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# CA FOUNDATION - MATHEMATICS

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**SURDS & INDICES**

**Q1**

$$a^m \cdot a^n = a^{m+n}$$

$$\frac{a^m}{a^n} = a^{m-n}$$

$$(a^m)^n = a^{mn}$$

01. **DEC 2022**

$$(2a^3b^4)^6 / (4a^3b)^2 \times (a^2b^2) =$$

a.  $4a^2b^3$     b.  $4a^6b$     c.  $4a^{10}b^{10}$

d.  $4a^{10}b^{20}$

02. **DEC 2023**

$$\frac{9^n \times 3^5 \times 27^5}{3 \times 81^4} = 27, n = ?$$

a. 2     b. 0    c. 3    d. 4

03. **JUNE 2022**

$$\sqrt{9^{-8}} \times \sqrt{3^{-5}} = 3a$$

a.  $\frac{2}{21}$     b.  $\frac{21}{2}$      c.  $-\frac{21}{2}$     d.  $-\frac{2}{21}$

04. **DEC 2020**

$$\sqrt{9^{-5}} \times \sqrt{3^{-7}} = \sqrt{3^{-a}}$$

a. 13    b. 11    c. 15     d. 17

05. **DEC 2021**

if  $\left(\frac{3a}{2b}\right)^{2x-4} = \left(\frac{2a}{3b}\right)^{2x-4}$  for some a&b ,

Find x

a. 8    b. 6    c. 4     d. 2

06. **JUNE 2023 , JUNE 2015**

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

then abc = ?

a. 1    b. 2    c. 3    d. 4

07. **NOV 2018**

$$\frac{2^{m+1} \times 3^{2m-n+3} \times 5^{n+m+4} \times 6^{2n+m}}{6^{2m+n} \times 10^{n+1} \times 15^{m+3}}$$

a.  $3^{2m-2n}$     b.  $3^{2n-2m}$      c. 1    d. none

**Q2**

01. **JUNE 2012**

$$\frac{3^{n+1} + 3^n}{3^{n+3} - 3^{n+1}} = ?$$

a.  $\frac{1}{5}$     b.  $\frac{1}{6}$     c.  $\frac{1}{4}$     d.  $\frac{1}{9}$

02. **DEC 2009**

$$\frac{2^n + 2^{n-1}}{2^{n+1} - 2^n} = ?$$

a.  $\frac{1}{2}$      b.  $\frac{3}{2}$     c.  $\frac{2}{3}$     d.  $\frac{1}{3}$

03. **DEC 2021**

$$\frac{6^{n+4} + 3^{n+3} \times 2^{n+3}}{5 \times 6^n + 6^n} = ?$$

a. 232    b. 242     c. 252    d. 262

04. **NOV 2019**

$$\left( \frac{9^{\frac{n+1}{4}} \sqrt{3 \cdot 3^n}}{3 \sqrt{3^{-n}}} \right)^{\frac{1}{n}}$$

a. 1    b. 3    c. 9     d. 27

**Q3**  $(a-b)(a^2 + ab + b^2) = a^3 - b^3$

$(a+b)(a^2 - ab + b^2) = a^3 + b^3$

01. **JUNE 2014**

$$\left(\frac{y^a}{y^b}\right)^{a^2+ab+b^2} \left(\frac{y^b}{y^c}\right)^{b^2+bc+c^2} \left(\frac{y^c}{y^a}\right)^{c^2+ca+a^2}$$

= ?

a. y    b. -1     c. 1    d. none of these

02.

$$\left(\frac{x^a}{x^{-b}}\right) a^2 - ab + b^2 \left(\frac{x^b}{x^{-c}}\right) b^2 - bc + c^2 \left(\frac{x^c}{x^a}\right) c^2 - ca + a^2$$

ans  $x^2(a^3 + b^3 + c^3)$

**Q4**  $a^{1/n} = b \Rightarrow a = b^n$   
 $a^n = b \Rightarrow a = b^{1/n}$

01. **JUNE 2016**

$$\frac{x}{3} = \frac{y}{5} = \frac{z}{75}, \text{ then}$$

a  $\frac{1}{x} + \frac{2}{y} = \frac{1}{z}$

b.  $\frac{2}{x} + \frac{1}{y} = \frac{1}{z}$

c.  $\frac{1}{x} + \frac{1}{y} = \frac{1}{z}$       d. none

02. **JUNE 2019**

$$2x^2 = 3y^2 = 12z^2, \text{ then}$$

a.  $\frac{1}{x^2} + \frac{1}{y^2} = \frac{1}{z^2}$

b.  $\frac{1}{x^2} + \frac{2}{y^2} = \frac{1}{z^2}$

c.  $\frac{2}{x^2} + \frac{1}{y^2} = \frac{1}{z^2}$       d. none

03. **DEC 2017**

if  $u^{5x} = v^{5y} = w^{5z}$  and  $u^2 = vw$  then

$xy + zx - 2yz =$

a. 0      b. 1      c. 2      d. none

**Q5**

$$(a+b)^3 = a^3 + b^3 + 3ab(a+b)$$

$$(a-b)^3 = a^3 - b^3 - 3ab(a-b)$$

If  $a+b+c = 0$  then

$$a^3 + b^3 + c^3 = 3abc$$

01. **JUNE 2009**

$$x = 3^{1/3} + 3^{-1/3}, \quad 3x^3 - 9x = ?$$

a. 3      b. 9      c. 12       d. 10

02. **JUNE 2023**

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

then  $\left(\frac{a+b+c}{3}\right)^3 = ?$

a) abc      b) 9abc      c) abc/2      d) abc/9

**Q6 SURDS**

01. **DEC 2023**

$$x = \frac{\sqrt{5+\sqrt{3}}}{\sqrt{5-\sqrt{3}}}, \quad y = \frac{\sqrt{5-\sqrt{3}}}{\sqrt{5+\sqrt{3}}}$$

Find the value of  $\frac{1}{x^2} + \frac{1}{y^2}$

a. 63      b. 61       c. 62      d. 60

02. **DEC 2021**

$$a = \frac{\sqrt{5+\sqrt{3}}}{\sqrt{5-\sqrt{3}}}, \quad b = \frac{\sqrt{5-\sqrt{3}}}{\sqrt{5+\sqrt{3}}}$$

Find the value of  $a^2 + b^2$

a. 64       b. 62      c. 60      d. 254

03. **JUNE 2017**

$$a = \frac{\sqrt{6+\sqrt{5}}}{\sqrt{6-\sqrt{5}}}, \quad b = \frac{\sqrt{6-\sqrt{5}}}{\sqrt{6+\sqrt{5}}}$$

Find the value of  $\frac{1}{a^2} + \frac{1}{b^2}$

a) 486      b) 484       c) 482      d) 500

04. **NOV 2019**

Find the value of  $x^2 - 10x + 1$  if

$$x = \frac{1}{5-2\sqrt{6}}$$

a. 25      b. 1       c. 0      d. 49

LOGARITHMS

**Q1**  $\log(ab) = \log a + \log b$   
 $\log(a/b) = \log a - \log b$   
 $\log_a a = 1$

01. JUNE 2023

$\log_{10} x = m+n-1$ ,  $\log_{10} y = m-n$  then  
 express  $\log_{10}(100x/y)$

- a.  $1-m+3n$    b.  $m-1+3n$    c.  $m+3n+1$   
 d.  $m^2-n^2$

02. DEC 2021

$\log_{10} 3 = x$ ,  $\log_{10} 4 = y$ , then  $\log_{10} 120 =$

- a.  $x-y+1$    b.  $x+y+1$    c.  $x+y-1$    d.  $2x+y-1$

03. DEC 2022

$\log_{10} 2 = y$ ,  $\log_{10} 3 = x$ , then  $\log_{10} 15 =$

- a.  $x-y+1$    b.  $x+y+1$    c.  $x-y-1$    d.  $y-x+1$

**Q2**  $\log a^n = n \cdot \log a$   
 $\log_a a = 1$

01. JUNE 2023

$[\log_{10}[5\log_{10} 100]]^2 =$

- a. 1   b. 2   c. 10   d. 25

02. NOV2018

$\log_2 \log_2 \log_2 16$

- a. 0   b. 3   c. 1   d. 2

03. SEPT 2024

$\log_2 \log_2 \log_4 256 + 2\log_{\sqrt{2}} 2$

- a. 2   b. 3   c. 5   d. 7

04. DEC 2021

Find  $\log(x^6)$

if  $\log x + 2\log(x^2) + 3\log(x^3) = 14$

- a. 3   b. 4   c. 5   d. 6

05. JUNE 2019

$\log_{2\sqrt{2}} 512 : \log_{3\sqrt{2}} 324$

- a. 128 : 61   b. 2 : 3   c. 3 : 2  
 d. none

**Q3**  $\log a + \log b = \log(ab)$   
 $\log a - \log b = \log(a/b)$   
 $\log a^n = n \cdot \log a$   
 $\log_a a = 1$   
 $\log 1 = 0$

01. JUNE 2022

Find the value of

$\log \frac{p^2}{qr} + \log \frac{q^2}{pr} + \log \frac{r^2}{pq}$

- a. 0   b. 1   c.  $\log pqr$    d.  $pqr$

02. JULY 2019

$\log_5 \left( \frac{1+1}{5} \right) + \log_5 \left( \frac{1+1}{6} \right) + \dots + \log_5 \left( \frac{1+1}{624} \right)$

- a. 2   b. 3   c. 5   d. 0

**Q4**

01.  $\log xy^2 - \log y = \log(x+y)$  then  $y =$

- a.  $\frac{1}{x}$    b.  $\frac{x}{x+1}$    c.  $\frac{x}{x-1}$    d. none

NOV 2019

02.  $\log \left( \frac{x-y}{2} \right) = \frac{1}{2} [\log x + \log y]$ , then  $x^2 + y^2 =$

- a.  $6xy$    b.  $2xy$    c.  $3x^2y^2$    d.  $4x^2y^2$

DEC 2017

03. if  $x^2 + y^2 = 7xy$ , then  $\log \left( \frac{x+y}{3} \right) =$

a.  $\log x + \log y$        b.  $\frac{1}{2} (\log x + \log y)$

c.  $\frac{1}{3} (\log x + \log y)$       d.  $\frac{1}{3} (\log x + \log y)$

JUNE 2014

**Q5**  $\log_b a = \frac{\log a}{\log b}$ ,  $\frac{1}{\log_b a} = \log_b a$

$\log_a x$   
a = x

02. JUNE 2018

$\log_x \sqrt[3]{2} = \frac{1}{15}$ ,  $x = ?$

a. 2      b. 8      c. 16       d. 32

03. JULY 2021

$\log_4 x + \log_{16} x + \log_{64} x + \log_{256} x = \frac{25}{6}$

Find x, a. 64      b. 4       c. 16      d. 2

01. DEC 2022

$\log_3 4 \cdot \log_4 5 \cdot \log_5 6 \cdot \log_6 7 \cdot \log_7 8 \cdot \log_8 9 =$

a. 3       b. 2      c. 1      d. 0

02. NOV 2019

$\log_{0.01} 10000 = ?$

a. 2       b. -2      c. 4      d. -4

03. MAY 2018

$\log_a b \cdot \log_b c \cdot \log_c d \cdot \log_d t$

a. t      b. abc dt      c. a+b+c+d+t

d. none

04. JAN 2021

$\log_a (ab) = x$ , then  $\log_b (ab) =$

a.  $\frac{1}{x}$       b.  $\frac{x}{x+1}$        c.  $\frac{x}{x-1}$       d. none

