20

RHS = $\frac{20}{2} \times [10 + (20 - 1)2] = 480 = LHS$

20. The sum of series 7 + 14 + 21 + ……. To 17^{th} term is: **Dec-2021**

(a) 1071 (b) 971 (c) 1171 (d) 1271

Answer:

(a) Clearly, this is an AP with a = 7; d = 14 – 7 = 7; n = 17

$S_n = \frac{n}{2}[2a + (n-1)d]$

$S_{17} = \frac{17}{2}[(2 \times 7) + (17-1)7] = 1,071$

21. The n^{th} term of the series 9, 7, 5, …. and 15, 12, 9, …. Are same. Find the n^{th} term? **June 2022**

(a) 7 (b) 8 (c) 9 (d) 10

Answer :

(a) Given Series

9,7,5, ……. n term

a = 9 , d = 7 – 9 = –2 , n = n

$T_n = a + (n-1)d$

$T_n = 9 + (n-1)(-2)$

$= 9 - 2n + 2$

$= 11 - 2n$

And other series

= 15 , 12 , 9 , …… n term

a = 15 , d = 12 – 15 = –3,n=n

$T_n = a + (n-1)d$

$= 15 + (n-1)(-3)$

$= 15 - 3n + 3 = 18 - 3n$

Given n^{th} term of both series are equal

then $11 - 2n = 18 - 3n$

$3n - 2n = 18 - 11$

n= 7

AP MEDIUM

22. The sum of the third and ninth term of an AP is 8. Find the sum of the first 11 terms of the progression Dec-2011

a) 44 b) 22 c) 19 d) 11

Solution :

$t_3 + t_9 = 8$

$\Rightarrow a + 2d + a + 8d + 8$

$\Rightarrow 2a + 10d = 8$ $\qquad t_{11} = a + 10d$

$\Rightarrow a + 5d = 4$

$\therefore S_{11} = \frac{11}{2}[a + a + 10d]$

$S_{11} = \frac{11}{2}(2a + 10d)$

$= 11(a + 5d) = 11 \times 4 = 44$

23. In an AP, if common difference is 2, Sum of n terms is 49,7^{th} term is 13 then n = _____ **Dec-2012**

(a) 0 (b) 5 (c) 7 (d) 13

Solution :

d = 2

$S_2 = 49$

$t_7 = a + 6d$=13

$\Rightarrow a + 6 \times 2 = 13$

$\Rightarrow a = 1$

$S_n = 49$

$\Rightarrow \frac{n}{2}[2a + (n-1)d] = 49$

$\Rightarrow n[2 + (n-1)2] = 49 \times 2$

$\Rightarrow 2n(1 + n - 1) = 49 \times 2$

$\Rightarrow n(n) = 49$

$\Rightarrow n = 7$

24. If the sum of the 4th term and the 12th term of an AP is 8, what is the sum of the first 15 terms of the progression? **June-2013**

a) 60 b) 120 c) 110 d) 150

Solution :

$$t_4 + t_{12} = 8$$
$$\Rightarrow a + 3d + a + 11d = 8$$
$$\Rightarrow 2a + 14d = 8$$
$$\Rightarrow a + 7d = 4$$
$$S_{15} = \frac{15}{2}[2a + 14d]$$
$$= 15(a + 7d)$$
$$= 15 \times 4 = 60$$

25. An Arithmetic progression has 13 terms whose sum is 143. The third term is 5 so the first terms is **Dec-2013**

(a) 4 (b) 7 (c) 9 (d) 2

MULTIPLE

26. The sum of all natural numbers from 100 and 1000 which are multiple of 5 is: **Nov-2006**

(a) 99,550 (b) 96,450 (c) 97,450 (d) 95,450

Solution :

The series is 100, 105, 110, 115 1000

a = 100 $\ell = 1000$ d = 105 - 100 = 5.

The sum of all natural numbers between 100 and 1000 which are multiple of 5 is

$\frac{n}{2}(a + \ell) = \frac{181}{2}(100 + 1000)$

$t_n = a + (n - 1)d$ = 99,550

$\Rightarrow$ 1000 = 100 + (n - 1)5

$\Rightarrow$ 900 = (n - 1)5

$\Rightarrow$ n = 181

Answer $\Rightarrow$ 99,550

27. Find the sum of all natural numbers: between 250 and 1,000 which exactly divisible by 3: **Feb-2007**

(a) 1,56,375 (b) 1,56,357 (c) 1,65,375 (d) 1,65,357

Solution :

The numbers divisible by 3
between 250 and 1000
are 252, 255, ... 999

$\therefore$ a = 252

d = 255 - 252 = 3

$t_n = 999$

$\Rightarrow$ a+(n-1)d = 999

$\Rightarrow$ 252 + (n-1)3 = 999

$\Rightarrow$ (n-1)3 = 747

$\Rightarrow (n - 1) = \frac{747}{3}$

$\Rightarrow$ n = 250

$\therefore s = \frac{n}{2}(a + \ell)$

$= \frac{250}{2}(252 + 999)$

$= \frac{250}{2}(1251) = 1,56,375$

28. The number of integers from 1 to 100 which are neither divisible by 3 nor by 5 nor by 7 is **Jan- 2021**

(a) 67 (b) 55 (c) 45 (d) 33

Not found question

AP APPLICATION

29. A contractor who fails to complete a building in a certain specified time is compelled to forfeit ₹ 200 for the first day of extra time required and thereafter forfeited amount is increased by ₹25 for every day If he loses ₹ 9,450, for how many days did he over-run the contract time? **Nov-2007**

(a) 19 days **(b) 21 days** **(c) 23 days** **(d) 25 days**

Solution :

a = 200
d = 25
s = 9450
n = ?

$\therefore S = \frac{n}{2}[2a + (n-1)d]$

$\Rightarrow 9450 = 200n + \frac{25^n}{2}(n-1)$

$\Rightarrow 18900 = 400n + 25n^2 - 25n$

$\Rightarrow 25n^2 + 375n - 18900 = 0$

$\Rightarrow n^2 + 15n - 756 = 0$

$\Rightarrow n^2 + 36n - 21n - 756 = 0$

$\Rightarrow n(n+36) - 21(n+36) = 0$

$\Rightarrow (n+36)(n-21) = 0$

$\therefore n = -36$ & n = 21

30. A man employed in a company is promised a salary of ₹ 3,000 every month for the first year and an increment of ₹ 1,000 in his monthly salary every succeeding year How much does the man earn from the company in 20 years? **Feb-2008**

(a) ₹ 30,00,000 (b) ₹ 27,50,000 (c) ₹ 19,10,000 (d) ₹ 7,90,000

Solution :

a = 3000
d = 1000
n = 20 years = 20 × 12 months = 240 months

$S = \frac{n}{2}[2a + (n-1)d]$

$S = \frac{240}{2}[2 \times 3000 + (20-1)1000]$

S = 120 (6000 + 19000)

S = 120 (25000) = 30,00,000

31. On 1st January every year a person buys National Saving Certificates of value exceeding that of his last year's purchase by ₹ 100 After 10 years, he finds that the total value of the certificates purchased by him is ₹ 54,500 Find the value of certificates purchased by him in the first year : **June-2008**

(a) ₹ 6,000 **(b) ₹ 4,000** **(c) ₹ 5,000** **(d) ₹ 5,500**

Solution :

Let the value of certificates purchased by him in the first year be a

n = 10
d = 100

$S = \frac{n}{2}[2a + (n-1)d]$

$\Rightarrow 54500 = \frac{10}{2}[2a + 9d]$

$\Rightarrow 54500 = 5[2a + 9 \times 100]$

$\Rightarrow 54500 = 5(2a + 900)$

$\Rightarrow 10900 = (2a + 900)$

$\Rightarrow 10,000 = 2a$

$\Rightarrow 2a = 10,000$

$\Rightarrow a = 5000$

32. The income of a person is ₹5,00,000 in the firm in the first year and he receives an increase of ₹15,000 per year for next 10 years. The total amount he receives in 10 years is: **Dec-2016**

(a) ₹56,75,000 (b) ₹72,50,000 (c) ₹15,67,5000 (d) None of these

Solution :

S_n after 10 years

$= \frac{n}{2}[2a + (n-1)d]$

$= \frac{10}{2}[2 \times 500000 + (10-1)15000]$

= 5 [10,00,000 + 1,35,000] = ₹ 56,75,000

33. A person pays ₹ 975 in monthly installments, each installments is less than former by ₹ 5. The amount of 1st installment is ₹ 100. In what time will the entire amount be paid? **June 2022, Feb 2007**

(a) 26 months (b) 15 months (c) Both (a) and (b) (d) 18 months

Solution :

Let the entire amount be paid in n months

First installment (a) = 100

d = - 5

$\therefore t_2 = a + d = 100 - 5 = 95$

Similarly,

The series is 100, 95, 90, 80, ... upto n months

Sum = $\frac{n}{2}[2a + (n-1)d]$

$\Rightarrow \quad 975 = \frac{n}{2}[2 \times 100 + (n-1)(-5)]$

$\Rightarrow \quad 975 = 100n - \frac{n}{2}.5(n-1)$

$\Rightarrow \quad 975 = \frac{200n - 5n^2 + 5n}{2}$

$\Rightarrow \quad 1950 = 200n - 5n^2 + 5n$

$\Rightarrow \quad 5n^2 - 205n + 1950 = 0$

$\Rightarrow \quad n^2 - 41n + 390 = 0$

$\Rightarrow \quad n^2 - 15n - 26n + 390 = 0$

$\Rightarrow \quad n(n - 15) - 26(n - 15) = 0$

$\therefore n = 15, 26$

But we take n = 15 months because after twenty one installments, the installments become negative. So ignored n = 26.

AP THEORETICAL

34. If the sum of 'x' terms of an Arithmetic Progression (A.P) is $3x^2 + 5x$ and its m^{th} term is 164, then the value of m is : **Dec-2015**

a) 27 b) 28 c) 24 d) 26

Answer:

(a) Given $S_n = 3n^2 + 5n$

Putting n =1, $S_1 = 3(1)^2 + 5(1) = 3 + 5 = 8$

n =2, $S_2 = 3(2)^2 + 5(2) = 12 + 10 = 22$

$S_3 = 3(3)^2 + 5(3) = 27 + 15 = 42$

then,

$T_1 = S_1 = 8$

$T_2 = S_2 - S_1 = 22 - 8 = 14$

$T_3 = S_3 - S_2 = 42 - 22 = 20$

A.P. series is

8, 14, 20 .....

a = 8, d = 14 – 8 = 6, $T_m = 164$

$T_m = a + (m-1)\, d$

$164 = 8 + (m - 1) \times 6$
$164 = 8 + 6m - 6$
$6m = 164 + 6 - 8$
$6m = 162$
$m = \frac{162}{6}$
$m = 27$

35. If $\frac{1}{b+c}, \frac{1}{c+a}, \frac{1}{a+b}$ are in arithmetic progression then $a^2, b^2, c^2,$ are in progression **June-2016**

a) Arithmetic Progression b) Geometric Progression
c) Both in arithmetic and geometric Progression d) None of these.

Solution :

$$\frac{1}{c+a} + \frac{1}{b+c} = \frac{1}{a+b} - \frac{1}{c+a}$$
$$\Rightarrow -\frac{1}{b+c} - \frac{1}{a+b} = -\frac{1}{c+a} - \frac{1}{c+a}$$
$$\Rightarrow \frac{1}{b+c} + \frac{1}{a+b} = \frac{2}{c+a}$$
$$\frac{a+b+b+c}{(b+c)(a+b)} = \frac{2}{c+a}$$
$$\Rightarrow \frac{a+2b+c}{ab+ac+b^2+bc} = \frac{2}{c+a}$$
$$\Rightarrow \cancel{ac} + \cancel{2bc} + c^2 + a^2 + \cancel{2ab} + \cancel{ac} = \cancel{2ab} + \cancel{2ac} + 2b^2 + \cancel{2bc}$$
$$\Rightarrow c^2 + a^2 = 2b^2$$
$$\Rightarrow a^2 - 2b^2 + c^2 = 0$$
$$\Rightarrow a^2 - b^2 - b^2 + c^2 = 0$$
$$\Rightarrow a^2 - b^2 = b^2 - c^2$$

(They are n A.P.)

36. If the sum of 'n' terms of an AP (Arithmetic Progression) is $2n^2$, the fifth term is_____ **July – 2021**

(a) 20 (b) 50 (c) 18 (d) 25

Answer:

(c) $a = t_1 = S_1 = 2(1)^2 = 2$
$S_2 = 2(2)^2 = 8$
$t_2 = S_2 - S_1 = 8 - 2 = 6$
$d = t_2 - t_1 = 6 - 2 = 4$
Therefore, we have $a = 2$; $d = 4$
$t_n = a + (n-1)d$
$t_5 = a + 4d = 2 + (4 \times 4) = 18$

37. If p^{th} term of an AP is q and its q^{th} term is p, then what will be the value of $(p+q)^{th}$ term? **Dec 2022**

(a) 0 (b) 1 (c) p + q – 1 (d) 2 (p + q -1)

Answer:

(a) Given $T_q = q$ and $T_q = p$
$a + (p-1)d = q$ $a + (q-1)d = p$
$a + pd - d = q$ __(i) $a + qd - d = p$ __(ii)

eq. (1) – eq.(2)
$\cancel{a} + pd - \cancel{d} = q$
$\cancel{a} + qd - \cancel{d} = p$
\- - + -

$Pd - qd = q - p$
$d(p-q) = -(p-q)$

$d = \frac{-(p-q)}{(p-q)}$

$d = -1$

Putting d= -1 in eq.(1)

$a + p(-1) - (-1) = q$

$a - p + 1 = q$

$a = p + q - 1$

Now $T_{p+q} = a + (p + q - 1)d$

$= p + q - 1 + (p + q - 1)(-1)$

$= p + q - 1 - p - q + 1$

$= 0$

38. Find the ninth term of the series: $\sqrt{2}, 5\sqrt{2}, 9\sqrt{2}, \ldots\ldots$ **Dec-2008**

(a) $25\sqrt{2}$ (b) $31\sqrt{2}$ (c) $33\sqrt{2}$ (d) $52\sqrt{2}$

GP BASIC

39. The sum of how many terms of the sequence 256, 128, 64,_____is 511 **Dec-2008**

(a) 8 (b) 9 (c) 7 (d) None of these

Solution :

$a = 256$

$r = \frac{128}{256} = 0.5 (r < 1)$

$S = \frac{a(1 - \quad^{n})}{1 - r}$

$511 = \frac{256[1 - (0.5)^n]}{1 - 0.5}$

$\Rightarrow 511 \times 0.5 = 256[1 - (0.5)^n]$

$\Rightarrow 255.5 = 256[1 - (0.5)^n]$

$\Rightarrow 1 - (0.5)^n = 0.998047$

$\Rightarrow 1 - 0.998047 = (0.5)^n$

$\Rightarrow (0.5)^n = 0.001953$

$\Rightarrow (0.5)^n = (0.5)^9$

$\Rightarrow n = 9$

40. In a GP the sixth term is 729 and the common ratio is 3, then the first term of GP is: **June-2013**

a) 2 b) 3 c) 4 d) 7

Solution :

$t_6 = 729$

$ar^5 = 729$

$a(3)^5 = 729$ [r = 23]

$a = \frac{(3)^6}{(3)^5}$

a = 3

41. The 3rd term of a G.P. is $\frac{2}{3}$ and the 6th is 2/81, then the 1st term is **Nov-2018**

(a) 6 (b) $\frac{1}{3}$ (c) 9 (d) 2

Answer:

(a) Let 1st term of G.P. is 'a' and common Ratio is 'r' then

Given $T_3 = \frac{2}{3}$ and $T_6 = \frac{2}{81}$

$ar^2 = \frac{2}{3}$ ……(i) $ar^5 = \frac{2}{81}$ ……..(ii)

eq.(2)/eq.(1)

$\frac{ar^5}{ar^2} = \frac{\frac{2}{81}}{\frac{2}{3}}$

$r^3 = \frac{2}{81} \times \frac{3}{2} \Rightarrow r^3 = \frac{1}{27} = r = \frac{1}{3}$

Putting r = $\frac{1}{3}$ in equation (i)

$ar^2 = \frac{2}{3}$

a $(\frac{1}{3})^2 = \frac{2}{3}$ => a $\times \frac{1}{9} = \frac{2}{3}$

=> a = $\frac{2}{3} \times \frac{9}{1}$

=> a = 6

42. Sum the series $\frac{1}{5}, \frac{1}{5^2}, \frac{1}{5^3} \ldots \ldots \ldots \ldots \ldots . \frac{1}{5^n}$. **Nov-2019**

(a) $\frac{1}{4}\left[1 - \left(\frac{1}{5}\right)^n\right]$ (b) $\frac{1}{5}\left[1 - \left(\frac{1}{4}\right)^n\right]$ (c) both (d) None

Answer :

(a) Series => $\frac{1}{5}, \frac{1}{5^2}, \frac{1}{5^3}, \ldots\ldots\ldots\frac{1}{5^n}$

So, here a = $\frac{1}{5}$, r = $\frac{1}{5}$, $\frac{1}{5} < 1$

Sn = a$\frac{(1-r^n)}{(1-r)}$, r < 1

Sn = $\frac{1}{5}\left[\frac{1-\left(\frac{1}{5}\right)^n}{\left(1-\frac{1}{5}\right)}\right]$

Sn = $\frac{1}{5} \times \frac{5}{4}\left[1-\left(\frac{1}{5}\right)^n\right]$

Sn = $\frac{1}{4}\left[1-\left(\frac{1}{5}\right)^n\right]$

43. Find the no. of terms of the series **Nov-2019**

25, 5, 1 …….. $\frac{1}{3125}$

(a) 6 (b) 7 (c) 8 (d) 9

Answer :

(c) Given series

25,5,1 …… $\frac{1}{3125}$

a = 25 , or = $\frac{1}{5} < 1$

T_n = a (r) $^{n-1}$

$\frac{1}{3125} = 25\left(\frac{1}{5}\right)^{n-1}$

$\frac{1}{78125} = \left(\frac{1}{5}\right)^{n-1}$

$\left(\frac{1}{5}\right)^7 = \left(\frac{1}{5}\right)^{n-1}$

n–1 = 7

n = 8

44. In a geometric progression the 3rd and 6th terms are respectively 1 and -1/8. The first term (a) and common ratio are respectively. **Jan - 2021**

(a) 4 and $\frac{1}{2}$ (b) 4 and $\frac{-1}{4}$ (c) 4 and $\frac{-1}{2}$ (d) 4 and $\frac{1}{4}$

Answer :

(c) Let 1st term of G.P. = a

Common Ratio of G.P. = 'r'

Given $T^3 = ar^{3-1}$ [$\because$ Tn = ar $^{n-1}$]

$1 = ar^2$

$ar^2 = 1$ ----------(1)

and $T^6 = ar^6$–1

$\frac{-1}{8} = ar^5$

$ar^5 = \frac{-1}{8}$ ----------(2)

Equation 2 / Equation 1

$\frac{ar^5}{ar^2} = \frac{-1/8}{1}$

$r^3 = \frac{-1}{8}$

$r^3 = \left(\frac{-1}{2}\right)^3$

$\boxed{r = -1/2}$

Putting $r = -1/2$ in Equation ----------(1)

$\left(\frac{a}{r} - 7\right)$ $a = \left(\frac{-1}{2}\right)^2 = -1$

$a \times \frac{-1}{4} = \frac{-1}{1}$

$a = \frac{-1}{1} \times \frac{4}{1}$

$\boxed{a = -4}$

45. The largest value of n for which $\frac{1}{2} + \frac{1}{2^2} + \cdots \cdot \frac{1}{2^n} < 0.998$ is. **Dec-2021**

(a) 9 (b) 6 (c) 7 (d) 8

Answer:

(d) The given series is a GP with a = ½; r = ½

Since r < 1, $S_{n=a}\left(\frac{1-r^n}{1-r}\right)$

Try the options,

Option (a) → 9

If n = 9

$S_9 = \frac{1}{2}\left(\frac{1-(1/2)^9}{1-(1/2)}\right) = 0.998046875$

Option (b) → 6

If n = 6

$S_6 = \frac{1}{2}\left(\frac{1-(1/2)^6}{1-(1/2)}\right) = 0.984375$

Option (c) → 7

If n = 7

$S_7 = \frac{1}{2}\left(\frac{1-(1/2)^7}{1-(1/2)}\right) = 0.9921875$

Option (d) → 8

If n = 8

$S_8 = \frac{1}{2}\left(\frac{1-(1/2)^8}{1-(1/2)}\right) = 0.99609375$

Clearly, option (d) is the answer as it is the largest value for which the sum of the series is less than 0.998.

46. The sum of first 8 terms of G.P is five times the sum of the first 4 terms. Find the common ratio? **June 2022**

(a) $\pm\sqrt{2}$ (b) 16 (c) $\pm\sqrt{20}$ (d) 4

Answer:

(a) Let 1st term of G.P. = a

Common Ratio (r) = r

Given,

$S_8 = 5\,S_4$

$\frac{a(r^8-1)}{(r-1)} = 5\frac{a(r^4-1)}{(r-1)}$

$r^8 - 1 = 5(r^4 - 1)$

$(r^4)^2 - (1)^2 = 5\,(r^4-1)$

$(r^4 + 1)(r^4 - 1) = 5\,(r^4-1)$

$r4 + 1 = 5$

$r^4 = 4$

$(r^2)^2 = (2)^2 \Rightarrow r = \pm\sqrt{2}$

47. In a GP 5th term is 27 and 8th term is 729. Find its 11th term? **Dec 2022**

(a) 729 (b) 6561 (c) 2187 (d) 19683

Answer:

(d) In G.P.

Given $T_5 = 27$ and $T_8 = 729$

$ar^4 = 27$ ---------(1) $ar7 = 729$ ----------(2)

eq . (2) / eq. (1)

$\frac{ar^7}{ar^4} = \frac{729}{27}$

$r^3 = 27 \Rightarrow r^3 = 3^3 \Rightarrow r = 3$

Putting r = 3 in equation (1) , we get

$a.3^4 = 27$

$a \times 81 = 27$

$a = \frac{27}{81}$

$a = \frac{1}{3}$

Now $T_{11} = ar^{11-1}$ [$\because T_n = ar^{n-1}$]

$= ar^{10}$

$= \frac{1}{3} \times (3)^{10}$

$= \frac{1}{3} \times 59049$

$= 19683$

INFINITE GP

48. If the first term of a GP exceeds the second term by 2 and the sum to infinity is 50, the series is :

(a) 10, 8, $\frac{32}{5}$ …… (b) 10, 8, $\frac{5}{2}$…… (c) 10, $\frac{10}{3}, \frac{10}{9}$… (d) None

49. If $x = 1 + \frac{1}{3} + \frac{1}{3^2} + \cdots \ldots \ldots \infty, y = 1 + \frac{1}{4} + \frac{1}{4^2} + \cdots \ldots \ldots \infty$ find xy **June-2008**

(a) 2 (b) 1 (c) 8/9 (d) ½

50. The first term of a GP where second term is 2 and sum of infinite term is 8 will be **Dec-2012**

(a) 6 (b) 3 (c) 4 (d) 1

Solution :

$t_2 = 2$

$\Rightarrow ar = 2$

$\frac{a}{1-r} = 8$

$\therefore ar = 2$

$\Rightarrow a\frac{1}{2} = 2$

$\Rightarrow a = 4$

$\Rightarrow 8(1 - r)r = 2$

$\Rightarrow 4(1-r)r = 2$

$\Rightarrow r - r^2 = \frac{1}{4}$

$\Rightarrow 4r - 4r^2 = 1$

$\Rightarrow 4r^2 - 4r + 1 = 0$

$\Rightarrow (2r - 1)^2 = 0$

$\Rightarrow 2r = 1$

$\Rightarrow r = \frac{1}{2}$

51. The sum of terms of an infinite GP is 15 And the sum of the squares of the term is 45 Find the common ratio

(a) 3/2 (b) 1 (c) -2/3 (d) 2/3

52. The number 2.353535 _____ in $\frac{p}{q}$ form is: **Dec-2016**

(a) $\frac{235}{99}$ (b) $\frac{234}{99}$ (c) $\frac{230}{99}$ (d) $\frac{233}{99}$

53. If $y = 1 + x + x^2 + \ldots\ldots\ldots\ldots \infty$ then x = **June-2019**

(a) $\frac{y-1}{y}$ (b) $\frac{y+1}{y}$ (c) $\frac{y}{y+1}$ (d) $\frac{y}{y-1}$

Answer:

(a) If $y = 1 + x + x^2 + \ldots\ldots\ldots\ldots \infty$

$a = 1, r = \frac{x}{1} = x$

$y = \frac{1}{1-x}$ $\left[S_\infty = \frac{a}{1-r}\right]$

In G.P.

$y(1-x) = 1$

$y - xy = 1$

$xy = y - 1$

$x = \frac{y-1}{y}$

54. Sum upto infinity of series. **Nov-2019**

$\frac{1}{2} + \frac{1}{3^2} + \frac{1}{2^3} + \frac{1}{3^4} + \frac{1}{2^5} + \ldots\ldots\ldots\ldots\ldots$

(a) 19/24 (b) 24/19 (c) 5/24 (d) None

Answer:

(a) We know,

$S\infty = \frac{a}{1-r}$, r<1

Here, $\frac{1}{2} + \frac{1}{3^2} + \frac{1}{2^3} + \frac{1}{3^4} + \frac{1}{2^6} + \ldots\ldots\ldots$

$\Rightarrow \left(\frac{1}{2} + \frac{1}{2^3} + \frac{1}{2^6} + \ldots\ldots\infty\right) + \left(\frac{1}{3^2} + \frac{1}{3^4} + \ldots\ldots\infty\right)$

$\Rightarrow \left(a = \frac{1}{2}, r = \frac{1}{4} < 1\right); \left(a = \frac{1}{9}, r = \frac{1}{9}\right)$

$\Rightarrow \left(\frac{\frac{1}{2}}{1-\frac{1}{4}}\right) + \left(\frac{\frac{1}{9}}{1-\frac{1}{9}}\right)$

$\Rightarrow \frac{\frac{1}{2}}{\frac{3}{4}} + \frac{\frac{1}{9}}{\frac{8}{9}}$

$\Rightarrow \frac{1}{2} \times \frac{4}{3} + \frac{1}{9} \times \frac{9}{8}$

$\Rightarrow \frac{2}{3} + \frac{1}{8}$

$\Rightarrow \frac{19}{24}$

55. The recurring decimal 2.7777…… can be expressed as : **Dec-2010**

(a) 24/9 (b) 22/9 (c) 26/9 (d) 25/9

GP THEORETICAL

56. If $a^{1/x} = b^{1/y} = c^{1/z}$ and a, b, c are in G.P; the x, y, z are in : **Feb-2007**

(a) A. P. (b) G. P. (c) Both (a) & (b) (d) None

Solution :

Let $a^{\frac{1}{x}} = b^{\frac{1}{y}} = c^{\frac{1}{z}} = k$

$\therefore a^{\frac{1}{x}} = k$

$\Rightarrow a = k^x$

Similarly, $b = k^y$

$c = k^z$

$\therefore$ a, b, & c are G. P

k^x, k^y, k^z are in G. P

$\therefore b^2 = ac$

$\Rightarrow (k^y)^2 = k^x . k^z$

$\Rightarrow (k)^{2y} = k^{x+z}$

$\Rightarrow 2y = x + z$

$\therefore$ In A.P series, 2b = a+c

$\therefore$ This is in A. P.

57. The first, second and seventh term of AP are in GP and the common difference is 2, the 2nd term of AP is : **Nov-2007**

(a) 5/2 (b) 2 (c) 3/2 (d)1/2

Solution :

$t_1 = a$ d = 2

$t_2 = a + d = a + 2$

$t_7 = a + 6d = a + 12$

$a, a+2, a+12$ are in G.P.

$\therefore (a+2)^2 = (a+12)^a$

$\Rightarrow a^2 + 4 + 4a = a^2 + 12a$

$\Rightarrow 4(a+1) = 12a$

$\Rightarrow a + 1 = 3a \qquad \Rightarrow 3a - a = 1$

$\Rightarrow 2a = 1 \qquad \Rightarrow a = \frac{1}{2}$

$\therefore t_2 = a + 2$

$= \frac{1}{2} + 2$

$= \frac{5}{2}$

58. If a, b, c are in AP and x, y, z are in GP, then the value of $x^{(b-c)}\ y^{(c-a)}\ z^{(a-b)}$ is: **Feb-2008**

(a) 1 (b) 0 (c) b(c-a) (d) None

Solution :

Let a = 1

b = 2 ∴ 1, 2, 3 are in A. P.

c = 3

and x = 1 ∴ 1, 2, 4 are in G. P.

y = 2

The value of $(x)^{b-c}\ (y)^{c-a}\ (z)^{a-b}$

$= (1)^{-1}\ (2)^2\ (4)^{-1} = 1 \times 4 \times \frac{1}{4} = 1$

59. The sum of three numbers in a geometric progression is 28. When 7, 2 and 1 are subtracted from the first, second and the third numbers respectively, then the resulting numbers are in arithmetic progression. What is the sum of squares of the original three numbers? **July – 2021**

(a) 510 (b) 456 (c) 400 (d) 336

Answer:

(d) Let the numbers in GP be $\frac{a}{r}$, a, and ar respectively .

Given that the sum is 28.

Therefore , $\frac{a}{r}$ + a+ ar = 28

⇨ $a\left(\frac{1}{r} + 1 + r\right) = 28$ … Eq. (1)

Also , given that if we subtract 7,2, and 1 from the first , second And third terms respectively , we get an AP .

On subtracting 7,2, and 1 from first , second and third terms , we get :

$(\frac{a}{r} - 7)$, (a-2), and (ar-1)

Since these numbers are in AP, we have (a-2)- $(\frac{a}{r} - 7)$

= $(ar - 1)$ - (a-2)

⇨ a- 2- $\frac{a}{r}$ +7 = ar – 1 – a +2

⇨ a- $\frac{a}{r}$ +5= ar-a +1

⇨ a- $\frac{a}{r}$ – ar+ a = 1-5

⇨ 2a- $\frac{a}{r}$ - ar = -4

⇨ $a\left(2 - \frac{1}{r} - r\right)$= -4 …. Eq.(2)

Dividing Eq. (1) by Eq. (2) , we get :

$\frac{a\left(\frac{1}{r}+1+r\right)}{a\left(2-\frac{1}{r}-r\right)} = \frac{28}{-4}$

$\Rightarrow \frac{\frac{1+1r+r^2}{r}}{\frac{2r-1-r^2}{r}} = -7$

$\Rightarrow \frac{1+r+r^2}{2r-1-r^2} = -7$

$\Rightarrow 1 + r + r^2 = -7\,(2r - 1 - r^2)$

$\Rightarrow 1 + r + r^2 = -14r+7+7r^2$

$\Rightarrow 7r^2 + 7 - 14r - 1 - r - r^2 = 0$

$\Rightarrow 6r^2 - 15r + 6 = 0$

Here , a = 6 ; b = –15 ; c = 6

$\alpha + \beta = -\frac{b}{a} = -\frac{-15}{6} = \frac{15}{6}$

$\alpha\beta = \frac{c}{a} = \frac{6}{6} = 1$

As per fastest method , $\left(\frac{15}{6\times2} + X\right)\left(\frac{15}{6\times2} - X\right) = 1$

$\Rightarrow \left(\frac{15}{12}\right)^2 - X^2 = 1$

$X^2 = \left(\frac{15}{12}\right)^2 - 1 = 1.5625 - 1 = 0.5625$

$X = \sqrt{0.5625} = 0.75$

$\alpha = \frac{15}{12} + 0.75 = 2$

$\beta = \frac{15}{12} - 0.75 = 0.5$

Therefore, common ratio could either be 2, or 0.5.

Taking the common ratio to be 2, let's find out the value of a.

Putting the value of r=2 in Eq. (1), we'll get

$a\left(\frac{1}{2} + 1 + 2) = 28\right)$

$\Rightarrow$ a(3.5) = 28

$\Rightarrow$ a = $\frac{28}{3.5} = 8$

Therefore, the GP will be $\frac{8}{2}$, 8, 8 × 2=4, 8, 16.

We can see that the sum of these numbers = 4 + 8 + 16 = 28

Subtracting 7,2, and 1 from first, second and third terms, we'll get 4 – 7 = –3, 8 – 2 = 6, 16 – 1 = 15.

These terms are clearly in AP as 15 – 6 = 6 – (–3) = 9

The sum of squares of the numbers 4, 8, and 16 = $4^2 + 8^2 + 16^2$ = 336.

Now, taking 0.5 as the common ratio, let's find out the value of a.

Putting the value of r = 0.5 in Eq. (1), we'll get;

$a\left(\frac{1}{r} + 1 + r\right) = 28$

$\Rightarrow a\left(\frac{1}{0.5} + 1 + 0.5\right) = 28$

$\Rightarrow$ a(3.5) = 28

$\Rightarrow$ a = $\frac{28}{3.5} = 8$

Therefore, the GP will be $\frac{8}{0.5}$, 8, 8 × 0.5 = 16, 8, 4

We can see that the sum of these numbers = 16 + 8 + 4 = 28

Subtracting 7, 2 and 1 from first, second, and third terms, we'll get 16 – 7 = 9, 8 – 2 = 6, 4 – 1 = 3.

These terms are clearly in AP as 6 – 9 = 3 – 6 = –3

The sum of squares of the numbers 16, 8 and 4 = $16^2 + 8^2 + 4^2$ = 336

PRODUCT OF GP

60. Find the product of : $(243), (243)^{1/6}, (243)^{1/36}$ ... . ∞, **June-2011**

(a) 1,024 (b) 27 (c) 729 (d) 246

Solution :

$(243), (243)^{1/6}, (243)^{1/36}$ ... . ∞,

$= (243)^{1+1/6+1/36+\cdots\cdots\cdots\infty}$

$= (243)^{\frac{1}{1-1/6}}$ a = 1 r = 1/6

$= (243)^{6/5}$ $= (3)^{5.6/5} = (3)^6 = 729$

61. If 5^{th} term of a GP is $\sqrt[3]{3}$, then the product of first nine terms is **Dec-2011**

a) 8 b) 27 c) 243 d) 9

Solution :

$t_5 = \sqrt[3]{3}$

$ar^4 = \sqrt[3]{3}$

∴ The product 06 first nine terms = $a^9 r^{36}$

$\therefore a^9 (r)^{36}$

$= (ar^4)^9$

$= \left(\sqrt[3]{3}\right)^9$

$= (3)^{9/3} = (3)^2 = 9$

62. In a G.P. If the fourth terms is '3' then the product of first seven terms is **June-2019**

a) 3^5 b) 3^7 c) 3^6 d) 3^8

Answer:

(b) In G.P. $T_4 = ar^{4-1} = 3$

$ar^3 = 3$

Product of 1^{st} seven terms

$= (a.ar .ar^2.ar^3.ar^4.ar^5.ar^6)$

$= a^7. r^{21}$

$= (ar^3)^7$

$= (3)^7$

63. If the sum and product of three numbers in G.P. are 7 and 8 respectively. then 4^{th} term of the series is **Dec-2021**

(a) 6 (b) 4 (c) 8 (d) 16

Answer:

(c) $t_n = ar^{n-1}$

Let the three terms of GP be $\frac{a}{r}$, a, and ar respectively.

Since the product is 8, we have:

$\frac{a}{r} \times a \times ar = 8$

$\Rightarrow a^3 = 8$

$\Rightarrow a = (8)^{\frac{1}{3}} = 2$

Also, it is given that $\frac{a}{r} + a + ar = 7$

⇨ $\frac{a+ar+ar^2}{r} = 7$

⇨ $a + ar + ar^2 = 7r$

Putting the value of a = 2 above, we get:

$2 + 2r + 2r^2 = 7r$

⇨ $2r^2 + 2r - 7r + 2 = 0$

⇨ $2r^2 - 5r + 2 = 0$

⇨ $2r^2 - 4r - r + 2 = 0$

⇨ 2r $(r-2)$ - $(r-2)$ = 0

⇨ (2r-1) (r-2) = 0

So, either 2r – 1 = 0 => r = $\frac{1}{2}$

Or r – 2 = 0 => r = 2

Taking r = Y_2, we have $t_4 = 4\left(\frac{1}{2}\right)^3 = 0.5$

Taking r = 2, we have $t_4 = 1(2)^3 = 8$

Since 0.25 is not in the options, option (d) is the answer.

9/9 RULE

64. The sum of the series 1 + 11 + 111 + ... to n terms is _____. **June 2014, June-2015**

(a) $\frac{1}{27}[10^{n+1} - 9n - 10]$ (b) $10^{n+1} - 9n - 10$

(c) $\frac{1}{81}[10^{n+1} - 9n - 10]$ (d) None of these

AM, GM

65. Insert 4 AM's between 3 and 18 : **Feb-2008**

(a) 12, 15, 9, 6 (b) 6, 9, 12, 15 (c) 9, 6, 12, 15 (d) 15, 12, 9, 6

Solution :

3, _____, _____, _____, _____, 18

a = 3

$t_6 = a + 5d$

⇒ 18 = 3 + 5d

⇒ 15 = 5d

⇒ d = 3

$t_2 = a + d = 3 + 3 = 6$

$t_3 = a + 2d = 3 + 6 = 9$

$t_4 = a + 3d = 3 + 9 = 12$

$t_5 = a + 4d = 3 + 12 = 15$

66. Find two numbers whose AM is 10 and GM is 8 **Dec-2008**

(a) [10,10] (b) [16,4] (c) [18,2] (d) [14,6]

Solution :

By Trial & Error Method

AM = $\frac{10+10}{2} = 10$

GM = $\sqrt{(10)(10)} = 10 \neq 8$

Not possible.