**Q6**  $\log_b a = n \Rightarrow a = b^n$ ,

01. JUNE 2022

$\log_a \sqrt[3]{3} = \frac{1}{6}$ , then find the value of a

a. 3      b. 9       c. 27      d. 81

**RATIO PROPORTION****01. DEC 2022**

Four persons A , B , C , D wish to share a sum in the ratio of 5 : 2 : 4 : 3 . IF C gets ₹ 1000 more than D , then share of B

- a ₹ 2000    b ₹ 1500    c ₹ 2500    d ₹ 1000

**02. JUNE 2019**

If ratio of two numbers is 7 : 11 and 7 is added to each number then the new ratio will be 2 : 3 . The numbers are

- a. 49, 77    b. 42, 45    c. 43, 42    d. 39, 40

**03. DEC 2020**

The ratio of no. of boys and the no. 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 2/3

- a. 20    b. 19    c. 23    d. 27

**04. DEC 2021**

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

- a. 9    b. 6    c. 3    d. 8

**05. JAN 2021   JULY 2021**

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

- a. 3 : 3 : 10    b. 10 : 11 : 20    c. 23 : 33 : 60  
d. can't be determined

**06. SEPT 2024**

The ratio of incomes of A and B is 5 : 4 and their expenditure is 3 : 2 . If at the end of the year each saves 1600 , then the income of A

- a ₹ 3400    b ₹ 3600    c ₹ 4000    d ₹ 4400

**07. DEC 2021**

a bag has 105 coins containing some 50 paise and 25 paise coins . The ratio of number of coins is 4 : 3 . The total value (in ₹) in the bag is

- a. ₹ 43.25    b ₹ 41.25    c. ₹ 39.25

**08. JUNE 2022**

a bag contains 25 paise , 10 paise and 5 paise coins in the ratio 3 : 2 : 1 . The total value of the bag is ₹ 40 . Find the number of 5 paise coins

- a. 45    b. 48    c. 40    d. 20

**09. DEC 2017**

The ratio of number of 5 rupee coins to number of 10 rupee coins is 8 : 15 . If the total value of 5 rupee coins is 360 , then the number of ten rupee coins is

- a. 72    b. 60    c. 150    d. 135

**10. DEC 2016**

a bag contains 23 number of coins in the form of 1 rupee , 2 rupee and 5 rupee coins . The total sum of coins is ₹ 43 . The ratio between 1 rupee and 2 rupee coins is 3 : 2 . The number of 1 rupee coins is

- a. 12    b. 8    c. 10    d. 16

**11. JULY 2021**

A : B = 5 : 3 , B : C = 6 : 7 , C : D = 14 : 9  
then A : B : C : D

- a. 20 : 14 : 12 : 9  
b. 20 : 9 : 12 : 14  
c. 20 : 9 : 14 : 12

- d. 20 : 12 : 14 : 9

option d

**12. JULY 2017**

if a : b = 2 : 3 , b : c = 4 : 5 , c : d = 6 : 7 , then a : d is

- a. 24 : 35    b. 8 : 15    c. 16 : 35    d. 7 : 15

$a, b, c$  are in proportion, then

$$\frac{a}{b} = \frac{b}{c},$$

$$b^2 = ac, \quad b = \text{mean proportion}$$

$a, b, c, d$  are in proportion then

$$\frac{a}{b} = \frac{c}{d}, \quad d = \text{fourth proportion}$$

13. **SEPT 2024**

The mean proportional between  $12x^2$  &  $27y^2$  is

- a.  $18xy$      b.  $81xy$      c.  $8xy$      d.  $19.5xy$

14. **DEC 2015**

Find the ratio of third proportional of 12, 30 and mean proportional of 9, 25

- a. 7 : 2     b. 5 : 1    c. 9 : 4    d. none

15. **JUNE 2024**

if the 4 nos.  $\frac{1}{4}, \frac{1}{6}, \frac{1}{10}$  and  $\frac{1}{x}$  are proportional, then what is the value of  $x$

- a. 14     b. 15    c. 10    d.  $\frac{1}{12}$

16. **DEC 2015**

What must be added to each of the numbers 10, 18, 22, 38 to make them proportional

- a. 5    b. 2    c. 3    d. 9

FOR  $x : y$

DUPLICATE RATIO =  $x^2 : y^2$

TRIPLICATE RATIO =  $x^3 : y^3$

SUB DUPLICATE RATIO =  $\sqrt{x} : \sqrt{y}$

SUB TRIPLICATE RATIO =  $\sqrt[3]{x} : \sqrt[3]{y}$

17. **MAY 2018**

if  $p : q$  is the sub duplicate ratio of  $p-x^2 : q-x^2$ , then  $x^2$  is

- a.  $\frac{p}{p+q}$     b.  $\frac{q}{p+q}$      c.  $\frac{pq}{p+q}$     d. none

18. **NOV 2018**

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

Find  $x$

- a. 6    b. 2    c. 5    d. 9

19. **DEC 2022**

a group of 400 soldiers [posted at the border area had provisions for 31 days. After 28 days, 280 soldiers were called back from the border. Find the number of days for which remaining ration will be sufficient?

- a. 3     b. 6    c. 8    d. 10

20. **JUNE 2015**

If one type of rice of cost ₹ 13.84 is mixed with another type of rice of cost ₹ 15.54, the mixture is sold at ₹ 17.60 with a profit of 14.6% on selling price, then in which proportion the two types of rice is mixed

- a. 3:7    b. 5:7    c. 7:9    d. 9:1

21. **JUNE 2023**

Mr Ram invested a total amount of 1,00,000 in two different banks for a fixed period. The first bank yields an interest of 9% per annum and second 11% per annum. If the total interest at the end of one year is 9.75% per annum, then the total amount invested in these banks are respectively

- a. ₹ 52500, ₹ 47,500  
 b. ₹ 62,500, ₹ 37,500  
 c. ₹ 57500, ₹ 42,500  
 d. ₹ 67500, ₹ 32500



LINEAR INEQUALITIES

01. **DEC 2023**

solution of the inequality

$$\frac{5-2x}{3} \leq \frac{x-5}{6}$$

- a)  $x \geq 8$       b)  $x \geq 7$       c)  $x \leq 80/3$       d)  $x \geq 40/3$

02. **DEC 2022**

$$2x+5 > 3x+2 \text{ and } 2x-3 \leq 4x-5$$

then x can take from the following values    a. 3      b. -1      c. 2      d. -3

03. **DEC 2023 MTP II**

$$2 \leq \frac{3x-2}{5} \leq 4, \quad x \in \mathbb{N}, \text{ Solve for } x$$

- a. {5,6,7}      b. {3,4,5,6}      c. {4,5,6}      d. {4,5,6,7}

04. **NOV 2019**

Solution set of the inequation  $x+2>0$  and  $2x-6 > 0$  is

- a.  $(-2, \infty)$       b.  $(3, \infty)$       c.  $(-\infty, -2)$       d.  $(-\infty, -3)$

05. **JUNE 2022**

a labour can be paid under two methods given below

1. ₹ 600 fixed and ₹ 50 per hour
2. ₹ 170 per hour .

If a labour job work takes 'x' hours to complete , find out the value of x for which the method (ii) gives the labour better wages

- a. 6      b. 4      c. 3      d. 2

06. **JUNE 2023**

the largest side of a triangle is 3 times the shortest side and the third side is 4 cm shorter than the largest side . If the perimeter of the traingle is at least 59 cm , what is the length of the shortest side

- a)  $< 7$  cm      b)  $\geq 7$  cm      c.  $< 9$  cm      d.  $\geq 9$  cm

07. **JUNE 2019**

employer recruits experienced (x) and fresh workmen(y) for his under the condition that he cannot employ more than 11 people. x and y can be related by the inequality

- a.  $x+y \neq 11$       b.  $x+y \leq 11, x \geq 0, y \geq 0$       c.  $x+y \geq 11, x \geq 0, y \geq 0$       d. none of these

08. **JUNE 2023 JUNE 2024**

in a garment factory , an average experienced tailor can stitch 5 shirts while a fresh tailor can stitch 3 shirts daily , but the employer has to maintain an output of at least 30 shirts stitched per day . This can be formulated as

- a.  $5x+3y \leq 30$    b.  $5x+3y > 30$    c.  $5x+3y \geq 30, x \geq 0, y \geq 0$    d.  $5x+3y \leq 30, x \geq 0, y \geq 0$

09. **JUNE 2023**

A fertilizer company produces two types of fertilizers called grade I and grade II . Each of these types is processed through a critical chemical plant unit . The plant has maximum of 180 hours available in a week . Manufacturing one bag of grade I fertilizer requires 4 hours in the plant . Manufacturing one bag of grade II fertilizer requires 10 hours in the plant . express this using linear inequalities

- a.  $2x_1+5x_2 \leq 180$    b.  $4x_1+10x_2 > 180$    c.  $2x_1+5x_2 > 180$    d.  $4x_1+10x_2 \leq 180$

10. **SEPT 2024**

a dietician wishes to mix two kinds of food so that vitamin contents of the mixture is at least 45 units of carb , 25 units of protien ,15 units of fat and 15 units of fibre . content of each food is shown below

|         | Carb | Protien | Fat | Fibre |
|---------|------|---------|-----|-------|
| Food I  | 20   | 5       | 3   | 2     |
| Food II | 10   | 2       | 4   | 5     |

Assuming x units of food I is mixed with y units of food II , the situation can be expressed as

- a.  $20x + 10y \leq 45, 5x + 2y \geq 25, 3x + 4y \leq 15, 2x + 5y \geq 15, x \geq 0, y \geq 0$   
 b.  $20x + 10y \leq 45, 5x + 2y \geq 25, 3x + 4y \leq 15, 2x + 5y \geq 15, x \geq 0, y \geq 0$   
 c.  $20x + 10y \geq 45, 5x + 2y \geq 25, 3x + 4y \geq 15, 2x + 5y \geq 15, x \geq 0, y \geq 0$   
 d.  $20x + 10y \leq 45, 5x + 2y \leq 25, 3x + 4y \leq 15, 2x + 5y \leq 15, x \geq 0, y \geq 0$