Again

AM = $\frac{16+4}{2} = 10$

GM = $\sqrt{16 \times 4} = 8$ ∴ Answer (b)

67. Find the numbers whose arithmetic mean is 12.5 geometric mean is 10 **Dec-2011**

(a) 20 and 5 (b) 10 and 5 (c) 5 and 4 (d) None of these

Solution :

By Trial and Error Method,

AM = $\frac{20+5}{2} = 12.5$

GM = $\sqrt{20 \times 5} = 10$

68. If sum of 3 arithmetic means between "a" and 22 is 42, then "a" = _____ **Dec-2011**

a) 14 b) 11 c) 10 d) 6

Solution :

a, _____, _____, _____, 22

$t_5 = a + 4d$ $t_2 = a + d$

22 = a + 4d ----- (i) $t_3 = a + 2d$

$S_3 = \frac{n}{2}(a + \ell)$

$\Rightarrow 42 = \frac{3}{2}(2a + 4d)$

$\Rightarrow 42 = \frac{3}{2}.2(a + 2d)$

$\Rightarrow 42 = 3(a + 2d)$

$\Rightarrow 14 = a + 2d$ ------ (ii)

$a + 2d = 14 \times 2$ ---------- (iii)

$a + 4d = 22$ ---------- (iv)

$\therefore 2a + \cancel{4d} = 28$

$\pm a \pm \cancel{4d} = \underline{6}^{22}$

$a = 6$

69. If 'n' arithmetic means are inserted between 7 & 71 and 5th arithmetic mean is 27, then 'n' is equal to: **June-2013**

a) 15 b) 16 c) 17 d) 18

Solution :

Total terms = n + 2

$t_6 = 27$ a = 7

a = 5d = 27

$\Rightarrow 5d = 27 - 7$

$\Rightarrow d = 4$

$t_{n+2} = 71$

$\Rightarrow a + (n + 2 - 1)d = 71$

$\Rightarrow a + (n + 1)d = 71$

$\Rightarrow 7 + (n + 1)4 = 71$

$\Rightarrow (n + 1)4 = 64$

$\Rightarrow (n + 1) = 16$

$\Rightarrow n = 15$

70. If Geometric mean (G.M.) of a, b, c, d is 3, then G.M. of 1/a, 1/b, 1/c, 1/d will be **Dec-2013**

(a) 1/3 (b) 3 (c) 81 (d) 1/810000

Answer:

(a) G.M. of a, b, c, d

$(G.M) = (a, b, c, d)^{1/4} = 3$

$a, b, c, d = 3^4$

$a, b, c, d = 81$ ……(¡)

G.M of $\frac{1}{a}, \frac{1}{b}, \frac{1}{c}, \frac{1}{d} = \left(\frac{1}{a}.\frac{1}{b}.\frac{1}{c}.\frac{1}{d}\right)^{1/4}$

$= \left(\frac{1}{abcd}\right)^{1/4}$

$= (abcd)^{-1 \times \frac{1}{4}}$

$= (81)^{-1/4}$

$= 3^{4x\ -1/4}$

$= 3^{-1}$

$= \left(\frac{1}{3}\right)$

71. Find the two numbers whose geometric mean is 5 and arithmetic mean in 7.5. **Dec-2015**

a) 10 and 5 b) 13.9 and 1.91 c) 12 and 3 d) None of the above

Answer:

(b) Let two Number a and b

A.M. $= \frac{a+b}{2}$

$7.5 = \frac{a+b}{2}$

$a+b = 15$ …….(1)

G.M. $= \sqrt{ab}$

$5 = \sqrt{ab}$

25 = ab ……..(2) (on squaring both side)

Solving (1) and (2) we get

a = 13.09 and b = 1.91

72. Insert two arithmetic means between 68 and 260. **May-2018**

a) 132, 196 b) 130, 194 c) 70, 258 d) None of the above

Answer:

(a) Let, two A.M's between 68 and 260 are A_1, A_2

68, A_1, A_2,; 260

d = $\frac{b-a}{n+1}$

d = $\frac{260-68}{2+1} = \frac{192}{3} = 64$

A_1 = a +d = 68 + 64 = 132

A_2 = a + 2d = 68 + 2×64 = 68 + 128 = 196

73. If the AM and GM of two numbers is 6.5 and 6 the no.'s are : **Nov-2019**

(a) 3 and 2 (b) 9 and 4 (c) 81 and 16 (d) None

Answer:

(b) Let the two nos. be 'a' and 'b'

AM =$\frac{a+b}{2}$; GM= $\sqrt{ab}$

$\sqrt{ab}$ = 6

a+b =6.5 On Squaring

ab= 36 -----Equation(2)

a+b = 13

a= 13-b -----Equation(1)

Put Eq (1) in Eq (2)

b×(13 − b) =36

13b-b^2 = 36

b^2 −13b+36 =0

b^2 −9b-4b+36=0

b(b-9) -4(b-9) = 0

b= 9 b= 4

a= 13-9 a= 13-4

a= 4 a= 9

So the two numbers are 4 and 9

74. If AM and HM for two numbers are 5 and 3.2, respectively. GM will be : **Nov-2019**

(a) 20 (b) 16 (c) 4 (d) 5

Answer:

(c) We know that

$(GM)^2$ = AM× HM

Here $(GM)^2$=5×3.2

$(GM)^2$= 16

(GM) = 4

3 CONDITION

75. Divide 30 into five parts in AP such that the first and last parts are in the ratio 2 :3 : **Feb-2007**

(a) $\frac{24}{5}, \frac{27}{5}, 6, \frac{33}{5}, \frac{36}{5}$ (b) $6, \frac{36}{5}, \frac{33}{5}, \frac{24}{5}, \frac{27}{5}$ (c) $\frac{27}{5}, \frac{24}{4}, \frac{36}{5}, \frac{33}{5}, 6$ (d) $6, \frac{24}{5}, \frac{27}{4}, \frac{33}{5}, \frac{36}{5}$

76. Find three numbers in GP such that their sum is 21, and the sum of their squares is 189 :

(a) 5,7,9 (b) 3,7,11 (c) 3,6,12 (d) 4,8,9

77. Three numbers in G.P. with their Sum 130 and their product 27,000 are: **Nov -2020**

(a) 10,30,90 (b) 90,30,10 (c) (a) and (b) both (d) 10,20,30

Answer:

(c) Let Three Nos. are in G.P.

$\frac{a}{r}$, a, ar

1st condition

$\frac{a}{r} \times a \times ar = 130$ …… (i)

IInd condition

$\frac{a}{r} \times a \times ar = 27{,}000$ …… (ii)

$a^3 = 27{,}000$

$a^3 = (30)^3$

$\boxed{a = 30}$

Putting a = 30 in eq. ……. (i)

$\frac{30}{r} + 30 + 30r = 130$

$\frac{30}{r} + 30r = 100$

$30\left(\frac{1}{r} + r\right) = 100$

$\frac{1+r^2}{r} = \frac{\cancel{100}}{\cancel{30}}$

$3 + 3r^2 = 10r$

$3r^2 - 10r + 3 = 0$

$3r^2 - 9r - r + 3 = 0$

$3r(r - 3) - 1(r -) = 0$

$(r - 3)(3r - 1) = 0$

If r = 300 $\boxed{r = 3}$ If 3r – 1 =0 $\boxed{r = 1/3}$

Three Nos. are

$\frac{a}{r}$, a, ar or $\frac{a}{r}$, a, ar

$\frac{30}{3}$, 30, 30 × 3 $\frac{30}{\frac{1}{3}}$, 30, $30 \times \frac{1}{3}$

10, 30, 90 90, 30, 10

78. Divide 69 into 3 parts which are in A.P. ad are such that the product of first two parts is 460: **Nov-2020**

(a) 20,23,26 (b) 21,23,25 (c) 19,23,27 (d) 22,23,24

Answer:

(a) Let Three Nos. are in AP is

(a-d),a ,(a+d)

their sum = 69

a-~~d~~+a+a+~~d~~ = 69

3a = 69

a = 23

The product of first two part = 460

(a-d)a =460

(23-d)23 = 460

23-d = 20 => $\boxed{d = 3}$

Nos. are

a-d, a, a+d

23-3, 23, 23+3

20 , 23, 26

SUM OF SERIES

79. The sum of n terms of the series 1 + (1+3) + (1+3+5) + ……is: **June-2017**

a) $\frac{n(n+1)(2n+1)}{6}$ b) $\frac{n(n+1)(n+2)}{6}$ c) $\frac{n(n+1)(2n+1)}{3}$ d) None of these

Answer:

(a) Given Series

1 + (1 + 3) + (1 + 3 + 5) + ……. n term

= 1 + 4 + 9 + ……. n term

$= 1^2 + 2^2 + 3^2 + \ldots\ldots + n^2$

$= \sum n^2$

$= \frac{n(n+1)(2n+1)}{6}$

MISCELLANEOUS QUESTIONS

80. If 9th and 19th term of an Arithmetic Progression are 35 and 75 , respectively , then its 20th term is : June 2023

(a) 78 (b) 79 (c) 80 (d) 81

Answer:

(b) Let Ist term and common difference of A.P are 'a' and 'd' respectively

Given

$T_9 = 35$ and $T_{19} = 75$

$a + 8d = 35$ ___(1) $a + 18d = 75$ _____(2)

Eq (2) – Eq (1)

$a + 18d = 75$

$a + 8d = 35$

\- - -

$10d = 40$

$\boxed{d = 4}$

Putting d = 4 in equation (1) we set

$a + 8 \times 4 = 35$

$a + 32 = 35$

$\boxed{a = 3}$

Now $T_{20} = a + 19d = 3 + 19 \times 4 = 3 + 76 = 79$

81. How Many number between 74 and 25,556 are divisible by '5' June 2023

(a) 5090 (b) 5097 (c) 5095 (d) 5075

Answer:

(b) Number b/w 74 and 25556 are divisible by 5 are

75 , 80 , 85 , ……. 25555

Here Ist term (a) = 75

Common difference (d) = 80 – 75 = 5

Last term (l) = 25555

No. of term $n = \frac{l-a+b}{d}$

$= \frac{25555-75+5}{5}$

$= 5097$

82. If 4th ,7th and 10th terms of a Geometric Progression are p, q and r , respectively , then : June 2023

(a) $p^2=q^2+2^r$ (b) $p^2= qr$ (c) $q^2= p^r$ (d) $pqr+pq+1=0$

Answer.

(c) In G.P.$T_4 = P$, $T_7 = q$, $T_{10} = r$

$ar^3 = P$ – (1) $ar^6 = q$ – (2) $ar^3 = r$ – (3)

Multiply by (1) & (3)

$ar^3 \times ar^9 = pr$

$a^2r^{12} = pr$

$(a + b)^2 = pr$

$(q)^2 = pr$

$\boxed{q^2 = pr}$

83. Find the 17th term of an AP series if 15th and 21st terms are 30.5 and 39.5 respectively. dec

2023

(a) 33.5 (b) 35.5 (c) 36.0 (d) 38.0

Answer:

(b) In A.P series

Given $T_{15} = 30.5$ and $T_{21} = 39.5$

$a + 14d = 30.5$ ---(1) & $a + 20d = 39.5$ ---(2)

eq. (2) – eq.(1)

$a + 20d = 39.5$

$a + 14d = 30.5$

\- - -

$6d = 9$

$d = \frac{9}{6} = 1.5$

Putting $d = 1.5$ in equation (i)

$a + 20 \times 1.5 = 39.5$

$a + 30 = 39.5$

$a = 39.5 - 30$

$a = 9.5$

Now $T_{12} = a + 16d$

$= 9.5 + 16 \times 1.5$

$= 9.5 + 24$

$= 33.5$

84. If n^{th} term of AP series is 7n-2, then sum of 'n' terms is : dec 2023

(a) $0.5(7n^2+2n)$ (b) $0.5(7n^2-3n)$ (c) $0.5(7n^2+3n)$ (d) $0.5(7n^2-2n)$

Answer.

(c) Given n^{th} term of A.P. (Tn) = (7n – 2)

Putting n = 1 , $T_1 = 7\times1 - 2 = 5$

" n = 2, $T_2 = 7\times2 - 2 = 12$

" n = 3, $T_3 = 7\times3 - 2 = 19$

A.P series is

5, 12, 19 , ……

Here, a = 5 , d = 12 – 5 = 7 , n = n

Sum of 'n' terms $S_n = \frac{n}{2}[2a + (n-1)d]$

$= \frac{n}{2}[2 \times 5 + (n-1)7]$

$= \frac{n}{2}[10 + 7n - 7]$

$= \frac{n}{2}[7n + 3]$

$= 0.5[7n^2 + 3n]$

85. Given an infinite geometric series with first term 'α'and common ratio 'r'. If its sum is 4 and the second term is $\frac{3}{4}$, then one of correct option is : dec 2023

(a) $\alpha = 1$ and $r = \frac{1}{4}$ (b) $\alpha = 3$ and $r = \frac{3}{4}$ (c) $\alpha = 3$ and $r = \frac{1}{4}$ (d) $\alpha = 1$ and $r = \frac{1}{2}$

Answer:

(c) Let GP series ia a, ar, ar^2 , ……

Let 1^{st} term (a) = a, Common Ratio (r) = r

Given, Sum = 4

$\frac{a}{1-r} = 4$

$a = 4(1 - r)$

$a = (4 - 4r)$ — (1)

$T_2 = ¾$

$ar^{2-1} = \frac{3}{4}$

$ar = \frac{3}{4}$

$a = \frac{3}{4r}$ — (2)

From eq. (1) and (2)

$4 - 4r = \frac{3}{4r}$

$16r - 16r^2 = 3$

$16r^2 - 16r + 3 = 0$
$16r^2 - 12r - 4r + 3 = 0$
$4r(4r - 3) - 1(4r - 3) = 0$
$(4r - 3)(4r - 1) = 0$
If $4r - 3 = 0$, if $4r - 1 = 0$
$r = 3/4$ & $r = ¼$

Put $r = 3/4$ in eq. (1) $a = 4 - 4 \times \frac{3}{4} = 4 - 3 = 1$

Put $r = \frac{1}{4}$ in eq. (1) $a = 4 - \frac{1}{4} \times 4 = 3$

Option (c) is correct

86. Find the value od 'x' for the following data.1+7+13+19……..+x=225 dec 2023

(a) 56 (b) 63 (c) 49 (d) 42

Answer:

(c) Series, $1 + 7 + 13 + 19 +$ ---------- $+ x = 225$

$I = x$, $a = 1$, $d = 7 - 1 = 6$, $S_n = 225$, $n = ?$

$S_n = \frac{n}{2}|2a + (n - 1)d|$
$225 = \frac{n}{2}|2 \times 1 + (n - 1)6|$
$450 = n[2 + 6n - 6]$
$450 = n(6n - 4)$
$450 = 6n^2 - 4n$
$6n^2 - 4n - 450 = 0$
$2(3n^2 - 2n - 225) = 0$
$3n^2 - 2n - 225 = 0$
$3n^2 - 27n + 25n - 225 = 0$
$3n(n - 9) + 25(n - 9) = 0$
$(n - 9)(3n + 25) = 0$

If $n - 9 = 0$
$n = 9$

and if $3n + 25 = 0$
$3n = -25$
$n = -25/3$
(Impossible)

We know that,
$I = a + (n - 1)d$
$x = 1 + (9 - 1)6$
$= 1 + 8 \times 6$
$= 1 + 48$
$x = 49$

Answer Key

1	b	2	a	3	c	4	a	5	b	6	a	7	b	8	a	9	c	10	d
11	c	12	d	13	c	14	d	15	c	16	c	17	b	18	c	19	a	20	a
21	a	22	a	23	c	24	a	25	d	26	a	27	a	28	c	29	b	30	a
31	c	32	a	33	b	34	a	35	a	36	c	37	a	38	c	39	b	40	b
41	a	42	a	43	c	44	c	45	d	46	a	47	d	48	a	49	a	50	c
51	d	52	d	53	a	54	a	55	d	56	a	57	a	58	a	59	d	60	c
61	b	62	b	63	d	64	c	65	b	66	b	67	a	68	d	69	a	70	a
71	b	72	a	73	d	74	c	75	a	76	c	77	c	78	a	79	a		

CHAPTER
SET THEORY
PAST YEAR QUESTIONS

1. Out of 20 members in a family, 11 like to take tea and 14 like coffee Assume that each one likes at least one of the two drinks Find how many like both coffee and tea : **Nov-2006**

(a) 2 (b) 3 (c) 4 (d) 5

Ans:-$A \cup B = 20$ $A = 11$ $B = 14$

$A + B - AB = 20$ $11 + 14 - AB = 20$ $AB = 5$

2. In a group of 70 people, 45 speak Hindi, 33 speak English and 10 speak neither Hindi nor English Find how many can speak both English as well as Hindi: **Feb-2007**

(a) 13 (b) 19 (c) 18 ; (d) 28

Ans:- Hindu = 45 = A English = B = 33 $\bar{A} \cap \bar{B} = 10$

Now $A \cup B = (\bar{A} \cap \bar{B})^C = S - (\bar{A} \cap \bar{B})$ $= 70 - 10 = 60$

$A + B - AB = 60$ $45 + 33 - AB = 60$ $AB = 18$

3. In a survey of 300 companies, the number of companies using different media - Newspapers (N), Radio (R) and Television (T) are as follows : n(N) = 200, n(R) =100, n(T) = 40, $(N \cap R)$ = 50, $n(R \cap T) = 20,\ n(N \cap T) = 25\ and\ n(N \cap R \cap T) = 5$ **May-2007**

Find the numbers of companies-using none of these media :

(a) 20 companies (b) 250 companies (c) 30 companies (d) 50 companies

Ans:- N = 200 R = 100 T = 40 NT = 25 NR = 50 RT = 20 NRT = 5

$N \cup R \cup T = N + R + T - NR - NT - RT + NRT$ $= 200 + 100 + 40 - 50 - 20 - 25 + 5 = 250$

None media = $\bar{N}\ \bar{R}\ \bar{T}$ $= (N \cup R \cup T)^C = 300 - 250 = 50$

4. In a town of 20,000 families it was found that 40% families buy newspaper A, 20% families buy newspaper B and 10% families buy newspaper C, 5% families buy A and B, 3% buy B and C and 4% buy A and C If 2% families buy all the three newspapers, then the number of families which buy A only is: **Nov-2006**

(a) 6600 (b) 6300 (c) 5600 (d) 600

Ans:-

A = 40% B = 20% C = 10% AC = 4% AB = 5% BC = 3% ABC = 2%

Only A = $A\ \ \bar{B}\ \ \bar{C}$ = A – AB – AC + ABC

= 40 – 5 – 4 + 2 = 33% No of families = 33% of 2000 = 6600.

5. Out of total 150 students, 45 passed in Accounts, 30 in Economics and 50 in Maths, 30 in both Accounts and Maths, 32 in both Maths and Economics, 35 in both Accounts and Economics, 25 students passed in all the three subjects Find the numbers who passed at least in any one of the subjects : **Feb-2008**

(a) 63 (b) 53 (c) 73 (d) None

Ans. :

A = Account = 45 B = Economics is = 30 C = Maths = 50

AC = 30 BC = 32 AC = 35

ABC = 25 $A \cup B \cup C$ = A + B + C – AB – AC – BC + ABC = 53

6. If A = {p, q, r, s} B = {q, s ,t} C = {m, q, n} Find C – (A ∩ B) **Dec-2008**

(a) {m, n} (b) {p, q} (c) {r, s} (d) {p, r}

Ans:- $A \cap B = \{q,s\}$ $C - (A \cap B) = m, n$

7. If A = $\{x : x^2 - 3x + 2 = 0\}$, B = $\{x : x^2 + 4x - 12 = 0\}$, then B – A is Equal to **June-2010**

(a) {-6} (b) {1} (c) {1,2} (b) {2, -6}

Ans:-

(A) $x^2 - 3x + 2 = 0$

$(x - 2)(x - 1) = 0$

$x = 2, 1$

(B) $x^2 - 4x + 12 = 0$

$(x + 6)(x - 2) = 0$

$x = -6, 2$

A = {2 , 1} | B = {-6 , 2}

∴ B – A = {-6}

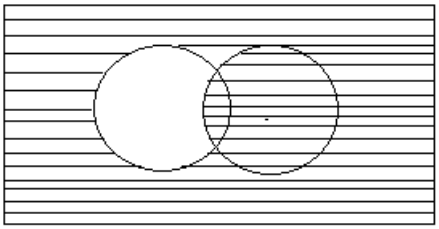
8. For any two sets A and B, $A \cap (A' \cup B) =$ _____, where A' represent the compliment of the set A **Dec-2010**

(a) $A \cap B$ (b) $A \cup B$ (c) $A' \cup B$ (d) None of these

Ans:-

$\bar{A} \cup B$ = shaded area

A ∩ shaded = A ∩ B



9. If $A \subset B$, then which one of the following is true **Dec-2010**

(a) $A \cap B = B$ (b) $A \cup B = B$ (c) $A \cap B = A^1$ (d) $A \cap B = \Phi$

Ans:- A⊂B So, A ∪ B = B Option (b) is correct

10. There are 40 students, 30 of them passed in English, 25 of them passed in Maths and 15 of them passed in both Assuming that every Student has passed at least in one subject How many student's passed in English only but not in Maths **June-2011**

(a) 15 (b) 20 (c) 10 (d) 25

Ans:- E = 30 M = 25 EM = 15 E $\bar{M}$ = E – EM = 30 – 15 = 15

11. If A = (1, 2, 3, 4, 5), B = (2, 4) and C = (1, 3, 5) then (A – C) × B is **Dec -2011**

a) {(2, 2), (2, 4), (4, 2), (4, 4), (5, 2), (5, 4)} b) {(1, 2), (1, 4), (3, 2), (3, 4), (5, 2), (5, 4)}

c) {(2, 2), (4, 2), (4, 4), (4, 5)} d) {(2, 2),(2, 4), (4, 2), (4, 4)}

Ans:- A – C = {2 , 4} B = {2 , 4} (A – C) × B ={(2 , 2) (2 , 4) (4 , 2) (4, 4)}

12. For any two sets A and B the set $(A \cup B')$ is Equal to (where' denotes compliment of the set) **Dec-2011**

a) B – A b) A – B c) A' – B' d) B' – A

Ans:- $(A \cup \bar{B})^C = \bar{A} \cap B = B - A$

13. The number of proper sub set of the set {3, 4, 5, 6, 7} is **June-2012**

(a) 32 (b) 31 (c) 30 (d) 25

Ans:- $2^n - 1 = 2^5 - 1 = 31$

14. For a group of 200 persons, 100 are interested in music, 70 in photography and 40 in swimming, Further more 40 are interested in both music and photography, 30 in both music and swimming,20 in photography and swimming and 10 in all the three How many are interested in photography but not in music and swimming? **Dec-2012**

(a) 30 (b) 15 (c) 25 (d) 20

Ans:- M = 100 P = 70 S = 40 MP = 40 MS = 30 PS = 20 MPS = 10

$P\bar{M}\bar{S}$ = P – PM – PS + PMS = 70 – 40 – 20 + 10 = 20

15. Of the 200 candidates who were interviewed for a position at call centre, 100 has a two-wheeler, 70 has a credit card and 140 had a mobile phone, 40 of them had both a two-wheeler and a credit card, 30 had both a credit card and a mobile phone, 60 had both a two-wheeler and a mobile phone, and 10 had all three. How many candidates had none of the three? **Dec-2013**

(a) 0 (b) 20 (c) 10 (d) 18

Ans. : Two wheeler = A = 100 Credit Card = B = 70

Mobile = C = 140 AB = 40 BC = 30 AC = 60 ABC = 10

$A \cup B \cup C$ = A + B + C – AB – BC – AC + ABC

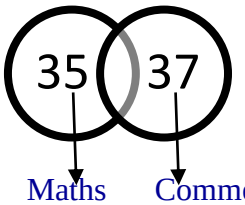
= 100 + 70 + 140 – 40 – 30 – 60 + 10 = 190

none = $\bar{A}\ \bar{B}\ \bar{C} = (A \cup B \cup C)^C$ = S – $(A \cup B \cup C)$ = 200 – 190= 10

16. In a class of 50 students, 35 opted for Mathematics and 37 opted for Commerce. The number of such students who opted for both Mathematics and Commerce are : **Dec-2013**

a) 13 b) 15 c) 22 d) 28

Ans. : n = 50
Mathematics = 35
Commerce = 37
Maths ∩ Commerce ?



Maths Commerce

P(Maths ∪ Commerce) = P(Maths) + P(Commerce)
- P(Maths ∩ Commerce)
50 = 35 + 37 – P(M ∩ C)
P(M ∩ C) = 72 – 50
= 22 (Ans.)

17. The number of subsets of the set formed by the word Allahabad is : **Dec-2016**

(a) 128 (b) 16 (c) 32 (d) 64

18. In a class of 80 students, 35% students can play only cricket, 45% students can play only table tennis and the remaining students can play both the games. In all how many students can play cricket? **Dec-2015**

a) 55 b) 44 c) 36 d) 28

19. In a group of students 80 can speak Hindi, 60 can speak English and 40 can speak English and Hindi both, then number of students is: **June-2017**

a) 100 b) 140 c) 180 d) 60

20. The no. of subsets of the set {3, 4, 5} is : **Dec-2018**

a) 4 b) 8 c) 16 d) 32

21. In a class of 80 students, 50 like maths and 40 like statistics then the number if students who like both maths and statistics is : **Dec-2018**

a) 10 b) 20 c) 30 d) 40

22. In a class of 35 students, 24 like to pay cricket and 16 like to play football. Also each student likes to pay at least one of the two games. How many students like to play both cricket and football? : **Dec-2017**

(a) 5 (b) 11 (c) 19 (d) 8

23. In a town of 20,000 families it was found that 40% families buy newspaper, A, 20% families buy newspaper B and 10% families buy newspaper C, 5% families buy A and B, 3% buy B and C and 4% buy A and C if 2% families buy all the three newspapers, then the number of families which buy A only is: **May-2018**

(a) 6600 (b) 6300 (c) 5600 (d) 600

24. The numbers of proper sub set of the set {3, 4, 5, 6, 7} is: **May-2018**

(a) 32 (b) 31 (c) 30 (d) 25

25. If A = {1, 2} and B = {3, 4}. Determine the number of relations from A and B: **Nov-2018**

(a) 3 (b) 16 (c) 5 (d) 6

26. If A = {1, 2, 3, 4, 5, 6, 7} and B = {2, 4, 6, 8}. Cardinal number of A - B is: **Nov-2018**

(a) 4 (b) 3 (c) 9 (d) 7

27. If A = {1, 2, 3, 4, 5, 6, 7, 8, 9} **June-2019**
B = {1, 3, 4, 5, 7, 8};
C = {2, 6, 8} then find (A - B)∪ C

(a) {2, 6} (b) {2, 6, 8} (c) {2, 6, 8, 9} (d) None

28. The no. of subsets of the set {3, 4, 5}is: **June-2019**

(a) 4 (b) 8 (c) 16 (d) 32

29. Two finite sets respectively have x and y number of elements. The total number of subsets of

the first is 56 more than the total number of subsets of the /second. The value of x and y respectively. **Nov – 2020**

(a) 6 and 3 (b) 4 and 2 (c) 2 and 4 (d) 3 and 6

30. The number of items in the set A is 40; in the set B is 32; in the set C is 50; in both A and B is 4, in both A and C is 5; in both B and C is 7 in all the sets 2. How many are in only one set? **Nov – 2020**

(a) 110 (b) 65 (c) 108 (d) 84

31. The set of cubes of the natural number is: **Nov – 2020**

(a) A null set (b) A finite set

(c) An infinite set (d) A finite set of three numbers

32. The set of cubes of natural number is **Jan - 2021**

(a) Null set (b) A finite set (c) An infinite set (d) Singleton Set

33. Let U be the universal set, A and B are the subsets of U. If n(U) = 650, n(A) = 310 N(A∩B) = 95 and n(B) = 190, then $n(\bar{A} \cap \bar{B})$ is equal to ($\bar{A}$ and $\bar{B}$ are the complement of A and B respectively): **July – 2021**

(a) 400 (b) 200 (c) 300 (d) 245

34. Out of a group of 20 teachers in a school, 10 teach Mathematics, 9 teach Physics and 7 teach Chemistry. 4 teach Mathematics and Physics but none teach both mathematics and Chemistry. How many teach Chemistry and Physics; how many teach only Physics? **Dec-2021 Ans.(a)**

(a) 2, 3 (b) 3, 2 (c) 4, 6 (d) 6, 4

35. Two finite sets have x and y number of elements. The total number of subsets of first is 56 more than the total number of subsets of second. The value of x and y is: **June 2022**

(a) 6 and 3 (b) 4 and 2 (c) 2 and 4 (d) 3 and 4

36. Given A = {2, 3}, B = {4 5}, C = {5, 6} then A x (B ∩ C) is: **June 2022**

(a) {(2, 5), (3, 5)} (b) {(5, 2), (5, 3)} (c) {(2, 3), (5, 5)} (d) None of these

37. If the universal set E = { x: x is a positive integer < 25}, A = {2, 6, 8, 14, 22}, B = {4, 8, 10, 14} **June 2022**

(a) (A ∩ B)' = A' ∪ B' (b) (A ∩ B)' = A' ∩ B'

(c) (A' ∩ B') = φ (d) None of these

38. If A = {1,2,3,4,5,6,7,8,9} and B = {2,4,6,7,9} then how many proper subset of $A \cap B$ can be created? **Dec 2022**

(a) 16 (b) 15 (c) 32 (d) 31

39. The number of subset of the set (0, 1, 2, 3) is **Dec 2022**

(a) 2 (b) 4 (c) 8 (d) 16

40. A survey shows that 74% of the Indian like grapes , whereas 68% like bananas. What percentage of the Indian like both grapes and bananas if everybody likes either fruit? June 2023

(a) 42% (b) 26% (c) 58% (d) 62%

Answer :

(a) Let A ⟶ Grapes Let Total Fruits = 100

B ⟶ Banana's $n(A \cup B) = 100$

$n(A) = 74\%$ of $100 = 74$

$n(B) = 68\%$ of $100 = 68$

$n(A \cap B) = ?$

We know that

$n(A \cup B) = n(A) + n(B) - n(A \cap B)$

$100 = 74 + 68 - n(A \cap B)$

$n(A \cap B) = 142 - 100$

$n(A \cap B) = 42$

So no. of persons like both grapes and banana's = 42%

41. If A ={a, b, c}, B ={b, c, d} and C= {a, b, c) , then (A-B)×(BΠC) is equal to June 2023

(a) {(a,d),(c,d)} (b) {(a,c),(a,d)} (c) {(c,a),(d,a)} (d) {(a,c),(a,d),(b,d)}

Answer :

(b) Here A = {a,b,c}
B = {b,c,d}
C = {a,d,c}
A – B = {a,b,c} – {b,c,d} = {a}
B ∩ C = {b,c,d}∩{a,d,c} = {c,d}
(A–B)×(B ∩ C)= {a}×{c,d}
= {(a,c)}.(a,d)

42. In a survey of 100 boys it was found that 50 used white shirts, 40 red shirts and 30 blue shirts. 20 were habituated in using both white and red shirts. 15 were using both red and blue shirts 10 were using blue and white shirts. Find the number of boys who are using all colours: dec 2023

(a) 20 (b) 25 (c) 30 (d) 35

Answer :

(b) Here , A → for white shirt, B → for red shirt , C → for blue shirt .
n(A) = 50, n(A ∩ B) = 20, n(A ∪ B ∪ C) = 100
n(B) = 40, n(B ∩ C) = 15, n(A ∩ B ∩ C)=?
n(C) = 30 , n(C ∩ A)=10,
We know that,
n(A ∪ B ∪ C)= n(A) + n(B) + n(C) – n(A ∩ B) − n(B ∩ C) − n(C ∩ A) + n(A ∩ B ∩ C)
100 = 50+40 + 30 – 20 – 15 – 10 + n(A ∩ B ∩ C)
100 = 120 + 45+ n(A ∩ B ∩ C)
n(A ∩ B ∩ C) = 100 + 45 – 120
n(A ∩ B ∩ C) = 25

43. If A ={2,4}and B={1,2,3}then (A ∪ B) × (A ∩ B) is equal to : dec 2023

(a) {(1,2) ,(2,2) ,(3,2)} (b) {(1,2) ,(2,2) ,(2,3) ,(2,4)}
(c) {(2,1) ,(2,2) ,(2,4)} (d) {(1,2) ,(2,2),(3,2),(4,2)}

Answer :

(d) Here, A = {2,4} and B={1,2,3}
A∪B = {2,4} ∪ {1,2,3}
= {1,2,3,4}
A∩B = {2,4} ∩ {1,2,3}
={2}
(A ∪ B)×(A ∩ B)={1,2,3,4}×{2}
= {(1,2) (2,2),(3,2),(4,2)}

44. If B = {1,2,3,4,5}, then the number of proper subsets of B is : dec 2023

(a) 120 (b) 30 (c) 31 (d) 32

Answer :

(c) Given B = {1,2,3,4,5}
N(B) = 5
No. of Proper Subset = $2^n - 1$
$= 2^5 - 1$
= 32 – 1
= 31

45. If A ={1,2},B = {3,4},C ={5,6}then the value of A×(B ∪ C) dec 2023

(a){(1,2),(3,4),(5,6) (b){(1,3),(2,3),(1,4),(2,4),(1,5),(2,5),(1,6),(2,6)}
(c){(1,3),(2,3),(1,4),(2,4),(2,5),(1,5)} (d){(3,1),(2,3),(4,1),(2,4),(2,5),(1,5),(1,6),(2,6)}

Answer :

(b) If A = {1,2,}B= {3,4,} C ={5,6,}
B∪C = {3,4}∪{5,6}
= {3,4,5,6}
A×(B ∪ C)={1,2,}×{3,4,5,6}
= {(1,3)(1,4)(1,5)(1,6)
(2,3)(2,4)(2,5)(2,6)}

Answer Key																			
1.	d	2.	c	3.	d	4.	a	5.	b	6.	a	7.	a	8.	a	9.	b	10.	a
11.	d	12.	a	13.	b	14.	d	15.	c	16.	c	17.	c	18.	b	19.	a	20.	b
21.	a	22.	a	23.	a	24.	b	25.	b	26.	a	27.	c	28.	b	29.	a	30.	c
31.	c	32.	c	33.	d	34.	a	35.	a	36.	a	37.	a	38.	b	39.	d		

CHAPTER FUNCTIONS

PAST YEAR QUESTIONS

1. Let R is the set of real numbers, such that the function f: R→R and g : R → R are defined by $f(x) = x^2 + 3x+1$ and $g(x) = 2x - 3$ Find (fog): **Feb-2007**

(a) $4x^2 + 6x + 1$ (b) $x^2 + 6x + 1$ (c) $4x^2 - 6x + 1$ (d) $x^2 - 6x+1$

Ans:- $f(x) = x^2 + 3x + 1$ $g(x) = 2x - 3$ $fog = f\{g(x)\} = f(2x - 3)$

$= (2x - 3)^2 + 3(2x - 3) + 1$ $= 4x^2 - 6x + 1$

2. If R is the set of real numbers such that function $f: R \to R$ is defined by $f(x) = (x + 1)^2$, then find (fof) : **May-2007**

(a) $(x + 1)^2 + 1$ (b) $x^2 + 1$ (c) $\{(x + 1)^2 + 1\}^2$ (d) None

Ans:- $f(x) = (x + 1)^2$ f of $= f\{f(x)\} = f(x + 1)^2$ $= \{(x + 1)^2 + 1\}^2$

3. Let $f: R \to R$ be such that $f(x) = 2^x$ then $f(x + y)$ equals : **Nov-2006**

(a) $f(x)+f(y)$ (b) $f(x)f(y)$ (c) $f(x)\div f(y)$ (d) None of these

Ans:- $f(x) = 2^x$ $f(x + y) = 2^{x+y}$ $f(x) \cdot f(y) = 2^x \cdot 2^y = 2^{x+y}$ (b) is correct

4. If $f(x) = x^2 + x-1$ and $4f(x) = f(2x)$ then find 'x' **Dec-2008**

(a) 4/3 (b) 3/2 (c) –3/4 (d) None of these

5. Given the function $f(x) = (2x + 3)$, then the value of $f(2x) - 2f(x) + 3$ will be : **Dec-2009**

(a) 3 (b) 2 (c) 1 (d) 0

6. If $f(x) = 2x + h$ then find $f(x+ h) - 2f(x)$ **Dec-2009**

(a) h–2x (b) 2x–h (c) 2x + h (d) None of these

7. If F: A → R is a real valued function defined by $f(x) = \frac{1}{x}$, then A = _____ **June-2010**

(a) R (b) R – {1} (c) R–{0} (d) R – N

Ans:- $f(x) = \frac{1}{x}$ x can take all real nos value except R – {0}

8. If f:R→R, $f(x) = x+1$, g: R→R $g(x) = x^2+1$ then fog(–2) equals to **Dec-2010**

(a) 6 (b) 5 (c) –2 (d) None

Ans:- $f(x) = x + 1$ $g(x) = x^2 + 1$

fog(-2) first $g(-2) = (-2)^2 + 1 = 5$

$f\{g(-2)\} = f(5) = 5 + 1 = 6$

9. If $f(x-1) = x^2-4x+8$, then $f(x+1)$ =_____ **Dec-2010**

(a) x^2+8 (b) x^2+7 (c) x^2+4 (d) x^2-4x

10. If $f(x) = \frac{x}{\sqrt{1+x^2}}$ and $g(x) = \frac{x}{\sqrt{1-x^2}}$ Find *fog*? **June-2011**

(a) x (b) $\frac{1}{x}$ (c) $\frac{x}{\sqrt{1-x^2}}$ (d) $x\sqrt{1-x^2}$

11. f(x) = 3 + x, for – 3 < x < 0 and 3 – 2x for 0 < x < 3, then value of f(2) will be **Dec-2011**

a) – 1 b) 1 c) 3 d) 5

12. If $f(x) = x + 2, g(x) = 7^x$, then g of (x) = _____ **June-2013**

a) $7^x.x + 2.7^x$ b) $7^x + 2$ c) $49(7^x)$ d) None of these

Ans:- $f(x) = x + 2$ $g(x) = 7^x$

g of (x) $g\{f(x)\}$ $g(x + 2) = 7^{x+2} = 7^x \times 49$

13. If $f(x) = log\left(\frac{1+x}{1+x}\right)$, then $f\left(\frac{2x}{1+x^2}\right)$ is equal to : **June-2013**

a) f(x) b) 2f(x) c) 3f(x) d) –f(x)

14. If $f(x) = (a - x^n)^{1/n}, a > 0$ and 'n' is a positive integer, then $f(f(x)) =$ _____ **Dec-2013**

(a) x (b) a (c) $x^{1/n}$ (d) $a^{1/n}$

15. If $f(x) = \frac{x}{x-1}$, then $\frac{f(x/y)}{f(y/x)}$ = _____ **Dec-2014**

a) $\frac{x}{y}$ b) $\frac{y}{x}$ c) $-\frac{x}{y}$ d) $-\frac{y}{x}$

16. If $f(x) = 2x + 2$ and $g(x) = x^2$, then the value of fog (4) is: **Dec-2015**

a) 18 b) 22 c) 34 d) 128

17. If $f(x) = \frac{x-1}{x}$ and $g(x) = \frac{1}{1-x}$ then $fog(x)$ is equal to : **June-2017**

a) x - 1 b) x c) 1 - x d) - x

18. If $f(x) = \frac{x+1}{x+2}$ then f $\left[f\left(\frac{1}{x}\right)\right]$ = _____ : **Dec-2017**

(a) $\frac{2x+3}{3x+5}$ (b) $\frac{2x+5}{3x+2}$ (c) $\frac{3x+2}{5x+3}$ (d) $\frac{5x+2}{2x+3}$

19. A is (1, 2, 3, 4) and B is (1, 4, 9, 16, 25) if a function f is defined from set A to B where f(x) = x^2 then the range of f is: **Nov-2018**

(a) {1, 2, 3, 4} (b){1, 4, 9, 16} (c) {1, 4, 9, 16, 25} (d) None of these

20. The inverse function f^{-1} of $f(y) = 3y$ is **Nov – 2020**

(a) 1/3y (b) y/3 (c) -3y (d) 1/y

21. Let F : R R be defined by **Jan - 2021**

$$f(x) = \begin{cases} 2x \ for \ x > 3 \\ x^2 \ for \ 1 < x \leq 3 \\ 3x \ for \ x \leq 1 \end{cases}$$

The value of f(-1) + f(2) + f(4) is

(a) 9 (b) 14 (c) 5 (d) 6

22. The range of the function F defined by f (x) = $\sqrt{16 - x^2}$ is **July – 2021**

(a) [-4, 0] (b) [-4, 4] (c) [0, 4] (d) [+4, 4]

23. Let A = R -{3} and B = R-{1}. let $f(x) \to B$ **July – 2021**

Defined by f(x) = $\frac{x-2}{x-3}$ what is the value of $f^{-1}\left(\frac{1}{2}\right)$?