11. **JUNE 2022 MTP II**

the rules and regulations demand that the employer should employ not more than 5 experienced hands (x) to 1 fresh one (y) . This is represented by

- a.  $y \geq x/5$    b.  $5y \leq x$    c.  $y \geq 5x$    d. none

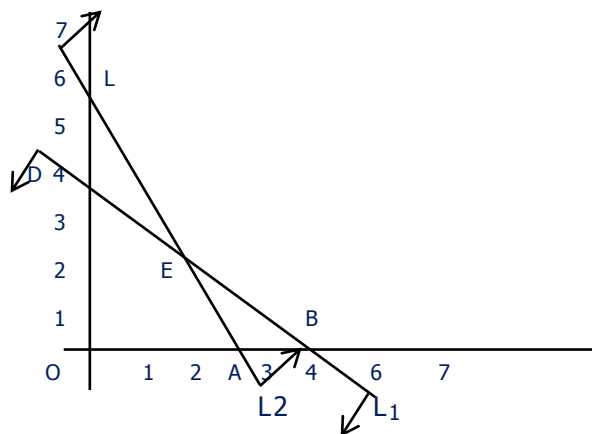
12. **DEC 2021**

XYZ company has a policy for recruitment as it should not recruit more than 8 men (x) to 3 women (y). Express this as an inequality

- a.  $3y \geq 8x$    b.  $3y \leq x/8$    c.  $8y \geq 3x$    d.  $8y \leq 3x$

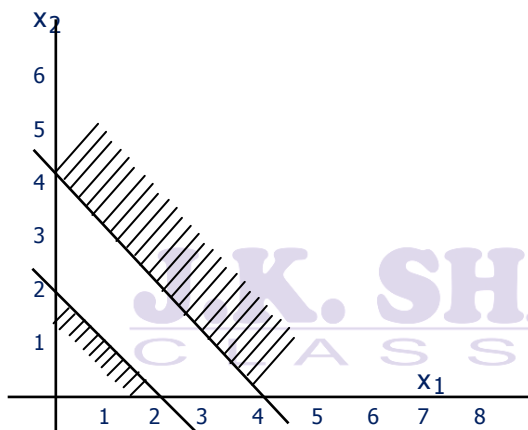
13. **JUNE 2019**

common region represented by the following inequalities  $L_1 : x_1+x_2 < 4$  ,  $L_2 : 2x_1+x_2 > 6$   
 a.  $\triangle OAC$       b. Outside of  $\triangle OAB$       c.  $\triangle BCE$       d.  $\triangle ABE$



14. **DEC 2021**

The region indicated by the shaded portion in the graph is expressed by the inequalities



- a.  $x_1+x_2 \leq 2$  ,  $x_1+x_2 \geq 4$  ,  $x_1, x_2 \geq 0$
- b.  $x_1+x_2 \leq 2$  ,  $x_1+x_2 \leq 4$  ,  $x_1, x_2 \geq 0$
- c.  $x_1+x_2 \geq 2$  ,  $x_1+x_2 \geq 4$  ,  $x_1, x_2 \geq 0$
- d. none of the above

15. **DEC 2018**

on solving  $5x+y \leq 100$  ,  $x+y \leq 60$  ,  $x \geq 0$  ,  $y \geq 0$  we get following situations

- a.  $(0,0), (20,0), (10,50), (0,60)$
- b.  $(0,0), (60,0), (10,50), (0,60)$
- c.  $(0,0), (20,0), (0,100), (10,50)$
- d. None of these

16. **JUNE 2023**

On solving  $6x+y \geq 18$  ,  $x+4y \geq 12$  ,  $2x+y \geq 10$  ,  $x, y > 0$  , we get following solution

- a.  $(0,18)$  ,  $(12,0)$  ,  $(4,2)$  ,  $(2,6)$
- b.  $(3,0)$  ,  $(0,3)$  ,  $(4,2)$  ,  $(2,6)$
- c.  $(5,0)$  ,  $(0,10)$  ,  $(4,2)$  ,  $(2,6)$
- d.  $(0,18), (12,0)$  ,  $(4,2)$  ,  $(0,0)$  ,  $(2,6)$

17. **NOV 2019**

The solution of  $2x+y \geq 12$  ,  $5x+8y \geq 74$  ,  $x+6y \geq 24$  ,  $x, y \geq 0$  is given by

- a (24,0) (126/11,23/11) , (2,8) , (0,12)
- b (0,24) , (2,8) , (0,12) , (126/11,23/11)
- c (8,4) , (2,8) , (0,12), (0,24)
- d (8,4) , (0,0) , (0,6) , (2,0)

**EQUATIONS**

**Q1**

01. **DEC 2022**

the solution of the following system of linear equation  $2x-5y+4=0$  &  $2x+y-8=0$  is

- a. (2,-3)   b. (1,-4)   **c.** (3,2)   d. (-2,2)

02. **DEC 2014**

$$x+5y = 33, \quad \frac{x+y}{x-y} = \frac{13}{3}$$

- a. (4,8)   **b.** (8,5)   c. (4,16)   d. (16,4)

03. **JUNE 2017, MAY 2018**

$$\frac{3}{x+y} + \frac{2}{x-y} = -1, \quad \frac{1}{x+y} - \frac{1}{x-y} = \frac{4}{3}$$

- a. (2,1)   **b.** (1,2)   c. (-1,2)   d. (-2,1)

04. **JUNE 2022**

Solve for x and y

$$\left(\frac{b}{a}\right)x + \left(\frac{a}{b}\right)y = a^2 + b^2$$

&  $x + y = 2ab$

- a. (a/b, b/a)   **b.** (ab, ab)  
c. 3ab, -ab   d. -3ab, ab

05. **MAY 2018, JUNE 2016**

if  $2^{x+y} = 2^{2x-y} = \sqrt{8}$ , x, y ?

- a.** 1, 1/2   b. 1/2, 1   c. 1/2, 1/2

06. **DEC 2019**

Solve  $4^x \cdot 8^y = 128$ ,  $3^x / 27^y = 1/3$

- a.** 2, 1   b. -2, 1   c. 2, -1   d. 1, 2

07. **DEC 2020**

SOLVE  $m + \sqrt{m} = 6/25$

- a. 2/25   **b.** 1/25   c. 3/25   d. 1

08. **DEC 2023**

$$2^x = 4^y = 8^z \text{ and } \frac{1}{2x} + \frac{1}{4y} + \frac{1}{6z} = \frac{24}{7}$$

then the value of z =

- a)  $7/16$    b.  $7/32$    **c.**  $7/48$    d.  $7/64$

09. **JUNE 22 MTP I**

if  $abc = 2$ , then the value of

$$\frac{1}{1+a+2b^{-1}} + \frac{1}{1+b+c^{-1}} + \frac{1}{1+c+a^{-1}}$$

- a.** 1   b. 2   c. 3   d. 1/2

10. **JUNE 2016**

$$\frac{x^2-(y-z)^2}{(x+z)^2-y^2} + \frac{y^2-(x-z)^2}{(x+y)^2-z^2} + \frac{z^2-(x-y)^2}{(y+z)^2-x^2} = ?$$

- a. 0   **b.** 1   c. -1   d. none

11. **JULY 21**

if  $xy + yz + zx = -1$  then the value of

$$\frac{x+y}{1+xy} + \frac{z+y}{1+zy} + \frac{x+z}{1+xz} =$$

- a) xyz   b.  $\frac{-1}{yz}$    **c.**  $\frac{1}{xyz}$    d.  $\frac{1}{x+y+z}$

**Q2**

01. **DEC 2022**

a man wants to cut three lengths from a single piece of board of length 91 cm . Second length is 3 cm longer than shortest and 3rd is twice as much as shortest one . Find the length of shortest piece

- a. 15    b. 18.    c. 20     d. 22

02. **DEC 2023**

Divide 27 into 2 parts so that 5 times the first and 11 times the second together equal to 195 , then ratio of first and second part is

- a) 17 :10    b) 15 :12    c) 14 :13    d) 16 :11

03. **DEC 2022**

if the cost of 3 bags and 4 pens is 257 where as the cost of 4 bags and 3 pens is 324 , then the cost of one bag is

- a. 8    b. 24    c. 32     d. 75

04. **JULY 2021**

cost of 2 oranges and 3 apples is 28 . If the cost of an apple is doubled , then the cost of 3 oranges and 5 apples is 75 . Original cost of 7 oranges and 4 apples

- a. 59    b. 47    c. 71    d. 63

05. **SEPT 2024**

A person purchased 2 apples and 5 bananas at the cost of Rs 90 . Later he visited another shop where shopkeeper told him that if you give me Rs 50 and 1 banana , I can give you 3 apples . he agreed to the deal . What is the cost of one apple and one banana

- a.15,10    b. 10,15    c. 10,20     d. 20,10

06. **JUNE 2024**

fraction becomes 1 when 3 is added to numerator & 1 is added to denominator . But when numerator and denominator are decreased by 2 and 1 respectively it becomes  $\frac{1}{2}$  . The denominator of the fraction is

- a. 5    b. 6     c. 7    d. 8

07. **JUNE 2023**

the age of a persons is FOUR TIMES the sum of the ages of his two son's and after 10 years his age will be double the sum of their ages . Find his present age

- A. 56    B. 45     C. 60    D. 64

08. **JUNE 2015**

the age of a persons is 8 years more than thrice the sum of the ages of his two grandson's who were twins and after 8 years his age will 10 years more than twice the sum of their ages . Find his when twins were born

- A. 86     B. 73    C. 68    D. 63

09. **JUNE 2019**

A NUMBER CONSISTS OF TWO DIGITS . THE DIGIT IN THE ONE'S PLACE IS 3 TIMES THE DIGIT IN THE TEN'S PLACE . IF 36 IS ADDED , THE DIGITS GET REVERSED . THE NUMBER IS

- A. 62     B. 26    C. 39    D. NONE

10. **SEPT 2024**

A NUMBER CONSISTS OF TWO DIGITS . THE DIGIT IN THE TEN'S PLACE IS 3 TIMES THE DIGIT IN THE ONE'S PLACE . IF 54 IS SUBTRACTED , THE DIGITS GET REVERSED . THE NUMBER IS

- A. 39    B. 62    C. 93    D. 31

11. **JUNE 2017 , MAY 2018**

IF SIDES OF AN EQUILATERAL TRIANGLE ARE SHORTENED BY 3 , 4 , 5 UNITS RESPECTIVELY , A RIGHT TRIANGLE IS FORMED . THE SIDE OF EQUILATERAL TRIANGLE IS

- A. 6      B. 7       C. 8      d. 10

12. **DEC 2021**

in a MCQ type question paper of 100Q's of 1 mark each , candidate score 60% marks . Candidate attempted all Q's and there was a penalty of 0.25marks for wrong answers . The difference between the number of right answers and wrong answers will be

- a. 32       b. 36      c. 40      d. 38

13. **JUNE 2015**

NUMBER OF STUDENTS IN EACH SECTION OF A SCHOOL IS 36 . AFTER ADMITTING 12 NEW STUDENTS , FOUR NEW SECTIONS ARE STARTED . IF TOTAL STUDENTS IN EACH SECTION NOW IS 30 , THEN NUMBER OF SECTION INITIALLY WERE

- A. 6      B. 10      C. 14       D. 18

14. **JUNE 2015**

A PERSON ON A TOUR HAS RS 9600 FOR HIS EXPENSES . BUT THE TOUR GOT EXTENDED FOR ANOTHER 16 DAYS SO HE HAS TO CUT DOWN HIS DAILY EXPENSES BY RS 20 . THE ORIGINAL DURATION OF THE TOUR IS

- A. 48      B. 64       C. 80      D. 96

QUADRATIC & CUBIC EQUATION

**Q1** Q.E.:  $x^2 - Sx + P = 0$

01. **DEC 2015 , MAY 2018**

If  $\alpha$  and  $\beta$  be the roots of Q.E. such that  $\alpha + \beta = -2$  and  $\alpha\beta = -3$ . Find the Q.E.