(a) 2/3 (b) 3/4 (c) 1 (d) -1

24. If F (X) = x^2 – 1 and g(X) = $|2x + 3|$, then Fog (3) – g of (-3) = **July – 2021**

(a) 71 (b) 61 (c) 41 (d) 51

25. If u(x) = $\frac{1}{1-x}$, then $u^{-1}(x)$ is: **Dec-2021**

(a) $\frac{1}{x-1}$ (b) 1 – x (c) 1 - $\frac{1}{x}$ (d) $\frac{1}{x}$ – 1

26. If f (y) = $\frac{y-1}{y}$, find f^{1} (x). **June 2022**

(a) $\frac{1}{1-y}$ (b) y (c) $\frac{y}{y-1}$ (d) $\frac{y}{1-y}$

27. If f (x): N→R is a function defined as f (x) =4x+3,∀x ∈ N, then f^{-1} (x) is June 2023

(a) 4+$\frac{x+3}{4}$ (b) $\frac{x+3}{4}$ (c) $\frac{x-3}{4}$ (d) $\frac{3x+3}{4}$

Answer :

(c) Given f(x) = 4x + 3

Let f(x) = y => x = f^{+}(y)

y = 4x + 3

4x = y – 3

x= $\frac{y-3}{4}$

$f^{-1}(y) = \frac{y-3}{4}$

Then $f^{-1}(x) = \left(\frac{x-3}{4}\right)$

Answer Key																		
1.	c	2.	c	3.	b	4.	b	5.	d	6.	a	7.	c	8.	a	9.	c	10.	a
11.	a	12.	c	13.	b	14.	a	15.	c	16.	c	17.	b	18.	a	19.	b	20.	b
21.	a	22.	b	23.	c	24.	b	25.	c	26.	a								

CHAPTER
INTEGRAL CALCULUS

(i)

PAST EXAMINATION QUESTIONS MEMORY BASED QUESTIONS FROM SCANNER NOT FROM ICAI PUBLICATION(BETTER SKIP)

1. The slope of the tangent at the point (2, - 2) to the curve $x^2 + xy + y^2 - 4 = 0$ is ;given by: **Nov-2006 Ans:(b)**

(a) 0 (b) 1 (c) -1 (d) None

Ans: So, $x^2 + xy + y^2 - 4 = 0$ (1)

(Slope of the tangent at any point to the curve is equal to $\frac{dy}{dx}$ at that point)

∴ Differentiating (1) both side we get

Or $2x + x\frac{dy}{dx} + y + 2y\frac{dy}{dx} - 0 = 0$ Or $\frac{dy}{dx}(x + 2y) = -2x - y$

Or $\frac{dy}{dx} = \frac{-2x-y}{x+2y}$ Or $\left[\frac{dy}{dx}\right](2,-2) = \frac{-2(2)-(-2)}{2+2(-2)} = \frac{-4+2}{2-4} = \frac{-2}{-2} = 1$

2. The derivative of x^2 log x is : **Nov-2006 Ans:(c)**

(a)1 + 2 log x (b) 2 1og x (c) x (l + 2 1og x) (d) None of these

Ans: So, Let $y = x^2 \log x$ Differentiating both sides we get

$\frac{dy}{dx} = x^2 \frac{d}{dx}(\log x) + \log x \frac{d}{dx}(x^2) = x^2 \times \frac{1}{x} + \log x \times 2x^{2-1}$

$= x + x \log x = x(1 + \log x)$

3. $\int_0^1 (e^x + e^{-x})$ dx is: **Nov-2006 Ans:a**

(a) $e - e^{-1}$ (b) $e^{-1} - e$ (c) $e + e^{-1}$ (d) None

Ans: So, $\int e^x dx + \int e^{-x} dx = e^x - e^{-x}$

∴ $\int_0^1 (e^x + e^x) dx = [e^x - e^{-x}]_0^1$

$= e^1 - e^{-1} - e^0 + e^{-0} = e^1 - e^{-1} - 1 + 1 = e^1 - e^{-1}$

4. $\int \frac{8x^2}{(x^3+2)^3}$ dx is equal to:

Nov-2006 Ans:(b)

(a) $-\frac{4}{3}(x^3 + 2)^2 + C$ (b) $-\frac{4}{3}(x^3 + 2)^{-2} + C$ (c) $\frac{4}{3}(x^3 + 2)^2 + C$ (d) None of these

Ans: So, $\int \frac{8x^2}{(x^3+2)^3} dx$

Let $x^3 + 2 = z$

Now, differentiating both side the above eq. we get

$3x^2 dx = dz$

$dx = \frac{dz}{3x^2}$

$= \int \frac{8x^2}{z^3} \times \frac{dz}{3x^2}$ [∵ $x^3 + 2 = z$]

$= \frac{8}{3} \int z^{-3} dz$

$= \frac{8}{3} \times \frac{z^{-3+1}}{-3+1}$

$= \frac{8}{3} \frac{z^{-2}}{(-2)}$ [∵ $\int x^n = \frac{x^{-n+1}}{-n+1}$]

$= -\frac{4}{3}(x^3 + 2)^{-2} + c$

5. If x = y log (xy), then $\frac{dy}{dx}$ is equal to: **Feb-2007Ans:(b)**

(a) $\frac{x+y}{x(1+\log xy)}$ (b) $\frac{x-y}{x(1+\log xy)}$ (c) $\frac{x+y}{x(\log x+\log y)}$ (d) $\frac{x-y}{x(\log x+\log y)}$

Ans: So, $x = y \log (xy)$

Differentiating both sides we get Or,$1 = \log (xy) \times \frac{dy}{dx} + y\frac{d}{dx}[\log(xy)]$

Or, $1 = \log(xy)\frac{dy}{dx} + y \times \frac{1}{xy}\left[y + x\frac{dy}{dx}\right]$ Or, $1 = \log (xy)\frac{dy}{dx} + \frac{y}{x} + \frac{dy}{dx}$

Or, $1 - \frac{y}{x} = [\log(xy) + 1]\frac{dy}{dx}$ Or, $\frac{x-y}{x[1+\log(xy)]} = \frac{dx}{dy}$

6. If $y = 2x + \frac{4}{x}$, then $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} - y$ yields **Feb-2007Ans:(c)**

(a) 3 (b) 1 (c) 0 (d) 4

Ans: So, $y = 2x + \frac{4}{x}$

Differentiating both sides we get $\frac{dy}{dx} = 2 - \frac{4}{x^2}$

Again differentiating we get $\frac{d^2y}{dx^2} = +\frac{8}{x^3}$

A T P $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} - y$ Putting the value of $\frac{d^2y}{dx^2}$ and $\frac{dy}{dx}$ and y

$= x^2 \times \frac{8}{x^3} + x\left(2 - \frac{4}{x^2}\right) - 2x - \frac{4}{x} = \frac{8}{x} + 2x - \frac{4}{x} - 2x - \frac{4}{x}$

$= \frac{8}{x} + 2x - 2x - \frac{8}{x}\left[\because -\frac{4}{x} - \frac{4}{x} = -\frac{8}{x}\right] = 0$

7. Evaluate: $\int \frac{dx}{\sqrt{x^2+a^2}}$ **Feb-2007Ans:(b)**

(a) $\frac{1}{2}\log(x + \sqrt{x^2+a^2}) + C$ (b) $\log(x + \sqrt{x^2+a^2}) + C$

(c) $\log(x\sqrt{x^2+a^2} + C$ (d) $\frac{1}{2}\log(x\sqrt{x^2+a^2}) + C$

Ans: $\log(x + \sqrt{x^2+a^2}) + c$ [by formula]

8. The value of $\int_0^2 \frac{\sqrt{x}}{\sqrt{x}+\sqrt{2-x}}$ dx is : **Feb-2007Ans:(d)**

(a) 0 (b) 3 (c) 2 (d) 1

Ans: Let $I = \int_0^2 \frac{\sqrt{2-x}}{\sqrt{2-x}+\sqrt{2-(2-x)}}\,dx$ .....(1)

$= \int_0^2 \frac{\sqrt{2-x}}{\sqrt{2-x}+\sqrt{2-(2-x)}}$ $\left[\because \int_0^a x\,dx = \int_0^a (a-x)dx\right]$

$= \int_0^2 \frac{\sqrt{2-x}}{\sqrt{2-x}+\sqrt{x}}$ .....(2)

Adding (1) and (2) we get

$2I = \int_0^2 \frac{\sqrt{x}+\sqrt{2-x}}{\sqrt{x}+\sqrt{2-x}}dx$ $2I = \int_0^2 dx$ $2I = [x]_0^2$ $2I = 2-0$ $I = 1$

9. If $f(x) = x^k$ and $f'(1) = 10$, then the value of k is : **May-2007Ans:a**

(a) 10 (b) -10 (c) 1/10 (d) None

Ans: $f(x) = x^k$ $f^1(x) = k.\, x^{k-1}$ $f^1(1) = 10$ Or, $10 = k(1)^{k-1}$ Or, $10 = k\frac{(1)^k}{1}$

Or. $k = 10$ [$\therefore$1 to the power any thing is 1]

10. Given $x = 2t + 5$; $y = t^2 - 2$, then $\frac{dy}{dx}$ is calculated as : **May-2007Ans:a**

(a) t (b) 1/t (c) -1/t (d) None

Ans: $x = 2t + 5$ .....(1) $\frac{dx}{dt} = 2$

$y = t^2 - 2$ .....(2) $\frac{dy}{dt} = 2t$

$\frac{dx}{dy} = \frac{dx/dt}{dy/dt} = \frac{2t}{2} = t$

11. The integral of $(e^{3x} + e^{-3x}) / e^x$ is: **May-2007 Ans:(b)**

(a) $\frac{e^{2x}}{2} + \frac{e^{-4x}}{4} + C$ (b) $\frac{e^{2x}}{2} - \frac{e^{-4x}}{4} + C$ (c) $e^{2x} - e^{-4x} + C$ (d) None of these

Ans: $\int \frac{e^{3x}+e^{-3x}}{e^x} dx = \int \frac{e^{3x}}{e^x} dx + \int \frac{1}{e^{3x} \times e^x} dx = \int e^{2x} dx + \int e^{-4x} dx = \frac{e^{2x}}{2} - \frac{e^{-4x}}{4} + c$

12. $\int x^2 e^{3x} dx$ is: **May-2007 Ans:(c)**

(a) $x2e^{3x} - 2xe^{3x} + 2e^{3x} + C$ (b) $\frac{e^{3x}}{3} - \frac{x.e^{3x}}{9} + 2e^{3x} + C$

(c) $\frac{x^2.e^{3x}}{3} - \frac{2x.e^{3x}}{9} + \frac{2}{27} e^{3x} + C$ (d) None of these

Ans: $\int x^2 e^{3x} dx$

Applying by parts we get

$= x^2 \int e^{3x} dx - \int [2x. \int e^{3x} dx] dx$ [Taking x^2 as first function] $= x^2 \frac{e^{3x}}{3} - \int 2x \frac{e^{3x}}{3} dx$

$= x^2 \frac{e^{3x}}{3} - \frac{2}{3} \int x c^{3x} dx$

Again applying by parts we get

$= x^2 \frac{e^{3x}}{3} - \frac{2}{3} [x \int e^{3x} dx - \int \{1. \int e^{3x} dx\} dx]$

$= x^2 \frac{e^{3x}}{3} - \frac{2}{3} . x \frac{e^{3x}}{3} + \frac{2}{3} \int \frac{e^{3x}}{3} dx = x^2 . \frac{e^{3x}}{3} - \frac{2}{3} . \frac{e^{3x}}{3} + \frac{2}{3} . \frac{e^{3x}}{3.3} + c$

$= \frac{x^2 e^{3x}}{3} - \frac{2x\, e^{3x}}{9} + \frac{2}{27} e^{3x} + c$

13. $\int_1^2 \frac{2x}{1+x^2} dx$: **May-2007Ans:a**

(a) $\log_e \frac{5}{2}$ (b) $\log_e 5 - \log_e 2 + 1$ (c) $\log_e \frac{2}{5}$ (d) None of these

Ans:

$\int_1^2 \frac{2x}{1+x^2} dx$ Let $1 + x^2 = z$

[Dierentiating we get]

When	X	Z
	2	5
	1	2

$2x\, dx = dz = \int_2^5 \frac{dz}{z} = [log_e\, z]_2^5$

$= log_e 5 - log_e 2 = log_e \frac{5}{2}$

14. If $x^y = y^x$, then gives : **Aug-2007Ans:(c)**

(a) $\frac{x(x \log y - y)}{y(y \log x - x)}$ (b) $\frac{x(y \log x - x)}{y(x \log y - y)}$ (c) $\frac{y(x \log y - y)}{x(y \log x - x)}$ (d) None of these

Ans: $x^y = y^x$

Talking log on both sides we get

Or, $y\, logx = x\, logy$ Or, $\frac{y}{x} + logx \frac{dy}{dx} = \frac{x}{y} \frac{dx}{dy} + logy$

Or, $\left[logx - \frac{x}{y}\right] \frac{dy}{dx} = logy - \frac{y}{x}$ Or, $\frac{ylogx - x}{y} \frac{dy}{dx} = \frac{xlogy - y}{x}$ Or, $\frac{dy}{dx} = \frac{y(xlogy - y)}{x(ylogx - x)}$

15. If $x^3 - 2x^2y^2 + 5x + y = 5$, then $\frac{dy}{dx}$ at x = 1 and y = 1 is: **Aug-2007Ans:a**

(a) 4/3 (b) -5/4 (c) 4/5 (d) -4/3

Ans: $x^3 - 2x^2y^2 + 5x + y = 5$

Differentiating both sides we get

Or, $3x^2 - 4xy^2 - 4x^2y \frac{dy}{dx} + 5 + \frac{dy}{dx} = 0$ Or, $\frac{dy}{dx} [1 - 4x^2y] = 4xy^2 - 3x^2 - 5$

Or, $\frac{dy}{dx} = \frac{4xy^2 - 3x^2 - 5}{1 - 4x^2y}$ Or, $\left[\frac{dy}{dx}\right]_{(1,1)} = \frac{4 - 3 - 5}{1 - 4}$ Or, $\left[\frac{dy}{dx}\right]_{(1,1)} = \frac{-4}{-3} = \frac{4}{3}$

16. The value of $\int_1^e \frac{(1 + \log x)}{x} dx$ is: **Aug-2007Ans:(b)**

[Given Loge = 1]

(a) 1/2 (b) 3/2 (c) 1 (d) 5/2

Ans: $\int_1^e \frac{(1+\log x)}{x}dx$

Let 1 + log x = z [differentiating we get] $\frac{1}{x}$ dx = dz

when x = e , z = 2 when x = 1 , z = 1 = $\int_1^2 z\,dz = \left[\frac{z^2}{2}\right]_1^2 = \frac{1}{2}[4-1] = \frac{3}{2}$

17. Find $\int \frac{x^3}{(x^2+1)^3}$ dx: **Aug-2007Ans:(b)**

(a) $\frac{1}{4}\left[\frac{2x^2+1}{(x^2+1)^2}\right]$ (b) $-\frac{1}{4}\left[\frac{2x^2+1}{(x^2+1)^2}\right]$ (c) $\frac{1}{2}\left[\frac{2x^2+1}{(x^2+1)^2}\right]$ (d) $-\frac{1}{2}\left[\frac{2x^2+1}{(x^2+1)^2}\right]$

Ans: $\int \frac{x^{3.}}{(x^2+1)^3}dx$

Let, x^2 + 1 = z $[x^2 = z-1]$

2x dx = dz x dx = $\frac{1}{2}$ dz

$= \int \frac{x^2.x\,dx}{(x^2+1)^3} = \int \frac{\frac{1}{2}(z-1)dz}{z^3} = \frac{1}{2}\int \frac{1}{z^2}dz - \frac{1}{2}\int \frac{1}{z^3}dz = \frac{-1}{2Z} + \frac{1}{2\times 2Z^2} = \frac{1}{4Z^2} - \frac{1}{2Z}$

$= \frac{1-2Z}{4Z^2} = \frac{1-2(x^2+1)}{4(x^2+1)^2} = \frac{1-2x^2}{4(x^2+1)^2} = \frac{-1}{4}\left[\frac{2x^2+1}{(x^2+1)^2}\right]$

18. If y = $(x+\sqrt{x^2+m^2})^n$ then $\frac{dy}{dx}$: **Nov-2007Ans:a**

(a) $\frac{ny}{\sqrt{x^2+m^2}}$ (b) ny (c) $-\frac{ny}{\sqrt{x^2+m^2}}$ (d) None

Ans: y = $(x+\sqrt{x^2+m^2})^n$

Differentiating both sides we get

$\frac{dx}{dy} = n(x+\sqrt{x^2+m^2})^{n-1}\left(1+\frac{2x}{2\sqrt{x^2+m^2}}\right) = \frac{n(x+\sqrt{x^2+m^2})^n}{(x+\sqrt{x^2+m^2})}\left(\frac{\sqrt{x^2+m^2}+x}{\sqrt{x^2+m^2}}\right) = \frac{ny}{\sqrt{x^2+m^2}}$