- a.  $x^2 + 2x - 7 = 0$      b.  $x^2 + 2x - 3 = 0$   
c.  $x^2 - 2x - 3 = 0$     d.  $x^2 - 2x + 7 = 0$

02. **JUNE 2023**

if  $\alpha$  and  $\beta$  are roots of the equation  $x^2 - 2x - 3 = 0$ , then equation whose roots are  $\alpha + \beta$  and  $\alpha - \beta$  is

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

if  $\alpha = p + \sqrt{q}$ , then  $\beta = p - \sqrt{q}$

03. Find quadratic equation whose one root is  $6 + \sqrt{11}$

ans  $x^2 - 12x + 25 = 0$

04. **JUNE 2012**

If one of the roots of the equation  $x^2 + px + a = 0$  is  $\sqrt{3} + 2$ , then find the value of  $p$  and  $a$

- a.  $-4, -1$     b.  $4, -1$      c.  $-4, 1$     d.  $4, 1$

05. **DEC 2021**

When roots of quadratic equation are  $\alpha$ ,  $\frac{1}{\alpha}$ , then what will be the quadratic equation

- a.  $\alpha x^2 - (\alpha^2 + 1)x + \alpha = 0$   
b.  $\alpha x^2 - (\alpha^2 + 1)x + 1 = 0$   
c.  $\alpha x^2 - \alpha^2 x + 1 = 0$   
d. None of these

06. **JUNE 2012**

If arithmetic mean between roots of a quadratic equation is 8 and the geometric mean between them is 5, then the equation is

- a.  $x^2 - 16x - 25 = 0$   
 b.  $x^2 - 16x + 25 = 0$   
c.  $x^2 - 16x + 5 = 0$     d. none of these

07. **DEC 2018**

if one root is half of the other of quadratic equation and difference in roots is  $a$ , then quadratic equation is

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

**Q2** if  $\alpha, \beta$  are roots of the equation  $ax^2 + bx + c = 0$ ,  
 $\alpha + \beta = -\frac{b}{a}$ ,  $\alpha\beta = \frac{c}{a}$

01. **JUNE 2022**

if roots of  $5z^2 + 13z + y = 0$  are reciprocals of each other, then find the positive value of  $y$ .

- a.  $1/5$     b.  $-1/5$      c.  $5$     d.  $-5$

02. **JUNE 2010**

if roots of  $3x^2 - 14x - k = 0$  are reciprocals of each other, then find the value of  $k$ .

- a.  $-3$     b.  $0$     c.  $3$     d.  $14$



**Q3** if  $\alpha, \beta$  are roots of the equation  
 $ax^2+bx+c=0$ ,  
 $\alpha+\beta = -b/a$ ,  $\alpha\beta = c/a$   
 $\alpha^2+\beta^2 = (\alpha+\beta)^2-2\alpha\beta$

01. **DEC 2012**

If  $\alpha$  and  $\beta$  are roots of  $2x^2 + 3x + 7 = 0$ ,  
 find  $\alpha\beta^{-1} + \beta\alpha^{-1}$   
 a. 2    b.  $3/7$     c.  $7/2$     **d.**  $-19/14$

02. **JULY 2021**

if  $\alpha, \beta$  are the roots of  $2x^2+5x+k=0$  &  
 $4(\alpha^2+\beta^2+\alpha\beta) = 23$  then  
 a.  $k^2+3k-2=0$     b.  $k^2-2k+3=0$   
 c.  $k^2-2k-3=0$     **d.**  $k^2-3k+2=0$

03. **DEC 2023**

IF  $\alpha$  &  $\beta$  are roots of equation  
 $x^2 - (n^2+1)x + \frac{1}{2}(n^4+n^2+1) = 0$  then  
 $\alpha^2+\beta^2 =$   
 a.  $2n$     **b.**  $n^2$     c.  $2n^2$     d.  $n^3$

**Q4** if  $\alpha, \beta$  are roots of the equation  
 $ax^2+bx+c=0$ ,  
 $\alpha+\beta = -b/a$ ,  $\alpha\beta = c/a$   
 $\alpha^3+\beta^3 = (\alpha+\beta)^3-3\alpha\beta(\alpha+\beta)$

01. **DEC 2023**

if  $\alpha$  and  $\beta$  are roots of  $x^2-4x+1=0$ ,  
 then the value of  $\alpha^3+\beta^3$   
 a. -76    b. 76    c. -52    **d.** 52

02. **JUNE 2011**

if  $\alpha$  and  $\beta$  are roots of  $x^2+x+r=0$ , &  
 $\alpha^3+\beta^3 = -6$ . Find r  
**a.**  $-5/3$     b.  $7/3$     c.  $-4/3$     d. 1

03. **JUNE 2017, MAY 2018**

if  $\alpha$  and  $\beta$  are roots of  $x^2+x+5=0$ ,  
 then the value of  $\frac{\alpha^2+\beta^2}{\beta/\alpha}$   
 a.  $16/5$     b. 2    c. 3    **d.**  $14/5$

04. **JUNE 2015**

If  $\alpha$  and  $\beta$  are roots of  $2x^2 - 4x = 1$   
 find  $\frac{\alpha^2}{\beta} + \frac{\beta^2}{\alpha}$   
 a. -11    b. 22    **c.** -22    d. 11

05. **NOV 2018**

if  $\alpha$  and  $\beta$  are roots of  $x^2+7x+12=0$ ,  
 then the value of  $\frac{\alpha^2}{\beta} + \frac{\beta^2}{\alpha}$   
 a.  $-12/91$     b.  $-12/91$     **c.**  $-91/12$     d.  $91/12$

**Q5** if  $\alpha, \beta$  are roots of the equation  
 $ax^2+bx+c=0$ ,  
 $\alpha+\beta = -b/a$ ,  $\alpha\beta = c/a$   
 $(\alpha-\beta)^2 = (\alpha+\beta)^2 - 4\alpha\beta$

01. **DEC 2017**

the difference in roots of the equation  
 $x^2-7x-9=0$  is  
 a. 7    **b.**  $\sqrt{85}$     c. 9    d.  $2\sqrt{85}$

02. **JAN 2021**

The value of p for which the difference  
 between the roots of equation  
 $x^2+px+8=0$  is 2  
 a.  $\pm 2$     b.  $\pm 4$     **c.**  $\pm 6$     d.  $\pm 8$

03. **JUNE 2016**

if the difference between the roots of  
 the equation  $x^2-kx+8=0$  is 4 then the  
 value of k is  
 a. 0    b.  $\pm 4$     c.  $\pm 8\sqrt{3}$     **d.**  $\pm 4\sqrt{3}$

04. **JUNE 2013**

If  $\alpha, \beta$  are roots of  $x^2+7x+11=0$  then  
 the equation whose roots are  
 $(\alpha+\beta)^2, (\alpha-\beta)^2$   
**a.**  $x^2-54x+245=0$     b.  $x^2-14x+49=0$   
 c.  $x^2-24x+144=0$     d.  $x^2-50x+49=0$

**Q6** if  $\alpha, \beta$  are roots of the equation  $ax^2+bx+c=0$ ,  
 $\alpha+\beta = -b/a$ ,  $\alpha\beta = c/a$

01. **JUNE 2019**

If one root of  $ax^2+bx+c=0$  is twice the other then

- a.  $2b^2=3ac$     b.  $b^2=3ac$     **c.**  $2b^2=9ac$   
 d. none of these

02. **DEC 2011**

If roots of  $4x^2-6x+p=0$  are in ratio 1:2, then find the value of p

- a. 1    **b.** 2    c. -2    d. -1

03. **DEC 2010**

If roots of  $12x^2+kx+5=0$  are in ratio 3:2, then find the value of k

- a.  $5/12$     **b.**  $12/5$     c.  $5\sqrt{10}/2$     d.  $5\sqrt{10}$

04. **DEC 2022**

if the roots of the equation  $x^2-px+q=0$  are in ratio 2:3 then

- a.  $p^2=25q$     b.  $p^2=6q$     c.  $6p^3=5q$   
**d.**  $6p^2=25q$

**Q7** For equal roots,  
 $b^2-4ac=0$

01. **DEC 2012**

Find k for which roots of the equation  $x^2-2kx+16=0$  are equal

- a.  $\pm 1$     b.  $\pm 2$     c.  $\pm 3$     **d.**  $\pm 4$

02. **DEC 2015**

Find k for which roots of the equation  $4x^2-12x+k=0$  are equal

- a. 144    **b.** 9    c. 5    d. none

03. **DEC 2022**

What will be the value of k, if the roots of the equation

$(k-4)x^2-2kx+(k+5)=0$  are equal

- a. 18    **b.** 20    c. 19    d. 21

**Q8**

$$HM(a,b) = \frac{2ab}{a+b}$$

01. **JAN 2021**

The harmonic mean of the roots of  $(5+\sqrt{2})x^2-(4+\sqrt{5})x+8+2\sqrt{5}=0$  is

- a. 2    **b.** 4    c. 6    d. 8

QE: [ 2,3]

S = 5, P = 6

$x^2 - Sx + P = 0$

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

QE: [ $1/2, 1/3$ ]

S =  $5/6$ , P =  $1/6$

$x^2 - Sx + P = 0$

$x^2 - 5/6x + 1/6 = 0$

$6x^2 - 5x + 1 = 0$

a & c have exchanged places

Conclusion :

Q.E. [ $\alpha, \beta$ ]

$ax^2+bx+c=0$

Q.E. [ $1/\alpha, 1/\beta$ ]

$cx^2+bx+a=0$

02. **JUNE 2024**

if  $\alpha$  and  $\beta$  are the roots of the equation  $ax^2+bx+c=0$ , then the equation whose roots are  $1/\alpha$  and  $1/\beta$  is

a.  $cx^2-bx+a=0$

**b.**  $cx^2+bx+a=0$

c.  $x^2+bx+a=0$

d.  $x^2+bx-a=0$

03. **JUNE 2018**

If the roots of  $kx^2-3x-1=0$  are the reciprocal of the roots of  $x^2+3x-4=0$  then k = ?

- a.** 4    b. -4    c. 3    d. -3

**Q9 CUBIC EQUATION**

$$ax^3 + bx^2 + cx + d = 0$$

$$\alpha + \beta + \gamma = S = -b/a, \alpha\beta\gamma = P = -d/a$$

01. **DEC 2023 , JUNE 2014**

roots of the equation

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

- a. 1,-1,-1   b. 1,1,-1   c. -1,-1,-1   d. 1,1,1

02. **DEC 2019**

THE ROOTS OF THE EQUATION

$$x^3 + 9x^2 - x - 9 = 0$$

03. **DEC 2020**

RATIONAL ROOTS OF THE EQUATION

$$2x^3 - x^2 - 4x + 2 = 0$$

- a. -2   b. 2   c.  $\frac{1}{2}$    d.  $-\frac{1}{2}$

04. **DEC 2017**

THE ROOTS OF THE EQUATION

$$x^3 + 7x^2 - 21x - 27 = 0$$

- a. -3,-9,-1   b. 3,-9,-1   c. 3,9,1   d. -3,9,1

05. **DEC 2023**

the solution of cubic equation

$$x^3 - 23x^2 + 142x - 120 = 0$$
 is given by

- a. 1,10,12  
b. 1,-10,12  
c. -1,-10,-12  
d. 1,10,-12<sup>i</sup>

06. **SEPT 2024**

If one root of the cubic equation

$$3x^3 - 5x^2 - 11x - 3 = 0$$
 is  $-\frac{1}{3}$  then the

other roots are

- a. 1,3   b. -1,3   c. 1,-3   d. -1,-3

07. Find value of k if 2 is a root of the equation  $3x^2 - 2kx + 5 = 0$

- a.  $\frac{17}{4}$    b.  $\frac{4}{17}$    c.  $-\frac{17}{4}$    d.  $-\frac{4}{17}$

08. **JULY 2021**

Find value of k if 2 is a root of the following cubic equation

$$x^3 - (k+1)x + k = 0$$

- a. 2   b. 6   c. 1   d. 4

09. **JULY 2018**

If roots of  $x^3 - 15x^2 + kx - 45 = 0$  are in A.P. , find the value of k

- a. 56   b. 59   c. -56   d. -59

TIME VALUE OF MONEY

**SIMPLE INTEREST**

$$SI = \frac{Pnr}{100}, A = P + SI = P + \frac{Pnr}{100} \Rightarrow A = P \left(1 + \frac{nr}{100}\right)$$

**Q1**  $A = P + \frac{Pnr}{100}$

01. 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  
 a. 3 years     b. 4 years    c. 2 years    d. 5 years    [DEC 2023]
02. an investor is saving to pay off an obligation of ₹ 15,250 which will be due in 7 years . If the investor is earning 7.5% S.I. rate per annum , he must deposit ₹ \_\_\_\_ to meet the obligation  
 a. ₹ 8000    b. ₹ 9000     c. ₹ 10000    d. ₹ 11000    [DEC 2022]
03. in SI , a certain sum of money amounts to ₹ 59000 in 3 years and ₹ 62000 in 4 years . Find principal amount and rate of interest  
 a. ₹ 50000,6%    b. ₹ 45000,4.5%    c. ₹ 55000,5%    d. ₹ 52000,7%    [DEC 2021]

**Q2 DIFFERENCE IN S.I.**

01. Two equal sum was lent at simple interest at 15% p.a. for 3 ½ yrs and 5 yrs respectively . If the difference in interest for two periods was ₹ 144 , Find the sum  
 a. ₹ 620     b. ₹ 640    c. ₹ 820    d. ₹ 840    [JAN 2021]
- 02 Mr X invest 90,500 in post office at 7.5% p.a. SI . While calculating the rate was wrongly taken as 5.7% p.a. . The difference in amounts of maturity is 9774 . Find the period for which the sum was invested .  
 a. 7 years    b. 5.8 years     c. 6 years    d. 8 years    [DEC 2012]

**COMPOUND INTEREST**

$$A = P(1+i)^n, A = \text{Future val.}, P = \text{Present value}$$

i = rate per compounding period ,

n = no. of times the money is compounded

**Q1 FIND AMOUNT/ F.V.**

01. Mr X makes a deposit of ₹ 50,000 in a bank for 2 ½ years . If the rate of interest is 12% p.a. compounded HALF YEARLY , then maturity value is , Given  $(1.06)^5 = 1.3382$

- [a] ₹ 66,910      b ₹ 66,123      c ₹ 67,925      d ₹ 65,550      [DEC 2023]
02. if ₹ 10,000 is invested at 8% per year COMPOUNDED QUARTERLY , then the value of investment after 2 years is
- a. ₹ 10,716.59      [b.] ₹ 11,716.59      c. ₹ 117.1659      d. none      [NOV 2018]
03. the present population of a town is 25000 . If it grows at the rate of 4% , 5% , 8% during 1<sup>st</sup> , 2<sup>nd</sup> & 3<sup>rd</sup> year respectively , then find the population after 3 years
- [a.] 29484      b. 29844      c. 29448      d. 28994      [DEC 2019]

## Q2 FIND PRESENT VALUE

01. Jonny wants to have 2,00,000 in his saving account after three years . The rate of interest offered by bank is 8% p.a. 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
02. It needs to pay ₹ 5,00,000 after 10 years . He invested a sum in a scheme at 9 % rate of interest COMPOUNDED HALF YEARLY. How much amount be invested ( $1.045^{20} = 2.41171$ )
- a. ₹ 397321      [b.] ₹ 207321      c. ₹ 297321      d. ₹ 340321      [DEC 2021]

## Q3 FIND COMPOUND INTEREST      C.I. = $P[(1+i)^n - 1]$

01. Ram borrowed ₹ 5000 @ 12.5% p.a compound interest . The money was repaid after 3 years .The total interest paid by him approximately is  $(1+0.125)^3 = 1.4238$
- [a] ₹ 2119      b. ₹ 2200      c. ₹ 2000      d. ₹ 2500      [JUNE 2024]
02. Compute the compound interest on 6,000 for 1  $\frac{1}{4}$  years at 8% p.a. Interest will be COMPOUNDED QUARTERLY
- a ₹ 642      b ₹ 630.78      c ₹ 634.68      [d] ₹ 624.48      [DEC 2023]
03. what is the CI on sum of ₹ 12600 for 1  $\frac{1}{2}$  year at 20% p.a. if the interest is COMPOUNDED HALF YEARLY
- a. ₹ 4271      [b.] ₹ 4171      c. ₹ 4711      d. ₹ 4117      [JULY 2021]
04. Mr Prakash invested money in two schemes A and B offering compound interest at the rate of 8% and 9% p.a respectively . If the total amount of interest accrued through two schemes

together in two years was ₹ 4818.30 and total amount invested was ₹ 27000 . What was the amount invested in scheme A

- a. ₹ 12000    b. ₹ 12500    c. ₹ 13000    d. ₹ 13500

[DEC 2022]

#### Q4 $CI - SI = P[(1+i)^n - 1 - ni]$

01. the difference between the compound interest amount and the simple interest amount for a period of 2 years at a simple interest of r is

- a.  $P \times r^2$     b.  $P \times r/2$     c.  $P \times 2 \times r$     d.  $P^2 \times r$

[JUNE 2024]

02. the difference between SI and CI on a certain sum invested for 2 years at 5% p.a. is ₹ 30 Find principal amount is

- a. ₹ 10,000    b. ₹ 12,000    c. ₹ 13,000    d. none

[DEC 2016]

03. Difference between CI and SI on an amount of ₹ 15000 for 2 years is ₹ 96 . What is rate of interest per annum a. 9%    b. 8%    c. 11%    d. 10%

[DEC 2022]

04. the difference between SI and CI on a certain sum invested for 3 years at 6% p.a. is ₹ 110.16 Find principal amount is

- a. ₹ 3,000    b. ₹ 3,700    c. ₹ 12,000    d. ₹ 10,000

[JUNE 2023]

#### Q5 DEPRECIATION

$$V = P(1-i)^n, \quad P = \text{initial price/cost of M/c}$$

$$V = \text{value of M/c after n years / Scrap Value}$$

$$i = \text{rate of depreciation}$$

01. a machine costing ₹ 1,00,000 has useful life of 10 years . If the rate of depreciation is 12% , what is the scrap value of the machine at the end of life  $(0.88)^{10} = 0.27850$

- a. ₹ 25,850    b. ₹ 26,850    c. ₹ 27,850    d. ₹ 28,850

[DEC 2023]

02. The value of furniture depreciates by 10% a year . If the present value of the furniture is ₹ 21870 , calculate the value of furniture 3 years ago

- a. ₹ 30,000    b. ₹ 35,000    c. ₹ 40,000    d. ₹ 50000

[NOV 2018]

#### Q6 FIND PERIOD

01. at 8% compounded annually , how long will it take ₹ 750 to double

- a. 6.5 years    b. 48 months    c. 9 years    d. 12 years

[JUNE 2024]

02. the population of a town increases every year by 2% of the population at the beginning of that year. The number of years by which the total increase of population be 40% is

- a. 15    b. 17    c. 19    d. 20

[JUNE 2023]

03. 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  
 a. 7      b. 8       c. 9      d. 10

[JUNE 2023]

**Q7 FIND INTEREST RATE**

01. if the initial investment of ₹ 4,00,000 becomes ₹ 6,00,000 in 24 months , then the compound annual growth rate (CAGR) is      a. 30.33%       b. 22.4%      c. 19.46%      d. 14.47%
02. You bought a painting 10 years ago as an investment . You originally paid ₹ 85000 for it . If you sold it for ₹ 4,84,050, what was your annual return on investment  
 a. 47%      b. 4.7%       c. 19%      d. 12.8%
03. 10 years ago the earnings per share (EPS) of ABC ltd was ₹ 5 per share . If EPS for this year is ₹ 22 . Compute at what rate , EPS of the company grow annually .  
 a. 15.97%      b. 16.77%      c. 18.64%      d. 14.79%
04. Mr. Paul invested ₹ 1,00,000 in a mutual fund scheme in January 2018 . After one year in January 2019 , she got a dividend amounting to ₹ 10,000 for first year , ₹ 12000 for second year , ₹ 16000 for third year , ₹ 18000 for fourth year and ₹ 21000 for the fifth year in January 2023 . What is CAGR of dividend return ?  
 a. 20.38%      b. 18.59%      c. 16.36%      d. 15.89%