19. If xy (x – y) = 0, find : **Nov-2007Ans:a**

(a) $\frac{y(2x-y)}{x(2y-x)}$ (b) $\frac{x(2x-y)}{y(2y-x)}$ (c) $\frac{y(2y-x)}{x(2x-y)}$ (d) None

Ans: xy(x – y) = 0 $x^2y - xy^2 = 0$ differentiating both sides we get

or, $2xy + x^2\frac{dy}{dx} - y^2 - 2xy\frac{dy}{dx} = 0$ or, $\frac{dy}{dx}[x^2 - 2xy] = y^2 - 2xy$

or, $\frac{dy}{dx} = \frac{y^2-2xy}{x^2-2xy}$ or, $= \frac{y(y-2x)}{x(x-2y)} = \frac{-y(2x-y)}{-x(2y-x)}$ or, $= \frac{y(2x-y)}{x(2y-x)}$

20. If y = $\sqrt{x}^{\sqrt{x^{\cdots\cdots\infty}}}$ then $\frac{dy}{dx}$ is: **Nov-2007Ans:(c)**

(a) $\frac{y^2}{\log x}$ (b) $\frac{y^2}{2-y\log x}$ (c) $\frac{y^2}{x(2-y\log x)}$ (d) None

Ans: $y = \sqrt{x}^{\sqrt{x.....\infty}}$

Taking log on both sides we get

$\log y = \sqrt{x.....\infty}$ $\log\sqrt{x} = \frac{y}{2}\log x$

Or, $\frac{1}{y}\frac{dy}{dx} = \frac{y}{\sqrt{x}}\times\frac{1}{2\sqrt{x}} + log\sqrt{x}\,\frac{dy}{dx}$ $\log y = y\ to\ g\ \sqrt{x}$

Or, $\frac{1}{y}\frac{dy}{dx} = \frac{y}{2x} + log\sqrt{x}\,\frac{dy}{dx}$ Or, $\frac{dy}{dx}\left[\frac{1}{y} - log\sqrt{x}\right] = \frac{y}{2x}$

Or, $\frac{dy}{dx}\left[\frac{1-ylog\sqrt{x}}{y}\right] = \frac{y}{2x}$ Or, $\frac{dy}{dx} = \frac{y^2}{x(2-y\,log\,x)}$

21. $\int \frac{1}{x^2-a^2}dx$ is: **Nov-2007Ans:(c)**

(a) log (x – a) – log (x + a) + C (b) $\log x - \frac{a}{x+a} + C$

(c) $\frac{1}{2a}\log\left(\frac{x-a}{x+a}\right)+C$ (d) None of these

Ans: (c) $\frac{1}{2a}\log\left(\frac{x-a}{x+a}\right) + c$ [by formula]

22. The value of $\int_0^1 \frac{dx}{(1+x)(2+x)}$ is: **Nov-2007Ans:(b)**

(a) $\log\frac{3}{4}$ (b) $\log\frac{4}{3}$ (c) log12 (d) None

Ans: $\int_0^1 \frac{dx}{x^2+3x+2}$

Or, $x^2 + 3x + 2 = \left(x^2 + 2 \times \frac{3}{2}x + \frac{9}{4}\right) + 2 - \frac{9}{4} = (x + \frac{3}{2})^2 - (\frac{1}{2})^2$

$= \int_0^1 \frac{dx}{(x+\frac{3}{2})^2-(\frac{1}{2})^2}$ $= \left[\frac{1}{2\times\frac{1}{2}}\log\left(\frac{x+\frac{3}{2}-\frac{1}{2}}{x+\frac{3}{2}+\frac{1}{2}}\right)\right]_0^1$

$= \log\left(\frac{1+\frac{3}{2}-\frac{1}{2}}{1+\frac{3}{2}+\frac{3}{2}}\right) - \log\left(\frac{0+\frac{3}{2}-\frac{1}{2}}{0+\frac{3}{2}+\frac{1}{2}}\right)$ $= log\left(\frac{2}{3}\right) - \log\left(\frac{1}{2}\right)$ $= log\frac{4}{3}$

23. If $y = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \ldots\ldots\ldots + \frac{x^n}{n!} + \ldots\ldots\infty$ then $\frac{dy}{dx} - y$ is equal to: **Nov-2007Ans:(c)**

(a) 1 (b) -1 (c) 0 (d) None

Ans: $y = e^x$ $[\because 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \cdots\frac{x^n}{n!} + \cdots\cdots\infty = e^x]$ $\frac{dy}{dx} = e^x$

A T P $\frac{dy}{dx} - y = e^x - e^x = 0$

24. The slope of the tangent to the curve $y = \sqrt{4-x^2}$ at the point, where the ordinate and the abscissa are equal, is: **Nov-2007Ans:a**

(a) -1 (b) 1 (c) 0 (d) None

Ans: $y = \sqrt{4 - x^2}$

Differentiating both side we get $\frac{dy}{dx} = \frac{-2x}{2\sqrt{4-x^2}}$

When x = $\sqrt{2}$, $y = \sqrt{2}$ $\therefore \left(\frac{dy}{dx}\right)^{(\sqrt{2},\sqrt{2})} = \frac{-2\sqrt{2}}{2\sqrt{4-2}} = -1$

y = x $\therefore y = \sqrt{4-x^2}$ $y = \sqrt{4-y^2}$ $\therefore x = \sqrt{2}, -\sqrt{2}$

$2y^2 = 4^2$ $y^2 = 2$ $y = \pm\sqrt{2}$

25. The value of $\int_2^3 f(5-x)dx - \int_2^3 f(x)dx$ is : **Nov-2007Ans:(b)**

(a) 1 (b) 0 (c) -1 (d) None

Ans. : : 0 $\left[by\ formula \int_b^a f(x)dx = \int_b^a f(a+b-x)dx\right]$

26. $\int \frac{e^{\log e^x}}{x} dx$ is; **Nov-2007Ans:(b)**

(a) $x^{-1} + C$ (b) x + C (c) $x^2 + C$ (d) None

Ans: $\int \frac{c^{log_e e^x}}{x} dx$

Let $log e^x = z$ Or, $\frac{\log x}{\log e} = z$ Or, $\log x = z$ [differentiating we get]

Or, $\frac{1}{x}dx = z$ $\int e^x dz$ $= e^x + c$ $= e^{log x} + c$ $= x + c$

27. Differentiate $e^{(x^x)}$: **June-2008Ans:(c)**

(a) (1 + log x) (b) $x^x(1 + \log x)$ (c) $e^{x^x}(1 + \log x)x^x$ (d) $e^{x^x}(1 + \log x)$

Ans: $y = e^{x^x}$

Talking log on both sides we get

log y = x^x log e

Or, log y = x^x

Again taking log we get

Or, log (log y) = x log x [Differenting both side we get]

Or, $\frac{1}{logy}\frac{1}{y}\frac{dy}{dx} = \frac{x}{x} + logx$ Or, $\frac{dy}{dx}$ = y log y (1 + log x) Or, $\frac{dy}{dx} = e^{x^x}(1 + logx)x^x$

28. If $x^m y^n = (x + y)^{m+n}$, then find $\frac{dy}{dx}$: **June-2008Ans:(b)**

(a) x/y (b) y/x (c) xy (d) None

Ans: $x^m y^n = (x + y)^{m+n}$

Talking log on both sides we get

Or, $\log(x^m y^n) = (m + n)\log(x + y)$

Or, $m\,logx + n\,logy = m\log(x + y) + n\log(x + y)$

Or, $\frac{m}{x} + \frac{n}{y}\frac{dy}{dx} = \frac{m}{(x+y)}\left(1 + \frac{dy}{dx}\right) + \frac{n}{(x+y)}\left(1 + \frac{dy}{dx}\right)$

Or, $\frac{m}{x} + \frac{n}{y}\frac{dy}{dx} = \frac{m}{x+y} + \frac{m}{(x+y)}\frac{dy}{dx} + \frac{n}{x+y} + \frac{n}{x+y}\frac{dy}{dx}$

Or, $\left[\frac{n}{y} - \frac{m}{(x+y)} - \frac{n}{(x+y)}\right]\frac{dy}{dx} = \frac{m}{x+y} + \frac{n}{x+y} - \frac{m}{x}$

Or, $\left[\frac{mx+ny-my-ny}{y(x+y)}\right]\frac{dx}{dy} = \frac{mx+nx-mx-my}{x(x+y)}$ Or, $\frac{dy}{dx} = \frac{(nx-my)\,y(x+y)}{x(x+y)\,(nx-my)} = \frac{y}{x}$

29. Evaluate $\int \frac{1}{(x-1)(x-2)}$ dx: **June-2008 Ans:a**

(a) $\log\left(\frac{x-2}{x-1}\right)+C$ (b) $\log[(x-2)(x-1)]+C$

(c) $\log\left(\frac{x-1}{x-2}\right)+C$ (d) None

Ans: $\int \frac{1}{(x-1)(x-2)}dx$

$= \int \frac{1}{x^2-3x+2}\,dx$

$x^2 - 3x + 2 = \left(x^2 - 2 \times \frac{3}{2}x + \frac{9}{4}\right) + 2 - \frac{9}{4} = (x - \frac{3}{2})^2 - \frac{1}{4} = \left(x - \frac{3}{2}\right)^2 - \left(\frac{1}{2}\right)^2$

$= \int \frac{dx}{(x-\frac{3}{2})^2-(\frac{1}{2})^2} = \frac{1}{2\times\frac{1}{2}}\log\frac{x-\frac{3}{2}-\frac{1}{2}}{x-\frac{3}{2}+\frac{1}{2}} = log\frac{(x-2)}{(x-1)} + c$

30. $\int_1^4 (2x+5)dx$ and the value is: **June-2008 Ans:(c)**

(a) 10 (b) 3 (c) 30 (d) None

Ans: $\int_1^4 2x\,dx + \int_1^4 5\,dx = 2\int_1^4 x\,dx + 5\int_1^4 dx = [\frac{2x^2}{2} + 5x]_1^4$

= 16 + 5(4) – 1 – 5 = 36 – 6 = 30

31. If f(x) = $a^x x^n$ then find $f'(x)$ **Dec-2008 Ans:(c)**

(a) f(x) [a + log a] (b) f(x)$\left[\frac{a}{x} - \log a\right]$ (c) f(x)$\left[\frac{a}{x} - \log a\right]$ (d) f(x)[a + x log a]

Ans: So, f(x) = $a^x x^n$ f ^{1}(x) = $na^x x^{n-1} + x^n a^x \log a = a^x x^n\left[\frac{n}{x} + loga\right]$

32. $\int \frac{1}{x(x^5+1)}dx$ **Dec-2008 Ans:(b)**

(a) $\log\left(\frac{x^5}{x^5-1}\right)+C$ (b) $\frac{1}{5}\log\left(\frac{x^5}{x^5+1}\right)+C$ (c) $\frac{1}{3}\log\left(\frac{x^5}{x^5+1}\right)+C$ (d) $\frac{1}{3}\log\left(\frac{x^5+1}{x^5}\right)+C$

Ans: $\int \frac{x^4}{x^5(x^5+1)}\,dx$ Let $x^5 + 1 = z$ $5x^4dx = dz$

$x^4\,dx = \frac{dz}{5}$ $= \frac{1}{5}\int \frac{dz}{z(z-1)}$ $= \frac{1}{5}\int \frac{dz}{z^2 - 2\times\frac{1}{2}z + \frac{1}{4} - \frac{1}{4}}$ $= \frac{1}{5}\int \frac{dz}{(z-\frac{1}{2})^2 - (\frac{1}{2})^2}$

$= \frac{1}{5}\log\left[\frac{z-\frac{1}{2}-\frac{1}{2}}{z-\frac{1}{2}+\frac{1}{2}}\right] + c = \frac{1}{5}\log\left[\frac{z-1}{z}\right] + c$

33. Find the value of $\int_{-3}^{3} x\sqrt{8-x^2}\,dx$ **June-2009 Ans:(c)**

(a) 1 (b) – 1 (c) 0 (d) None of these

Ans: $\int_{-3}^{3} x\sqrt{8-x^2}\,dx$ Let $8 - x^2 = z^2$ - 2x dx = 2z dz x dx = - z dz

$= \int_{-3}^{3} -z \times z\,dz = -\int_{-3}^{3} z^2\,dx = \left[\frac{-z^3}{3}\right]_{-3}^{3} = -\frac{1}{3}[(3)^3 - (3)^3] = \frac{1}{3}[27 - 27] = 0$

34. If $x^3 y^2 = (x - y)^5$ Find $\frac{dy}{dx}$ at (1,2) **June-2009 Ans:a**

(a) –7/9 (b) 7/9 (c) 9/7 (d) –9/7

Ans: $x^3y^2 = (x-y)^5$

Differentiating both sides we get

Or, $3x^2y^2 + 2x^3y\frac{dy}{dx} = 5(x-y)^4\,(1 - \frac{dy}{dx})$

Or, $3x^2y^2 + 2x^3y\frac{dy}{dx} = 5(x-y)^4 - 5(x-y)^4\frac{dy}{dx}$

Or, $\frac{dy}{dx}[2x^3y + 5(x-y)^4] = 5(x-y)^4 - 3x^2y^2$

Or, $\frac{dy}{dx} = \frac{5(x-y)^4 - 3x^2y^2}{2x^3y + 5(x-y)^4}$

Or, $\left[\frac{dy}{dx}\right]_{(1,2)} = \frac{5(1-2)^4 - 3(1)^2(2)^2}{2(1)^3(2) + 5(1-2)^4} = -\frac{7}{9}$

35. Evaluate $\int x.c^x\,dx$ **June-2009 Ans:(b)**

(a) $e^x(x + 1) + c$ (b) $e^x(x - 1) + c$ (c) $e^x + c$ (d) $x - e^x + c$

Ans: $\int xe^x dx$ Integrating by by parts we get

$= x\int e^x\,dx - \int[1.\int e^x dx]dx$ [talking x as first function]

$= xe^x - \int e^x dx = e^x(x-1) + c$

36. Find $\int \frac{x^3}{(x^2+1)^3}dx$ **June-2009 Ans:(c)**

(a) $1/4(x^2+1)^{-2} + 1/2(x^2+1)^{-1} + C$ (b) $1/4(x^2+1)^{-1} - 1/2(x^2+1) + C$

(c) $1/4(x^2+1)^{-2} - 1/2(x^2+1)^{-1} + C$ (d) None of these

Ans: $1/4(x^2 + 1)^{-2} - 1/2\,(x^2 + 1)^{-1} + c$ [Same as Q – 17]

37. $\int\left(\sqrt{x} + \frac{1}{\sqrt{x}}\right)dx$ **Dec-2009 Ans:(b)**

(a) $2x^{1/2}\left(\frac{1}{3}x - 1\right)$ (b) $2x^{1/2}\left(\frac{1}{3}x + 1\right)$ (c) $2\left(\frac{1}{3}x + x^{1/2}\right)$ (d) None of these

Ans: $\int\left(\sqrt{x} + \frac{1}{\sqrt{x}}\right)dx = \int\sqrt{x}\,dx + \int\frac{1}{\sqrt{x}}\,dx$

$= \int x^{1/2}dx + \int x^{-1/2}dx$ $= \frac{x^{3/2}}{3/2} + \frac{x^{1/2}}{1/2} + c$ $= 2x^{1/2}\left(\frac{x}{3} - 1\right) + c$

38. $\int_0^1\left(\frac{1-x}{1+x}\right)dx$ **Dec-2009 Ans:a**

(a) 2 log 2 – 1 (b) 4 log 2 – 1 (c) 2 log 2 (d) None of these

Ans: $\int_0^1\left(\frac{1-x}{1-x}\right)dx$

$= \int_0^1\left(\frac{1+x-2x}{1+x}\right)dx$ $= \int_0^1 dx - \int_0^1\frac{2x}{1+x}dx$

$= [x]_0^1 - 2\int_0^1\frac{x}{1+x}dx$ $= (1-0) - 2\int_0^1\frac{1+x-1}{1+x}dx$

$= 1 - 2\int_0^1 dx + 2\int_0^1 \frac{dx}{1+x}$ $= 1 - 2[x]_0^1 + 2[\log(1+x)]_0^1$

$= 1 - 2(1-0) + 2(\log 2 - \log 1)$ $= 1 - 2 + 2\log 2$ $= 2\log 2 - 1$ **Ans. a**

39. x = 2 t + 5 and $y = t^2 - 5$, then $\frac{dy}{dx}$ =? **Dec-2009 Ans:a**

(a) t (b) –1/t (c) 1/t (d) 0

Ans: x = 2t + 5 $y = t^2 - 5$ $\frac{dx}{dt} = 2$ $\frac{dy}{dt} = 2t$ $\frac{dy}{dx} = \frac{dy/dt}{dx/dt} = \frac{2t}{2} = t$

40. $x = at^2$ y = 2 at, $\frac{dy}{dx}$ =? **Dec-2009 Ans:a**

(a) 1/t (b) –1/t (c) t (d) None of above

Ans: $x = at^2$ y = 2at $\frac{dx}{dt} = 2at$ $\frac{dy}{dt} = 2a$ $\frac{dy}{dx} = \frac{dy/dt}{dx/dt} = \frac{2a}{2at}$ 1/t

41. Find the second derivative of $y = \sqrt{x+1}$ **Dec-2009 Ans:(b)**

(a) 1/2 (x + 1) $^{-1/2}$ (b) –1/4(x + 1) $^{-3/2}$ (c) 1/4 (x + 1) $^{-1/2}$ (d) None of these

42. $\int \frac{dx}{\sqrt{3x+4} - \sqrt{3x+1}}$ Equal to **June-2010 Ans:(b)**

(a) $\frac{2}{27}\left[(3x+4)^{3/2} - (3x+1)^{3/2}\right] + c$ (b) $\frac{2}{27}\left[(3x+4)^{3/2} + (3x+1)^{3/2}\right] + c$

(c) $\frac{2}{3}\left[(3x+4)^{3/2} - (3x+1)^{3/2}\right] + c$ (d) None of these

Ans : $\int \frac{dx}{\sqrt{3x+4} - \sqrt{3x+1}} = \int \frac{(\sqrt{3x+4} + \sqrt{3x+1})\,dx}{(\sqrt{3x+4} + \sqrt{3x+1})(\sqrt{3x+4} - \sqrt{3x+1})}$

$= \int \frac{(\sqrt{3x+4} + \sqrt{3x+1})\,dx}{3x+4-3x-1} = \frac{1}{3}\int \sqrt{3x+4}\,dx + \frac{1}{3}\int \sqrt{3x+1}\,dx$

$= \frac{1}{3}\int (3x+4)^{1/2}\,dx + \frac{1}{3}\int (3x+4)^{1/2}\,dx = \frac{1}{3}\frac{(3x+4)^{3/2}}{3/2} + \frac{(3x+4)^{3/2}}{3/2} + c$

$= \frac{2}{27}[(3x+4)^{3/2} + (3x+1)^{3/2}] + c$

Ans: $Y = \sqrt{x+1}$ Differentiating both sides we get $\frac{dy}{dx} = \frac{1}{2\sqrt{x+1}}$

Again differentiating we get $\frac{d^2y}{dx^2} = \frac{1}{2}\frac{1}{2\sqrt{x+1}}$ $= -\frac{1}{4(x+1)^{3/2}} = -\frac{1}{4}(x+1)^{-3/2}$