[DEC 2023]

[JUNE 2024]

[DEC 2022]

[JUNE 2023]

**Q8 KUCH KATKE**

01. if ₹ 64 amounts to ₹ 83.20 in 2 years , what will ₹ 86 amount to in 4 years at the same rate prevent per annum  
 a. ₹ 127.60      b. ₹ 147.60       c. ₹ 145.34      d. ₹ 117.60
02. What is the present value of an investment that pays ₹ 400 at the end of 3 years and ₹ 500 at the end of 6 years  
 a. ₹ 320      b. ₹ 335      c. ₹ 340      d. ₹ 280

[DEC 2022]

[JUNE 2024]

**Q9 EFFECTIVE RATE**       $E = [(1+i)^n - 1] \times 100$

01. Find the effective rate of interest if an amount of ₹ 40,000 is deposited in a bank for 1 year at the rate of 10% COMPOUNDED SEMI – ANNUALLY

- a. 10.20%    b. 10.05%    **c.** 10.25%    d. 10.10%

[JUNE 2024]

02. the nominal rate of interest is 10% per annum . The interest is COMPOUNDED QUARTERLY . The effective rate of interest per annum will be

- a. 10 %    b. 10.10%    c. 10.25%    **d.** 10.38%

[JUNE 2023]

03. you are considering two investments . Investment A yields 10% compounded quarterly . Investment B yields r% compounded semiannually . Both investments have equal annual yields . Find r

- a. 19.875%    b. 10%    c. 10.38%    **d.** 10.125%

[JUNE 2024]

### ANNUTIY (FUTURE VALUE / PRESENT VALUE)

F.V. =  $A \left[ \frac{(1+i)^n - 1}{i} \right]$  , annuities happen at the END of every period

=  $A \left[ \frac{(1+i)^n - 1}{i} \right] (1+i)$  , annuities happen at the START of every period

where A – instalment/annuity , i – rate of compounding per period  
n – no of instalments

F.V. INTEREST FACTOR  $A(n,i) = \frac{(1+i)^n - 1}{i} \Rightarrow F.V. = A \times A(n,i)$

### Q1 FIND FUTURE VALUE OF ANNUITY (ORDINARY)

01. Find future value of an annuity of ₹ 5000 made annually for 6 years at interest rate of 12% COMPOUNDED ANNUALLY if  $(1.12)^6 = 1.9738$

- a. ₹ 45,375    **b.** ₹ 40,575    c. ₹ 39,465    d. ₹ 37,868

[JUNE 2024]

02. ₹ 800 is invested at the end of EVERY MONTH in an account paying interest @ 6% p.a. compounded annually . What is the future value of this annuity just after making 10<sup>th</sup> payment [GIVEN  $1.005^{10} = 1.0511$  ,  $1.005^{20} = 1.1049$  ]

- a. ₹ 16,764    b. ₹ 8,766    c. ₹ 3,491    **d.** ₹ 8,176

[JAN 2021, JUNE 2022]

### Q2 FIND FUTURE VALUE OF ANNUITY (IMMEDIATE)

01. Suppose Mr X invested ₹ 5000 every year starting FROM TODAY in mutual fund for next 10 years . Assuming average return COMPOUNDED ANNUALLY is at 18% p.a. What is the future value



a. ₹ 183,677.68      b. ₹ 138,678.85      c. ₹ 1,83,776.53      **d. ₹ 1,38,774.55**      [DEC 2023]

**Q3 SINKING FUND - GIVEN F.V. FIND THE INSTALMENT SIZE**

01. 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  $A(10,0.1) = 15.9374$   
**a. ₹ 1882.36**      b. ₹ 1828.30      c. ₹ 1832.65      d. ₹ 1853.65      [DEC 2023]
02. company wants to replace its existing tool machine at the end of 10 years , the expected cost of machine would be 10,00,000 . If the management of the company creates a sinking fund , how much provision needs to be made out of revenue each year which can earn at the rate of 10% COMPOUNDED ANNUALLY .  $A(10,0.10) = 15.937425$   
 a. ₹ 74,625      b. ₹ 72,514      **c. ₹ 62,745**      d. ₹ 67,245      [JUNE 2023]
03. a company creates a sinking fund of ₹ 200,000 in a bank account for 15 years at interest rate of 6% p.a. . The YEARLY PAYMENT to be paid by company will be  $[1.06^{14} = 2.209]$   
**a. ₹ 8,945**      b. ₹ 8,145      c. ₹ 9,345      d. ₹ 9,645      [DEC 2022]

**Q4 PRESENT VALUE OF ANNUITY**

$$P.V. = A \left[ \frac{1-(1+i)^{-n}}{i} \right] \quad \text{ORDINARY ANNUITY} \quad \rightarrow \quad P(n,i)$$

$$P.V. = A \left[ \frac{1-(1+i)^{-n}}{i} \right] (1+i) \quad \text{ANNUITY IMMEDIATE} \quad \rightarrow \quad P(n,i)$$

01. If Mrs. 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  $(1.06)^{16} = 2.54035$   
 a. ₹ 5,51,217.75      b. ₹ 5,75,900.00      c. ₹ 5,05,288.08      **d. ₹ 5,35,612.45**      [DEC 2023]
02. Govinda's mother decides to gift him ₹ 50,000 every year STARTING FROM TODAY for the next 5 years . 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  $P(4,0.10) = 3.16987$ ]  
 a. ₹ 2,80,493.5      **b. ₹ 2,08,493.5**      c. ₹ 2,08,943.5      d. ₹ 2,58,493.5      [JUNE 2023]

**Q5 APP OF PRESENT VALUE OF ANNUITY - GIVEN THE LOAN AMT , FIND THE INSTALMENT SIZE**

01. a car is available for ₹ 4,98,200 cash payment or ₹ 60,000 cash down payment followed by 3 equal annual instalments . If the rate of interest charged is 14% per annum compounded yearly , then TOTAL INTEREST CHARGED in the instalment plan [Given  $P(3,0.14) = 2.32163$ ]

- a. ₹ 1,46,314    b. ₹ 1,46,137     c. ₹ 1,28,040    d. ₹ 1,58,040

[JUNE 2023]

02. Madhu takes a loan of 50,000 from XYZ bank @ 10% p.a. The first instalment will be paid at the end of year 5 . Determine the amount of equal instalments , if Madhu wishes to repay the amount in 5 instalments

- a. ₹ 19,510    b. ₹ 19,430     c. ₹ 19,310    d. ₹ 19,630

[JUNE 2022]

### Q6 PRESENT VALUE OF ANNUITY (LEASING)

01. a person wants to open a shop . He has 2 options . He can acquire the commercial space either by leasing for 10 years at annual rent of ₹ 2,00,000 or purchase the space for ₹ 12,00,000 . If person can borrow the money at 14% compounded per annum , which alternate is most suitable . GIVEN –  $P(10,0.14) = 5.21611$

- a. Leasing    b. Purchase    c. Can't say    d. Data insufficient

[DEC 2023]

02. A person wants to lease out a machine costing ₹ 5,00,000 for a 10 year period . It has a fixed rental of 51,272 per annum payable annually starting from the end of first year . Suppose the rate of interest is 10% p.a. compounded annually on which money can be invested . To whom the agreement is favorable

- a. Lessee    b. Lessor    c. Not for both    d. Can't be determined

[FEB 2008]

03. A machine can be purchased for ₹ 50,000 . Machine will contribute 12000 per year for the next five years . Assume borrowing cost is 10% per annum compounded annually . Determine whether machine should be purchased or not

- a. should purchase     b. should not purchase    c. can't say    d. none

[FEB 2007]

### Q7 PERPETUITY

FIXED PERPETUITY

$$PVA_{\infty} = \frac{R}{i}$$

GROWING PERPETUITY

$$PVA_{\infty} = \frac{R}{i-g}$$

01. Mr Sharad got his retirement benefits amounting to 50,00,000 . He wants to receive a fixed monthly sum of amount for his rest of life after one month and thereafter he wants 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

- a. ₹ 39,500    b. ₹ 38,500     c. ₹ 37,500    d. ₹ 36,600

[JUNE 2023]

02. assuming that the discount rate is 7% p.a , how much would you pay to get ₹ 200 per year growing @ 5% forever

- a. ₹ 2500    b. ₹ 5000    c. ₹ 7500     d. ₹ 10000

[JAN 21 , JUNE 22]

**Q8 BOND EVALUATION**

01. ₹ 1000 bond paying annual dividends of 8.5% will be redeemed at par value at the end of 10 years . Find the purchase value of this bond if the investor wishes a yield rate of 8%
- a ₹ 907.135     b ₹ 1033.54    c ₹ 945.67    d none of these    [MTP DEC 2023]
02. 3 year , ₹ 1000 bond paying annual nominal rate of 10% . At what price the bond may be purchased now if it matures at par and the investor requires a rate of return of 14%
- a ₹ 904     b ₹ 907.125    c ₹ 905.25    d 909    [SEPT 2024]

## PERMUTATION

$r$  items out of  $n$  can be arranged in  ${}^n P_r$  ways

example 1. Arrange 3 men on to 5 chairs ...  ${}^5 P_3 = 5.4.3 = 60$  ways

2. 5 men , arrange any 3 out of them into 3 chairs =  ${}^5 P_3 = 5.4.3. = 60$  ways

### Q1

01. A student has 3 books on Computer , 3 books on Economics , 5 on Commerce . If these books are to be arranged SUBJECTWISE on a shelf , in how many ways they can be arranged  
a. 25290 **b.** 25920 c. 4230 d. 4320 [JUNE 2015/DEC 2017]
02. if 5 books of English , 4 books of Tamil and 3 books of Hindi are to be arranged in a single row so that books of same language come together . Find number of ways  
a. 180630 b. 160830 **c.** 103680 d. 130680 [DEC 2014]
03. In how many ways can the 5 trophies be arranged on a shelf if one particular trophy must always be in the middle **a.** 24 b. 120 c. 48 d. 144 [JUNE 2024]
04. total number of arrangements of 8 persons in a row with President and Vice President occupying middle chairs  
a.  $6!$  b.  $7!$  **c.**  $6!.2!$  d.  $7!.2!$  [JUNE 2022]
05. 5 boys and 4 girls are to be seated in row . If the girls occupy even places then the number of arrangements a. 288 b. 2808 c. 2008 **d.** 2880 [DEC 2014]
06. Eight chairs are numbered from 1 to 8 . 2 women and 3 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 . The number of possible arrangements is  
a. 120 b. 288 c. 32 **d.** 1440 [JAN 2021]
07. Number of ways , 4 boys and 3 girls can be seated in a row so that they are alternate  
a. 12 b. 288 **c.** 144 d. 256 [DEC 2022]
08. 5 boys and 3 girls are to be seated together such that no two girls are together  
**a.** 14400 b. 2400 c. 720 d. none [DEC 2019/JUNE 2024]
09. in a class of 4 boys and 3 girls are to be seated together in a row such that no two girls are together a. 60 b. 480 c. 720 **d.** 1440 [SEPT 2024]
10. there are 10 students in a class including 3 girls . The number of ways to arrange them in a row , when any 2 girls out of them never come together [JUNE 2016]  
**a.**  ${}^8 P_{3..7}!$  b.  ${}^3 P_{3..7}!$  c.  ${}^8 P_{3..10}!$

## Q2

01. In how many ways letters of the word STADIUM be arranged in such a way that the vowels occur together      a.  $7!/3!$     **b.**  $5!.3!$     c.  $5!.4!$     d.  $7!.3!$       [JUNE 2024]
02. Number of ways the letters of the word DETAIL can be arranged in such a way that vowels occupy odd places      a. 32      **b.** 36      c. 48      d. 60      [DEC 2021]
03. In how many ways the word ARTICLE can be arranged in a row so that vowels occupy even places      a. 132      **b.** 144      c. 72      d. 160      [JUNE 2013]
04. Number of words that can be formed using the letters of the word PETROL such that words do not have P in the first place      a. 720      b. 120      **c.** 600      d. 540      [DEC 2021]
05. 4 letter words with or without any meaning can be formed using letters of word LOGARITHMS if repetition is not allowed      **a.** 5040      b. 7020      c. 5400      d. 30240      [JUNE 2022]
06. Number of 4 letter words that can be formed with letters of the word DECTIONARY      **a.** 5040      b. 720      c. 90      d. 30240      [DEC 2021]

## Q3

01. How many numbers between 1000 and 10000 can be formed with the digits 1, 2, 3, 4, 5, 6      a. 720      **b.** 360      c. 120      d. 60      [DEC 2016]
02. How many 7 digit numbers can be formed using digits 3, 4, 5, 6, 7, 8, 9 with no digits repeated not ÷ by 5.      **a.** 4320      b. 4690      c. 3900      d. 3890      [JULY 2021]
03. How many 3 digit odd numbers can be formed using digits 5, 6, 7, 8, 9 if the digits can be repeated      a. 55      **b.** 75      c. 65      d. 96      [DEC 2022]
04. How many odd numbers of 4 digit can be formed with digit 0, 1, 2, 3, 4, 7, 8      a. 150      **b.** 300      c. 120      d. 210      [JAN 2021]

## Q4

TOTAL NUMBER OF ARRANGEMENTS OF N DIFFERENT THINGS IN WHICH 'p items' ARE ALIKE AND OF ONE KIND, 'q items' ARE ALIKE AND OF ONE KIND WILL BE GIVEN BY  $\frac{n!}{p!.q!}$

LET ME TRY TO EXPLAIN

A,B,C,D would arrange amongst themselves in  ${}^4P_4 = 4!$  Ways

lets say A, B, C were like items (say all were A). In that case whichever 3 places they occupy, they would NOT further arrange amongst themselves in  $3!$  ways which they do happen to when distinct (A,B,C). Hence  $3!$  Needs to be removed from the final answer which we must have got initially, treating all items distinct

Answer would then be  $\frac{4!}{3!} = 4$  ..... (AAAD, AADA, ADAA, DAAA)

01. The number of arrangements that can be formed from the letters of the word ALLAHABAD  
 a. 7560     b. 3780     c. 30240     d. 15320 [JUNE 2017]
02. The number of words from the letters of word BHARAT in which B and H will never come together  
 a. 120    b. 360     c. 240    d. none [NOV 2018]
03. In how many different ways can the letters of the word CORPORATION be arranged so that the vowels always come together    a 810    b 1440    c 25200     d 50400 [DEC 2023]  
 CORPORATION = 11 L

## Q5

Lets consider arrangements of 4 items    **LINEAR V/s CIRCULAR**

LINEAR ARRANGEMENT

1 2 3 4 ... 3!  
 2 1 3 4 ... 3!  
 3 1 2 4 ... 3!  
 4 1 2 3 ... 3!

Starting with 1 , 2 , 3 , 4 the remaining gives you 3! arrangements leading to 4! = 24 arrangements . However since circle does not have start , 3! arrangements starting with 2 , 3 , 4 have to be ignored . Hence finally we are left with only 3! arrangements starting with 1

CONCLUSION

n items on a circular table can be arranged in (n-1)! ways

01. In how many ways 5 boys and 5 girls are seated on a round table if no 2 boys are adjacent  
 a. 2550     b. 2880    c. 625    d. 2476 [JULY 2021]
02. In how many ways can 6 GENTS and 5 ladies can be arranged at around table if no two ladies sit together  
 a. 86400    b. 14400    c. 84600    d. 34560

**Q6**  ${}^n P_r = \frac{n!}{(n-r)!}$  , however in practice we solve as

$${}^n P_3 = n(n-1)(n-2)$$

$${}^{n-1} P_3 = (n-1)(n-2)(n-3)$$

$${}^{n+1} P_3 = (n+1)n(n-1)$$

01. **JUNE 22**  
 $\frac{n!}{10} = {}^{n-1} P_{n-3}$  . Find n     a. 5    b. 6    c. 7    d. 8
02. **JUNE 23**  
 ${}^6 P_{2r} = 12 \cdot {}^6 P_r$  . Find r    a. 1     b. 2    c. 3    d. 4
03. **DEC 21**  
 ${}^n P_2 = 12$  . Find n    a. 2    b. 3     c. 4    d. 6

04. **JULY 21**

$${}^n P_6 = 20 \cdot {}^n P_4 . \text{ Find } n$$

a. 5

b. 3

 c. 9

d. 8

05. **DEC 20**

$${}^n P_4 = 20 \cdot {}^n P_2 . \text{ Find } n$$

a. 4

b. 2

c. 5

 d. 706. if  ${}^n P_{13} : {}^{n+1} P_{12} = 3:4$  , then n

a. 13

b. 15

c. 18

d. 31

a. 13

 b. 15

c. 18

d. 31

COMBINATIONS

Q1

1.  ${}^n C_r$  gives us the number of selections of  $r$  items out of the given  $n$  items

2 out of 4 items can be selected in  ${}^4 C_2$  ways

3 out of 5 items can be selected in  ${}^5 C_3$  ways

2.  ${}^n C_r = {}^n C_{n-r}$

$${}^6 C_4 = {}^6 C_2$$

since no. of ways of selecting 4 out of 6 = no. of ways of rejecting 2 out of 6

01. A person has 10 friends of which 6 of them are relatives . He wishes to invite 5 persons so that 3 of them are relatives . In how many ways he can invite  
a. 450    b. 600    **c.** 120    d. 810    [JUNE 2015]
02. Out of 6 boys and 4 girls , find the number of ways for selecting 5 member committee in which there are exactly 2 girls **a.** 120    b. 1440    c. 720    d. 71    [DEC 2019]
03. Out of 7 gents and 4 ladies a committee of 5 is to be formed . the number of committees such that AT LEAST 1 LADY is included    a. 400    b. 440    **c.** 441    d. none
04. 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  
a. 46    **b.** 64    c. 86    d. 68    [NOV 2018]
05. How many total combinations can be formed of 8 different counters marked as 1 , 2 , ..... , 8 taking 4 counters at a time and there being atleast one odd and one even counter in each combination    **a.** 68    b. 66    c. 64    d. 62    [SEPT 2024]
06. a selection is to be made for one post of of Principal and 2 post of Vice Principal . Amongst the 6 candidates called for the interview , only 2 are eligible for the post of Principal while they all six are eligible for the post of vice principal . The number of possible combinations  
a. 4    b. 12    c. 18    **d.** 20    [SEPT 2024]
07. In how many ways can a committee of 3 ladies and 4 gentlemen be appointed from a meeting consisting of 8 ladies and 7 gentle men ? What will be number of ways if Mrs X refuses to serve in a committee where Mr Y is a member  
a.1530    b. 1500    c. 1520    **d.** 1540    [JUNE 2023]

Q2

01. From a group of 8 men and 4 women, 4 persons are to be selected to form a committee so that ATLEAST 2 WOMEN are there on the committee . In how many ways can it be done  
**a.** 201    b. 168    c. 202    d. 220    [DEC 2020]
02. 6 gents & 4 ladies . A committee of 5 is to be formed if it includes ATLEAST 2 LADIES . How many committees can be formed    a. 64    b. 162    c. 102    **d.** 186    [DEC 2015]



03. In how many ways can a selection of 6 out of 4 teachers and 8 students be done so as to include ATLEAST 2 TEACHERS  
 a. 220    **b.** 672    b. 896    d. 968    [JUNE 2016]

**Q3**

01. 6 points on a circle . The number of quadrilateral s that can be formed are  
 a. 30    b. 360    **c.** 15    d. none    [JUNE 2010]
02. 20 points . Find number of triangles formed by joining 12 points if 5points are collinear  
 a. 550    b. 560    **c.** 1130    d. 1140    [DEC 2022]
03. the number of parallelograms that can be formed by a set of 6 parallel lines intersected by the another set of 4 parallel lines a. 360    **b.** 90    c. 180    d. 45    [JUNE 2017]
04. 6 points are marked on a straight line and 5 points are marked on another line which is parallel to the first line . How many straight lines including the given 2 lines can be formed with these points    a. 30    **b.** 32    c. 11    d. 2    [JUNE 2022]
05. the maximum number of points of intersection of 10 circles will be  
 a. 2    b. 20    **c.** 90    d. 180    [JUNE 2016]
06. a regular polygon has 44 diagonals , then the number of sides a. 8    b. 9    c. 10    **d.** 11    [JUNE 2013]
07. If there are 40 guests in a party , if each guest takes a shake hand with all the remaining guests , then the number of handshake is  
**a.** 780    b. 840    c. 1560    d. 1600    [JUNE 2019]
08. The number of handshakes in a group of 10 persons  
**a.** 45    b. 54    c. 90    d. 10    [JUNE 2013]
09. In a party every person shakes hand with every other person . If there are 105 handshakes in total , find the number of persons in the party  
 a. 14    **b.** 15    c. 21    d. 22    [SEPT 2024]

**Q4** SELECTION OF ANY NO. OF OBJECTS FROM 'n' DISTINCT OBJECTS

Lets say , we have 5 DISTICNT items . We can select no item , 1 item , 2 items and so on uptil all 5 items . This can be done in  ${}^5C_0$  ,  ${}^5C_1$  ,  ${}^5C_2$  , ..... ,  ${}^5C_5$  ways respectively . Hence total ways

$$= {}^5C_0 + {}^5C_1 + {}^5C_2 + {}^5C_3 + {}^5C_4 + {}^5C_5$$

$$= {}^5C_0 + {}^5C_1 + {}^5C_2 + {}^5C_2 + {}^5C_1 + {}^5C_5$$

$$= 1 + 5 + 10 + 10 + 5 + 1 = 32$$

More interesting is , we could have got the same answer by  $2^5$  .