43. $\int_1^2 \frac{x\,dx}{x^2+2} =$ _____ **June-2010 Ans:a**

(a) $\log\sqrt{2}$ (b) $\log\sqrt{3}$ (c) $\log\frac{1}{\sqrt{2}}$ (d) $\log\frac{1}{\sqrt{3}}$

Ans: $\int_1^2 \frac{x\,dx}{x^2+2}$ Let $x^2 + 2 = z$ when x = 2 , z = 6 2xdx = dz when x = 1 , z = 3

Xdx = dz/2 $= \frac{1}{2}\int_3^6 \frac{dz}{z} = \frac{1}{2}[\log z]_3^6$ = 1/2 [log 6 – log3] =1/2 log2 $= \log\sqrt{2}$

44. If $x^2 + y^2 = 4$ then **June-2010 Ans:(b)**

(a) $y\frac{d^2y}{dx^2} - \left(2\frac{dy}{dx}\right)^2 + 1 = 0$ (b) $y\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 + 1 = 0$

(c) $y\frac{d^2y}{dx^2} - \left(\frac{dy}{dx}\right)^2 - 1 = 0$ (d) $y\frac{d^2y}{dx^2} + 2\left(\frac{dy}{dx}\right)^2 + 1 = 0$

Ans: $x^2 + y^2 = 4$ differentiating both sides we get $2x + 2y\frac{dy}{dx} = 0$

or, $2y\frac{dy}{dx} = -2x$ or, $y\frac{dy}{dx} = -x$ again differentiating we get

or, $y\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 = -1$ or, $y\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 + 1 = 0$

45. The cost function for the production of x units of a commodity is given by $C(x) = 2x^3 - 15x^2 + 36x + 15$

The cost will be minimum when "x" is equal to **Dec-2010 Ans:a**

(a) 3 (b) 2 (c) 1 (d) 4

Ans: $c(x) = 2x^3 - 15x^2 + 36x + 15$ differentiating we get

$c^1(x) = 6x^2 - 30x + 36$ again differentiating we get

$c^{11}(x) = 12x - 30$ for minimum value $c^1(x) = 0$

or, $6x^2 - 30x + 36 = 0$ or, $x^2 - 5x + 6 = 0$

or, $x^2 - 3x - 2x + 6 = 0$ or, $x(x-3) - 2(x-3) = 0$

$x = 2$ or 2

putting $x = 3$ and $x = 2$ in $c^{11}(x)$ we get $c^{11}(3) = 36 - 30 = 6 > 0$

$c^{11}(2) = 24 - 30 = -6 < 0$ x is minimum at x = 3

46. $\int \frac{6x+4}{(x+2)(x+3)} dx$ is equal to **Dec-2010 Ans:(c)**

(a) $22\log(x-3) - 16(x-2)$ (b) $11\log(x-3) - 8(x-2)$

(c) $22\log(x-3) - 16\log(x-2)$ (d) $22\log(x-3) + 16\log(x-2)$

Ans: $\int \frac{6x+4}{x^2+5x+6} dx = \int \frac{3(2x+5)-11}{x^2+5x+6} dx = 3\int \frac{2x+5}{x^2+5x+6} dx - \int \frac{11dx}{x^2+5x+6}$

Let $x^2 + 5x + 6 = z$ $2x + 5dx = dz = 3\int \frac{dz}{z} - 11\int \frac{dx}{x^2+2\times\frac{5}{2}x+\frac{25}{4}+6-\frac{25}{4}} dx$

$= 3\log|(x+3)(x+2)| - 11\int \frac{dx}{\left(x+\frac{5}{2}\right)^2 - \left(\frac{1}{2}\right)^2}$

$= 3\log|(x+3)(x+2)| - \frac{11}{2\times 1/2} log\left|\frac{x+\frac{5}{2}-1/2}{x+\frac{5}{2}+1/2}\right| + c$

$= 3\log|(x+3)(x+2)| - 11\log\left|\frac{x+2}{x+3}\right| + c$

$= 3\log(x+3)(x+2) - 11\log(x+2) + 11\log(x+3) + c$

$= 3log(x+3) + 3\log(x+2) - 11\log(x+2) + 11\log(x+3) + c$

$= 14\log(x+3) - 8\log(x+2) + c$

47. $\int \frac{1}{x(1+\log x)^2} dx$ is equal to **Dec-2010 Ans:(c)**

(a) $-\frac{1}{2(1+\log x)^2} + c$ (b) $\frac{1}{(1+\log x)} + c$ (c) $-\frac{1}{(1+\log x)} + c$ (d) None of these

Ans: $\int \frac{dx}{x(1+logx)^2}$ $1 + \log x = z$ $\frac{1}{x}dx = dz$

$= \int \frac{dz}{z^2} = -\frac{1}{z} + c = -\frac{1}{(1+logx)} + c$

48. Solve : $\int_{-1}^{1} (e^x - e^{-x})\, dx$ **June-2011 Ans. a**

(a) 0 (b) 1 (c) 12 (d) None of the above

Ans: $= \int_{-1}^{1}(e^x - e^{-x})dx = \int_{-1}^{1} e^x dx - \int_{-1}^{1} e^{-x} dx = [\, e^x + e^{-x}]_{-1}^{1} = e^1 + e^{-1} - e^{-1} - e^1 = 0$

49. Solve : $\int \frac{(\log x^x)^2}{x^3}.dx$ **June-2011 Ans. (b)**

(a) $\frac{3}{2}(\log x)^3 + C$ (b) $\frac{1}{3}(\log x)^3 + C$ (c) $\frac{1}{6}(\log x)^3 + C$ (d) $\frac{3}{7}(\log x)^3 + C$

Ans: $\int \frac{(xlogx)^2}{x^3} dx$ $= \int \frac{(x)^2\,(logx)^2}{x^3} dx = \int \frac{(logx)^2}{x} dx$ Let $\log x = z$

$\frac{1}{x}dx = dz$ $= \int z^2 dz = \frac{z^3}{3} + c$ $= \frac{(logx)^3}{3} + c$

50. If $f(x) = {}^{x}C_3$; then $f'(1) = ?$ **June-2011. (Ans. b)**

(a) 1/6 (b) -1/6 (c) 5/6 (d) -5/6

Ans: $f(s) = x_{c_3}$ $= \frac{x!}{(x-3)!3!}$ $= \frac{x(x-1)(x-2)(x-3)}{(x-3)!\times 3\times 2\times 1}$

$= \frac{1}{6}(x^2 - x)(x-2) = \frac{1}{6}(3x^2 - 3x^2 + 2x)$

$y^1(x) = \frac{1}{6}(3x^2 - 6x + 2$ $y^1(1) = \frac{1}{6}[3(1)^2 - 6(1) + 2]$ $= -1/6$

51. Given, $y = \int \left(e^{a \log x} + e^{x \log a}\right) dx$; then $\frac{dy}{dx}$ **June-2011 Ans. (b)**

(a) $x^a\, a^x$ (b) $x^a + a^x$ (c) $ax^{x-1} + a^x \log a$ (d) None of the above

Ans: $y = \int (c^{a \log x} + c^{x \log a})\, dx$ $= \int (c^{\log x^a} + c^{\log a^x})\, dx$

$= \int x^a + a^x\, dx$

Differentiating both side we get

$\frac{dy}{dx} = \frac{d}{dx} \int (x^a + a^x) dx$ $= ax^{a-1} + a^x \log a + C$

52. If $f'(x) = 3x^2 - \frac{2}{x^3};\ f(1) = 0$ and $f(x) =$ _____ **June-2011 Ans. (c)**

(a) $\frac{x^3}{3} - x^2 - 2$ (b) $x^3 + x^2 + 2$ (c) $x^3 + x^{-2} - 2$ (d) None of these

Ans: $f'(x) = 3x^2 - \frac{2}{x^3}$

Integrating both side we get

$f(x) = 3 \int x^2 dx - 2 \int \frac{dx}{x^3} = 3\frac{x^3}{3} + \frac{1}{x^2} + c$ $= x^3 + \frac{1}{x^2} + c$ $f(1) = 1 + \frac{1}{1} + c$

$0 = 2 + c$ $c = -2$ $f(x) = x^3 + x^{-2} - 2$

53. $\int_{-1}^{1} \frac{|x|}{x} dx =$ _____ **Dec-2011 Ans. (b)**

a) -1 b) 0 c) 1 d) 2

Ans. $\int_{-1}^{1} \frac{|x|}{x} dx = \int_{-1}^{0} \frac{-x}{x} dx + \int_{0}^{1} \frac{x}{x} dx = -\int_{-1}^{0} dx + \int_{0}^{1} dx = 1 + 1 = 2$

54. $\frac{d}{dx}\left(2^{\log_2^x}\right) =$ _____ **Dec-2011 Ans. a**

a) 1 b) 0 c) 1/2 d) $2^x . \log^2 x$

Ans. $\frac{d}{dx} 2^{\log_2^x}$

Formula

$a^{\log_a^x} = x$

So, $2^{\log_2^x} = x\ \frac{d}{dx}(x) = 1$

55. $\int \frac{e^x}{(1+x)^3} . dx - \int \frac{e^x}{2(1+x)^2 .} dx =$ _____ **Dec-2011 Ans. (c)**

a) 0 b) $\frac{e^x}{2(1+x)^2} + C$ c) $-\frac{e^x}{2(1+x)^2} + C$ d) $\frac{e^x}{2(1+x)^2} + C$

Ans. $\int \frac{e^x}{(1+x)^3} . dx - \int \frac{e^x}{2(1+x)^2} dx \Rightarrow \int e^4 (f(x) + f'(x))$ $= e^x f(x)$ (So Ans. c)

56. If $Y = x^x$ *then* $\frac{d^2 y}{dx^2} =$ _____ **Dec-2011 Ans. a**

a) $\frac{dY}{dx}(1 + \log x) + Y \frac{d}{dx}(1 + \log x)$ b) $\frac{dY}{dx}(1 + \log x) + \frac{d}{dx}(1 + \log x)$

c) $\frac{dY}{dx}(1 + \log x) - Y \frac{d}{dx}(1 + \log x)$ d) $\frac{dY}{dx}(1 + \log x) - \frac{d}{dx}(1 + \log x)$

Ans. Y = x^x Putting log both the side we get,

$\log y = \log x^x$ $\log y = x\log x$ $\frac{d}{dx}\log y = x.\frac{d}{dx}\log x + \log x\frac{d}{dx}x$

$\frac{1}{y}.\frac{dy}{dx} = \frac{x}{x} + \log x$ $\frac{dy}{dx} = y[1+\log x]$ $\frac{d^2y}{dx^2} = \frac{dy}{dx}[1+\log x) + y.\frac{d}{dx}[1+\log x)$

$= \frac{dy}{dx}(1+\log x) + y\frac{d}{dx}(1+\log x)$ (Ans.)

57. If $g(x) = -\sqrt{25-x^2}$, then $\lim_{x\to 1}\frac{g(x)-g(1)}{x-1}$ is equal to _____ **June-2012 Ans. (b)**

(a) 0 (b) $1/\sqrt{24}$ (c) $\sqrt{24}$ (d) None of these

Ans. $g(x) = -\sqrt{25-x^2}$ then, $\lim_{x\to 1}\frac{g(x)-g(1)}{x-1} = 0 \Rightarrow \lim_{x\to 1}\frac{-\sqrt{25-x^2}-\sqrt{25-1}}{x-1}$

$\Rightarrow -\lim_{x\to 1}\left(\frac{\sqrt{25-x^2}+\sqrt{24}}{(x-1)}\right) \Rightarrow -\lim_{x\to 1}\frac{x^2-1}{(x-1)\left(\sqrt{25-x^2}+\sqrt{24}\right)} = \frac{x+1}{\sqrt{25-x^2}+\sqrt{24}} = \frac{1}{\sqrt{24}}$ (Ans.)

58. If x = c t, y = c/t, then $\frac{dy}{dx}$ is equal to:

June-2012 Ans. (c)

(a) 1/t (b) $t.e^t$ (c) $-1/t^2$ (d) None of these

Ans. x = ct $y = \frac{c}{t}$ $\frac{dx}{dt} = c$ $\frac{dy}{dt} = -c[(t)^{-2}$ $\frac{dy}{dx} = \frac{dy/dt}{dx/dt} = \frac{-c[t)^{-2}}{c} = \frac{-1}{(t)^2}$

59. $\int_0^1 \frac{dx}{[ax+b(1-x)]^2} =$ _____ **June-2012 Ans. (d)**

(a) a/b (b) b/a (c) ab (d) 1/ab

Ans. $\int_0^1 \frac{dx}{[ax+b(1-x)]^2}$ $\Rightarrow ax + b(1-x) = z$ $(a-b)dx = dz$ $dx = \frac{dz}{a-b}$ $\frac{1}{a-b}$ $\int_b^a \frac{dz}{z^2}$

$\Rightarrow \frac{1}{a-b}\left(\frac{-1}{2}\right)\frac{a}{b} = \frac{-1}{a-b}\left(\frac{1}{a} \quad \frac{-1}{b}\right) = \frac{1}{ab}$

60. If $y = e^{a\log x} + e^{x\log a}$, then $\frac{dy}{dx} =$ **June-2012 Ans. (b)**

(a) $x^a + a^x$ (b) $a\,x^{a-1} + a^x\log a$ (c) $a\,x^{a-1} + x\,a^{x-1}$ (d) $x^x + a^n$

Ans. $y = e^{a\log x} + e^{x\log a}$ $e^{\log x^a} + e^{\log a^x}$ $= x^a + a^x$

$\frac{dy}{dx} = ax^{a-1} + a^x\log a.$

61. $\int 2^{3x}3^{2x}5^x dx =$ _____ **Dec-2012 Ans. (b)**

(a) $\frac{2^{3x}\,3^{2x}5^x}{\log(720)} + c$ (b) $\frac{2^{3x}\,3^{2x}5^x}{\log(360)} + c$ (c) $\frac{2^{3x}\,3^{2x}5^x}{\log(180)} + c$ (d) $\frac{2^{3x}\,3^{2x}5^x}{\log(90)} + c$

62. For the functions $y = x^3 - 3x$, the value of $\frac{d^2y}{dx^2}$ at which $\frac{dy}{dx}$ is zero, is **Dec-2012 Ans. (c)**

(a) ±1 (b) ±3 (c) ±6 (d) None of these

Ans. $y = x^3 - 3x$ $\frac{dy}{dx} = 3x^2 - 3 = 0$ $x^2 = 1$

$x = \pm 1$

$\frac{d^2y}{dx^2} = 6x = \pm 6$

63. The equation of tangent to the curve, $f = x^2 - 3x + 2$, at the point (2,7) is _____ **Dec-2012 Ans. (c)**

(a) y = 2x – 3 (b) y = 10x (c) 10x – 13 (d) y = 10

Ans. $f = x^2 - 3x + 2$ $f'(x) = 2x - 3$ $f'(x)]_{2,7} = 4 - 3 = 1$

$\frac{y-z}{x-2} = f'(x) = 1$ $y - 7 = x - 2$ $y = x + 5$

Formula

$\frac{y - y_1}{x - x_1} = f'(x)$

64. If $y = log\left[\frac{5-4x^2}{3+5x^2}\right]$, then $\frac{dy}{dx}$ = _____ **Dec-2012 Ans. (c)**

(a) $\frac{8}{4x-5} - \frac{10}{3+5x}$ (b) $(4x^2 - 5) - (3 + 5x^2)$ (c) $\frac{8x}{4x^2-5} - \frac{10x}{3+5x^2}$ (d) 8x – 10

Ans. $y = \log\left[\frac{5-4x^2}{3+5x^2}\right]$

$\Rightarrow \log(5-x^2) - \log(3+5x^2)$ $\frac{dy}{dx} = \frac{-8x}{5-4x^2} - \frac{10x}{3+5x^2} \Rightarrow \frac{8x}{4x^2-5} - \frac{10x}{3+5x^2}$ (Ans.)

65. If y = $\log_y x$, then $\frac{dy}{dx}$ is equal to: **June-2013 Ans. (b)**

a) $\frac{1}{x + \log y}$ b) $\frac{1}{x + x\log y}$ c) $\frac{1}{1 + x\log y}$ d) $\frac{1}{y + \log x}$

Ans. $y = \log_y x$ $y = \frac{\log x}{\log y}$ $y \log y = \log x$

$\Rightarrow y.\frac{d}{dx}\log y + \log y.\frac{d}{dx}y = \frac{d}{dx}\log x$ $y.\frac{1}{y}.\frac{dy}{dx} + \log y.\frac{dy}{dx} = \frac{1}{x}$

$\Rightarrow \frac{dy}{dx}[1 + \log y] = \frac{1}{x}$ $\frac{dy}{dx} = \frac{1}{x[1+\log y]} = \frac{1}{x + x\log y}$ (Ans.)

66. $\int_1^2 \frac{(\log_e(ex))^n}{x} dx\,(n+1)$ is equal 1 **June-2013 Ans. a**

a) $\left[\frac{(\log_e(2e))^{n+1} - 1}{n+1}\right]$ b) $\left[(log_e(2e))^{(n+1)} + 1\right]$

c) $\frac{(\log_e(2e))^{n+1}}{n+1} - \frac{(\log_e 2)^{n+1}}{n+1}$ d) None of these

67. If x = log t, y = e^t, then $\frac{dy}{dx}$ = **June-2013 Ans. (b)**

a) 1/t b) $t.e^t$ c) $-1/t^2$ d) None of these

Ans. $x = \log t$, $y = e^t$ $\frac{dx}{dt} = \frac{1}{t}$, $\frac{dy}{dt} = e^t$ $\frac{dy}{dx} = \frac{dy/dt}{dx/dt} = e^t \times t$ (Ans.)

68. $\int 2^{3x}.3^{2x}.5^x dx$ = _____ **June-2013 Ans. (b)**

a) $\frac{2^{3x}.3^{2x}.5^x}{\log(270)} + C$ b) $\frac{2^{3x}.3^{2x}.5^x}{\log(360)} + C$ c) $\frac{2^{3x}.3^{2x}.5^x}{\log(180)} + C$ d) $\frac{2^{3x}.3^{2x}.5^x}{\log(90)} + C$

Ans. $\int 2^{3x} \times 3^{2x} \times 5^x dx$ Let 2^{3x} 3^{2x} $5x = y$ Putting log both the side

$\log 2^{3x} + \log 3^{2x} + \log 5^x = \log y$

69. The points on the curve y = $x^3 - x^2 - x + 1$, where the tangent is parallel to x – axis are **Dec-2013 Ans. a**

a) $\left(\frac{-1}{3},\frac{32}{27}\right)$ and (1, 0) b (0, 0) and (1, 0) (c) (1, 0) and (1, 1) (d) (0, 1) and (1, 1)

Ans. $y=x^3-x^2-x+1$ $\frac{dy}{dx}=3x^2-2x-1=0$ $\frac{dy}{dx}=\tan 0=0$ $3x^2-(3x-x)-1=0$

$3x^2-3x+x-1=0$ $3x(x-1)-(x-1)=0$ $(3x+1)(x-1)=0$ $x=1$ *or* $x=\frac{-1}{3}$

$x=1,\quad y=0\quad (1,0)$ $x=\frac{-1}{3},\qquad y=\frac{32}{27}$ $\left(\frac{-1}{3},\frac{32}{27}\right)$

70. $\int (p)^{2x}dx$_____ **Dec-2013 Ans. a**

(a) $\frac{a^{2x}}{2\log a}$ (b) $\frac{2.a^{2x}}{\log a}$ (c) $\frac{a^{2x}.\log a}{2}$ (d) None of these

Ans. Formula, $\int a^x.dx=\frac{a^x}{\log a}+c$ So $\int a^{2x}\ dx=\frac{a^{2x}}{2\log a}+c$ (Ans.)

71. $\int_0^5 \frac{x^2dx}{x^2+(5-x)^2}$ is equal to **June-2014 Ans. (b)**

a) 5 b) $\frac{5}{2}$ c) 1 d) None of these

72. If $y=ae^{nx}+be^{-nx}$, then $\frac{d^2y}{dx^2}$ is equal to _____. **June-2014 Ans. a**

a) $n^2 y$ b) $-n^2y$ c) ny d) None of these

Ans. $y=ae^{nx}+be^{-nx}$ $\frac{dy}{dx}=ane^{nx}-bne^{-nx}$ $\frac{d^2y}{dx^2}=an^2e^{nx}+bn^2+e^{nx}=n^2y$

73. The value of definite integral $\int_0^2 |1-x|\,dx=$_____ **Dec-2014 Ans. (d)**

a) 0 b) 1/2 c) 3/2 d) 1

Ans. $\int_0^2 |1-x|dx \Rightarrow -\int_0^1 (1-x)dx+\int_0^2 (1-x)dx \Rightarrow \left(x-\frac{x^2}{2}\right)_1^2-\left(x-\frac{x^2}{2}\right)_0^2$

$\Rightarrow \left\{(2-2)-\left(1-\frac{1}{2}\right)\right\}-\left(1-\frac{1}{2}\right)^0 \Rightarrow \frac{1}{2}-\frac{1}{2}=1(Ans)$

74. If $y=1+\frac{x}{\angle 1}+\frac{x^2}{\angle 2}+.....\frac{x^n}{\angle n}+$ ....., then **Dec-2014 Ans. (b)**

the value of $\frac{dy}{dx}-y=$_____

a) 1 b) 0 c) 2 d) – 1

75. The value of $\int_0^{1/2}\frac{dx}{\sqrt{3-2x}}$ is **June-2015 Ans. (c)**

a) 1 b) $1-\sqrt{3/2}$ c) $\sqrt{3}-\sqrt{2}$ d) $\sqrt{2}-\sqrt{3}$

Ans. $\int_0^{1/2}\frac{dx}{\sqrt{3-2x}}$ 3 – 2x = z - 2dx = dz

$\frac{-1}{2}\quad \int_3^2 \frac{dz}{\sqrt{z}}$ $=\frac{1}{2}\left[\frac{z^{\frac{-1}{2}+1}}{\frac{-1}{2}+1}\right]_2^3$ $\Rightarrow \left(\sqrt{z}\right)_2^3=(\sqrt{3}-\sqrt{2})$

76. The value of $\int_0^2 xe^{x^2}dx$ is **June-2015 Ans. (d)**

a) 1 b) e – 1 c) (e/2) – 1 d) $\frac{1}{2}(e^4-1)$

Ans. $\int_0^2 x\, e^{x^2} dx \quad x^2 = z \qquad 2x\,dx = dz \qquad \Rightarrow \frac{1}{2} \int_0^2 e^z \quad dz$

$\Rightarrow \frac{1}{2} \quad [e^z]_0^4 \quad \Rightarrow \frac{1}{2}(e^4-1)$ (Ans.)

77. If $x^p\, y^q = (x+y)^{p+q}$, then $\frac{dy}{dx}$ is equal to _____

June-2015 Ans. (c)

a) $\frac{q}{p}$ b) $\frac{x}{y}$ c) $\frac{y}{x}$ d) $\frac{p}{q}$

Ans. $x^p\, y^q = (x+y)^{p+q}$

Putting log both the side we get, $\log x^p\, y^q = \log(x+y)^{p+q}$

$\log x^p + \log y^q = p+q\log(x+y) \qquad p\log x + q\log y = (p+q)\log(x+y)$

$\Rightarrow \frac{pd}{dx}\log x + q\frac{d}{dx}\log y = (p+q)\frac{d}{dx}\log(x+y)$

$\Rightarrow \frac{p}{x} + \frac{q}{y}.\frac{dy}{dx} = \frac{(p+q)}{x+y}\left[1+\frac{dy}{dx}\right] \qquad \Rightarrow \frac{q}{y}.\frac{dy}{dx} + \frac{p}{x} = \frac{p+q}{x+y} + \frac{p+q}{x+y}.\frac{dy}{dx}$

$\Rightarrow \frac{q}{y}.\frac{dy}{dx} - \frac{p+q}{x+y}.\frac{dy}{dx} = \frac{p+q}{x+y}\frac{-p}{x} \qquad \Rightarrow \frac{dy}{dx}.\left[\frac{q}{y} - \frac{p+q}{x+y}\right] = \frac{x(p+q)-p(x+y)}{x(x+y)}$

$\Rightarrow \frac{dy}{dx}\left[\frac{q(x+y)-(p+q)y}{y(x+y)}\right] = \frac{xp+qx-px-py}{x(x+y)} \qquad \frac{dy}{dx} = \frac{xp+qx-px-py}{x(x+y)} \times \frac{y(x+y)}{qx+qy-py-qy}$

$\Rightarrow \frac{[xp+qx-px-py]}{qx+qx-py-qy} \times \frac{y}{x} \quad = \frac{y}{x}$ (Ans.)

78. If $e^{xy} - 4xy = 4$ then $\frac{dy}{dx}$ = _____ **June-2015 Ans. (b)**

a) $\frac{y}{x}$ b) $\frac{-y}{x}$ c) $\frac{x}{y}$ d) $\frac{-x}{y}$

Ans. $exy - 4xy = 4 \qquad e^{xy}\left[x.\frac{dy}{dx} + y\right] - \left[4x.\frac{dy}{dx} + y^4\right] = 0$

$e^{xy} \times x \times \frac{dy}{dx} + e^{xy} \times y - 4x.\frac{dy}{dx} - 4y \qquad \frac{dy}{dx}.[e^{xy} \times x - 4x] = 4y - e^{xy}y$

$\frac{dy}{dx} = \frac{4y - e^{xy}y}{e^{xy} \times x - 4x} \qquad \Rightarrow \frac{-y}{x}.\left[\frac{4-e^{xy}}{4-e^{xy}}\right] = \frac{-y}{x}$

79. If $u = 3t^4 + 5t^3 + 2t^2 + t + 4$, then the value of $\frac{du}{dt}$ at t = - 1 is : **Dec-2015 Ans. a**

a) 0 b) 1 c) 2 d) 5

80. The value of $\int_1^2 \frac{1-x}{1+x} dx$ is equal to : **Dec-2015 Ans. (b)**

a) $\log\frac{3}{2} - 1$ b) $2\log\frac{3}{2} - 1$ c) $\frac{1}{2}\log\frac{3}{2} - 1$ d) $\frac{1}{2}\log\frac{2}{3} - 1$

81. The slope of the tangent to the curve $y = \frac{x-1}{x+2}$ at $x = 2$ is : **Dec-2015 Ans. a**

a) $\frac{3}{16}$ b) $-\frac{3}{16}$ c) $\frac{1}{4}$ d) $-\frac{1}{4}$

82. $\int_0^2 \frac{3\sqrt{x}}{\sqrt{X}}dx$ is equal to _____ **June-2016 Ans. (c)**

a) $\frac{2\sqrt{2}}{\log_e^3}$ b) 0 c) $\frac{2}{\log_e^3}\left(3^{\sqrt{2}}-1\right)$ d) $\frac{3^{\sqrt{2}}}{\sqrt{2}}$

83. $\int \frac{x}{\left(x^2+1\right)\left(x^2+2\right)}dx$ is equal to _____ **June-2016 Ans. (b)**

a) $\log\left(\frac{x^2+1}{x^2+2}\right)+c$ b) $\frac{1}{2}\log\left(\frac{x^2+1}{x^2+1}\right)+c$ c) $\frac{1}{2}\log\left(\frac{x^2+2}{x^2+1}\right)+c$ d) $-\log\left(\frac{x^2+1}{x^2+2}\right)+c$

84. If $y=\sqrt{\frac{1-x}{1+x}}$, then $\frac{dy}{dx}$ is equal to -- **June-2016 Ans. a**

a) $\frac{y}{X^2-1}$ b) $\frac{y}{1-x^2}$ c) $\frac{y}{1+x^2}$ d) $\frac{y}{y^2-1}$

85. Differential Co-efficient of $\log_e\left(\sqrt{x-1}+\sqrt{x+1}\right)$ with respect to x is : **Dec-2016 Ans. a**

a) $\frac{1}{2\sqrt{x^2-1}}$ b) $\frac{1}{2\sqrt{x^2+1}}$ c) $\frac{1}{2\left(x^2\right)}$ d) $\frac{1}{\sqrt{x-1}+\sqrt{x+1}}$

86. If $f(x)=\log_e\left(\frac{x-1}{x+1}\right)$, then the value of x at which $f'(x)=1$, is **Dec-2016 Ans. (c)**

a) 0 b) 1 c) $\pm\sqrt{3}$ d) $\pm\sqrt{2}$

87. $\int_1^e \frac{e^x\left(x\log_e x+1\right)}{x}dx$ is equal to : **Dec-2016 Ans. (b)**

a) e + 1 b) e^e c) $e-1$ d) e^x+1

88. The function f (x) = $\left(\sqrt{1-x^2}/\sqrt{1-x^3}\right)$ is not defined at x = 1, the value of f (x) which will make f(x) continuous at x = 1, will be: **June-2017 (Ans: a)**

a) $\sqrt{\frac{2}{3}}$ b) $\frac{\sqrt{2}}{3}$ c) $\frac{2}{\sqrt{3}}$ d) $\frac{2}{3}$

89. $\lim_{n\to\infty}\frac{(n-1)^n}{n^n}$ is equal to: **June-2017 (Ans: b)**

a) e b) 1/e c) -e d) -1/e

90. The equation of the curve which passes through the point (1, 2) and has the slope 3x - 4 at any point (x, y) is: **June-2017 (Ans; a)**

a) $2y = 3x^2 - 8x + 9$ b) $y = 6x^2 - 8x + 9$ c) $y = x^2 - 8x + 9$ d) $2y = 3x^2 - 8x + c$

91. The value of $\int_1^2 \frac{x}{x^2+1}dx$ is equal to: **June-2017 (Ans: b)**

a) $\log_e\left(\frac{5}{2}\right)$ b) $\frac{1}{2}\log_e\left(\frac{5}{2}\right)$ c) $\log_e(5)-\log_e 2+c$ d) None of these

92. If $x = at^3 + bt^2 - t$ and $y = at^2 - 2bt$, then the value of $\frac{dy}{dx}$ at t = 0 is : **June-2017 (Ans: a)**

a) 2b b) -2b c) $\frac{1}{2b}$ d) $-\frac{1}{2b}$

93. The value of $\int e^x\left[f(x)+f^1(x)\right]dx=$ _____ **Dec-2017 Ans. a**

a) $e^x f(x)+c$ (b) $e^x f^1(x)+c$ (c) $\left[\frac{f^1(x)}{f(x)}\right]+c$ (d) $e^x\left[\frac{f(x)}{f^1(x)}\right]+c$

94. If $x^y=e^{x-y}$ then $\frac{dy}{dx}$ is equal to : **Dec-2017 Ans. (c)**

a) $\frac{2\log x}{(1+\log x)^2}$ (b) $\frac{\log x}{(1+\log x)}$ (c) $\frac{\log x}{(1+\log x)^2}$ (d) None of the above

95. If y = $1+\frac{x}{\lfloor 1}+\frac{x^2}{\lfloor 2}+\frac{x^3}{\lfloor 3}$ ……∞, then the value of $\frac{dy}{dx}$ is equal to : **Dec-2017 Ans. (b)**

a) x (b) y (c) 1 (d) 0

96. $\int x.e^{x^2}dx$ is equal to : **Dec-2017 Ans. (c)**

a) $2e^{x^2}+c$ (b) $e^{x^2}+c$ (c) $\frac{1}{2}.e^{x^2}+c$ (d) $xe^{x^2}+c$

97. If $x=at^2, y=2at$ then the value of $\frac{dy}{dx}$ at t = 2 is : **Dec-2017 Ans. (c)**

a) 2 (b) 4 (c) $\frac{1}{2}$ (d) $\frac{1}{4}$

98. If y = log x^x then $\frac{dy}{dx}$= _____ : **Dec-2017 Ans. (a)**

a) log ex (b) log $\frac{e}{x}$ (c) log $\frac{x}{e}$ (d) 1

99. The value of $\int_1^2 \frac{1-x}{1+x}dx$ is equal to : **May-2018 Ans. b**

(a) $\log\frac{3}{2}-1$ (b) $2\log\frac{3}{2}-1$ (c) $\frac{1}{2}\log\frac{3}{2}-x$ (d) $\frac{1}{2}\log\frac{2}{3}-1$

100. $\int_0^2 \frac{3^{\sqrt{x}}}{\sqrt{x}}dx$ is equal to **May-2018 Ans. (c)**

(a) $\frac{2\sqrt{2}}{\log_e 3}$ (b) 0 (c) $\frac{2\left(3\sqrt{2}-1\right)}{\log_e 3}$ (d) $\frac{3\sqrt{2}}{\sqrt{2}}$

101. The value of $\int_0^2 \frac{\sqrt{x}}{\sqrt{x}+\sqrt{2+x}}dx$ is : **May-2018 Ans. (d)**

a) 0 b) 3 c) 2 d) 1

102. $\lim_{x\to 1},\frac{x+x^2+x^3.....+x^n-n}{x-1}$ **May-2018 Ans. (b)**

a) (n) (b) $\frac{n(n+1)}{2}$ (c) (n+1) d) n (n+1)

103. The cost function for the production of x units of a commodity is given by **May-2018 Ans. (a)**

$C(x)=2x^3+15x^2+36x+15$

The cost will be minimum. When 'x' is equal to :

a) 3 b) 2 c) 1 d) 4

104. $\lim_{x-0}\frac{2e^{1/x-3x}}{e^{1/x+4x}}=?$ **May-2018 Ans. (c)**

a) -3 b) 0 c) 2 d) 9

105. Let $x=at^3, y=\frac{a}{t^2}$. Then $\frac{dy}{dx}$ = **Nov-2018Ans. b**

a) $\frac{-1}{t^6}$ b) $\frac{-3a}{t^6}$ c) $\frac{1}{3at^6}$ d) None of the above

106. $\int x\left(x^2+4\right)^5dx$ is equal to **Nov-2018 Ans. (b)**

(a) $\left(x^2+4\right)^6+c$ (b) $\frac{1}{12}\left(x^2+4\right)^6+c$ (c) $\frac{1}{2}\left(x^2+4\right)^6+c$ (d) None of these

107. $\int_1^3\left(1+3x-x^3\right)dx$ is equal to **Nov-2018 Ans. (a)**

(a) -4 (b) 4 (c) 3 (d) -3

108. xy = 1 then $y^2+\frac{dy}{dx}=?$ **Nov-2018 Ans . (d)**

(a) 1 (b) 0 (c) 2 (d) None of the above

109. If the given cost of function of a commodity is given by $C = 150x - 5x^2 + \frac{x^3}{6}$, where C stands for cost and x stands for output, if the average cost is equal to the marginal cost then the output x = _____

Ans. (c) June-2019

(a) 5 (b) 10 (c) 15 (d) 20

110. If $2^x - 2^y = 2^{x-y}$ then $\frac{dy}{dx}$ at x = y = 2 **Ans. (a) June-2019**

(a) 1 (b) 2 (c) 4 (d) 5

111. $\int_2 \frac{\sqrt{x}}{\sqrt{5-x}+\sqrt{x}}\,dx =$ **Ans. (c) June-2019**

(a) 1 (b) 1/2 (c) 2 (d) 3/2

112. $\int e^x\left(x^2+2x\right)dx =$ **Ans. (c) June-2019**

(a) $x^2.e^2 + c$ (b) $e^2.x + c$ (c) $-e^x x^2 + c$ (d) $-e^x.x + c$

113. $\int \log_e\left(a^x\right)dx =$ **Ans. (a) June-2019**

(a) $\log a\left(\frac{x^2}{2}\right)+c$ (b) $\log a\left(\frac{x}{2}\right)+c$ (c) $x\log a^x - x + c$ (d) $x\log a^x - c$

114. $\int a^x\,dx.$ **Nov-2019 Ans. (d)**

(a) $x^x\,(1+\log x)$ (b)1 + log x (c) x. log x (d) $\frac{a^x}{\log a}+c$

115. $\int x.e^x dx.$ **Nov-2019 Ans. (a)**

(a) $e^x\,(x-1)+c$ (b) $e^x.x + e^x + c$ (c) $\log x + e^x + c$ (d) $\frac{x^2}{e^x}+c$

116. $\int (4x+3)^6\,dx.$ **Nov-2019 Ans. (a)**

(a) $\frac{1}{28}(4x-3)^7+c$ (b) $\frac{1}{7}(4x-3)^7+c$ (c) $\frac{1}{6}(4x+3)^6+c$ (d) $\frac{4x}{5}+\frac{3}{5}+c$

117. $\int_{-1}^{1}(2x^2-x^3)\,dx.$ **Nov-2019 Ans. (a)**

(a) 4/3 (b) 1 (c) 2 (d) 2/3

118. $\frac{d}{dx}(x.\log x)$ **Nov-2019 Ans. (b)**

(a) x(1 + log x) (b) 1 + log x (c) e^x x. log x (d) x^2 (log x)

119. Differentiate x^x $w.r.t\ x.$ **Nov-2019 Ans. (a)**

(a) x^x (1 + log x) (b) y/x (c) – y/x (d) y + x^x log x

120. $\int x^2.e^x\,dx.$ **Nov-2019 Ans. (c)**

(a) $2x.e^x$ (b) $e^x(x^2-2x)$ (c) $x^2.e^x - e^x.(2x) + 2$ (d) $e^x(x-1)$

Answer Key

1	b	2	c	3	a	4	b	5	b	6	c	7	b	8	d	9	a	10	a
11	b	12	c	13	a	14	c	15	a	16	b	17	b	18	a	19	a	20	c
21	c	22	b	23	c	24	a	25	b	26	b	27	c	28	b	29	a	30	c
31	c	32	b	33	c	34	a	35	b	36	c	37	b	38	a	39	a	40	a
41	b	42	b	43	a	44	b	45	a	46	c	47	c	48	a	49	b	50	b
51	b	52	c	53	b	54	a	55	c	56	a	57	b	58	c	59	d	60	b
61	b	62	c	63	c	64	c	65	b	66	a	67	b	68	b	69	a	70	a
71	b	72	a	73	d	74	b	75	c	76	d	77	c	78	b	79	a	80	b
81	a	82	c	83	b	84	a	85	a	86	c	87	b	88	a	89	b	90	a
91	b	92	a	93	a	94	c	95	b	96	c	97	c	98	a	99	b	100	c
101	d	102	b	103	a	104	c	105	b	106	b	107	a	108	d	109	c	110	a
111	c	112	c	113	a	114	d	115	a	116	a	117	a	118	b	119	a	120	c