EXCITED TO KNOW THE LOGIC BEHIND IT !

You take a basket and go to each item ,

Each of the 5 items have 2 options **SELECT/NO SELECT**

Hence by **FUNDAMNETAL PRINCIPLE OF COUNTING** , number of ways of selecting any number of items =  $2 \times 2 \times 2 \times 2 \times 2 = 2^5 = 32$

**NOTE :** NUMBER OF WAYS TO SELECT ANY NUMBER OF ITEMS GIVEN N ITEMS =  $2^n$   
NUMBER OF WAYS TO SELECT ONE OR MORE (ATLEAST ONE) ITEM =  $2^n - 1$

01. The number of ways in which a man can invite one or more of his 7 friends to dinner is  
a. 64      b. 128      **c.** 127      d. 63      **[JUNE 2018]**
02. a question paper consist 10 questions , 6 in math and 4 in stats . Find out the number of ways to solve question paper if atleast one question is to be attempted from each section  
a. 1024      b. 950      **c.** 945      d. 1022      **[DEC 2015]**
03. A MCQ test has 5 Q's and each Q has 4 possible options . How many different answer keys are possible  
a. 512      **b.** 1024      c. 20      d. 625      **[JUNE 2022]**

**Q5 PERMUTATION & COMBINATION KA COMBO PACK**

01. A boats crew consists of 8 men , 3 of whom can row only on one side and 2 only on the other side . The number of ways in which the crew can be arranged is  
**a.** 1728      b. 256      c. 164      c. 126      **[JUNE 2019]**
02. a user wants to create a password using 4 lowercase letter (a-z) and 2 upper case letters (A-Z). No letter can be repeated in any form . In how many ways can the password be created if the password must start with an uppercase  
**a.**  $26 \times 25 \times 24 \times 23 \times 22 \times 5 \times 21$       b.  $26 \times 25 \times 24 \times 23 \times 22 \times 2 \times 21$       c.  $26 \times 5 \times 25 \times 24 \times 23 \times 2 \times 22 \times 21$   
d.  $6 \times 26 \times 25 \times 24 \times 23 \times 22 \times 21$       **[JUNE 2024]**

**Q6  ${}^n P_r = {}^n C_r \cdot r!$**

01. **NOV 2018**  
 ${}^n P_r = 720$  &  ${}^n C_r = 120$  . Find r      **a.** 3      b. 4      c. 5      d. 6
02. **DEC 2022 , JUNE 23**  
 ${}^n P_r = 3024$  &  ${}^n C_r = 126$  . Find n,r      **a.** 9,4      b. 10,3      c. 12,4      d. 11,4

${}^5 C_3 = {}^5 C_2$  , note  $3+2=5$  ,  ${}^6 C_4 = {}^6 C_2$  , note  $4+2=6$

03. **JUNE 2019**  
 ${}^{11} C_x = {}^{11} C_{2x-4}$  ,  $x \neq 4$  then  ${}^7 C_x = ?$       a 20      **b.** 21      c 22      d 23

04. DEC 23

$${}^{15}C_{3r} = {}^{15}C_{r+3}, \text{ then } r = ? \quad \text{a. 5} \quad \text{b. 4} \quad \text{c. 3} \quad \text{d. 2}$$

$${}^nC_r + {}^nC_{r-1} = {}^{n+1}C_r, \text{ Eg } {}^5C_3 + {}^5C_2 = {}^6C_3$$

05. JUNE 2017

$${}^{10}C_3 + 2 \cdot {}^{10}C_4 + {}^{10}C_5 = {}^nC_5, \quad n = \quad \text{a. 10} \quad \text{b. 11} \quad \text{c. 12} \quad \text{d. 13}$$

06. DEC 2012

$${}^{13}C_6 + 2 \cdot {}^{13}C_5 + {}^{13}C_4 = {}^{15}C_x, \quad x = \quad \text{a. 6} \quad \text{b. 7} \quad \text{c. 8} \quad \text{d. 9}$$

07. JUNE 2018

$${}^{12}C_3 + 2 \cdot {}^{12}C_4 + {}^{12}C_5 = {}^{14}C_x, \quad x = \quad \text{a. 3,5} \quad \text{b. 5,9} \quad \text{c. 7,1} \quad \text{d. 9,12}$$

08. JUNE 2014

$${}^{1000}C_{98} = {}^{999}C_{97} + {}^xC_{901}, \text{ then } x = \quad \text{a. 999} \quad \text{b. 998} \quad \text{c. 997} \quad \text{d. none}$$

09. JUNE 23

In next world cup , there will be 12 teams divided equally into 2 groups . Team of each group will play a match against other teams of the group . From each group 3 top teams will qualify for next round . In this round each team will play against each other . Four top teams of this round will qualify for semi finals and play against each other . Top 2 teams will go to final where they play best of 3 . How many MINIMUM number of matches will be held in the next world cup

a. 54      b. 53      c. 38      d. 43

ARITHMETIC PROGRESSION

**Q1**  $t_n = a + (n-1)d$   
 $t_6 = a+5d$  ,  $t_{10} = a + 9d$  ,  $t_{20} = a+19d$

01. 9<sup>th</sup> and 19<sup>th</sup> term of AP are 35 and 75 respectively . Find the 20<sup>th</sup> term JUNE 2023  
 a. 78     b. 79    c. 80    d. 81
02. Find the 17th term of an AP series if 15<sup>th</sup> and 21<sup>st</sup> terms are 30.5 and 39.5 respectively DEC 2023  
 a. 33.5     b. 35.5    c. 36.0    d. 38.0
03. 4<sup>th</sup> term of an A.P. is zero . Find ratio of 25<sup>th</sup> term to 11<sup>th</sup> term SEPT 2024  
 a. 5    b. 4     c. 3    d. 2
04. pth term is q and qth term is p . Find the (p+q)th term DEC 2022  
 a. 1    b. -1     c. 0    d. none of above
05. in an arithmetic progression , seventh term is x and (x+7)<sup>th</sup> term is zero , then xth term is JUNE 2024  
 a. 6     b. 7    c. 8    d. 10
06. the third term of an AP is 7 and seventh term is 2 more than thrice of third term . The common difference is JUNE 2024  
 a. 4    b. 3    c. 5    d. 6
07. The number of numbers between 74 & 25556 divisible by 5 JUNE 2023  
 a. 5079     b. 5097    c. 5907    d. 5709
08. if the second and the eighth terms of an arithmetic progression are equal to constant a , then the sum of first n terms of an AP is equal to JUNE 2024  
 a. na    b. a/n    c. 2n+n(a-1)    d. n+a(n-1)

**Q2** 3 NO'S IN A.P. = a-d , a , a+d / 5 NO'S IN A.P. = a-2d , a-d , a , a+d , a+2d

01. Divide 69 into 3 parts which are in A.P. and are such that product of first two parts is 460 DEC 2020  
 a. 20,23,26    b. 21,23,25    c. 19,23,27    d. none
02. Divide 144 into three parts which are in A.P. and such that the largest is twice the smallest . The smallest of three numbers will be MTP – MAY 2024  
 a. 48    b. 36    c. 13     d. 32
03. Find five numbers in AP whose sum is 20 and product of first and last is 15  
 ans 3,3.5,4,4.5,5 OR 4,4.5,4,3.5,3

**Q3**  $S_n = \frac{n}{2} [a + l]$

01. first and last term of AP are 5 and 905 . sum of n terms is 45955 . Find n  
a. 110    b. 100     c. 101    d. 111 JUNE 2022
02. if nth term of an AP series is  $7n-2$  , then sum of n terms is  
a.  $0.5(7n^2+2n)$     b.  $0.5(7n^2-3n)$      c.  $0.5(7n^2+3n)$     d.  $0.5(7n^2-2n)$  DEC 2023
03. The sum of n terms of an AP is  $3n^2+5n$  , The series is DEC 2021  
a. 8,14,20,26,.....     b. 8,22,42,68,...    c. 22,68,114,...    d. 8,14,28,44
04. Sum of all natural numbers between 100 and 1000 which are divisible by 11 DEC 2017

**Q4**  $S_n = \frac{n}{2} [2a + (n-1)d]$

01. Sum of series  $7+14+21+ \dots$  To 17th term is DEC 2021  
 a. 1071    b. 971    c. 1171    d. 1271
02. A person recieved the salary for the first year ₹ 5,00,000 and he received an increment of ₹ 15000 per year then the sum of the salary he has taken in 10 years is DEC 2016  
 a. ₹ 56,75,000    b. ₹ 72,75,000    c. ₹ 63,75,000    d. none of these
03. In an A.P. if the sum of 4<sup>th</sup> and 12<sup>th</sup> term is 8 then sum of first 15 terms is JUNE 2013  
 a. 60    b. 120    c. 110    d. 150
04. Sum of five terms of A.P. is 75 , find the 3rd term DEC 2019  
a. 20    b. 30     c. 15    d. none

**Q5**  $S_n = \frac{n}{2} [2a + (n-1)d]$

01. A person pays 975 in monthly instalments , each instalment is less than former by 5 . The amount of 1st instalment is 100 . In what time (months ) will be entire amount be paid MAY 2018  
a. 26     b. 15    c. a&b    d. 18
02. The number of terms of the series  $5+7+9 + \dots$  must be taken so that the sum may be 480 JULY 2021  
 a. 20    b. 10    c. 15    d. 25
03. Find the value of x for the following data  $1+7+13+19+\dots+x = 225$  DEC 2023  
a. 56    b. 63     c. 49    d. 42

**Q6** ARITHMETIC MEANS (A.M.'s)

$2 + 4 + 6 + 8 + 10$  are in AP

$4, 6, 8$  are the A.M.s called as  $A_1, A_2, A_3$

$$A_1 + A_2 + A_3 = 18$$

$$= 3(6)$$

$$= 3(\text{mean of } 2 \& 10)$$

Conclusion

1. Sum of  $n$  A.M.s =  $n \times (\text{Mean of } a \& b)$   
between  $a$  &  $b$

2.  $n^{\text{th}}$  A.M. is  $n+1^{\text{th}}$  term in the AP

01. The value of  $k$  for which the terms  $7k+3, 4k-5, 2k+10$  are in A.P. NOV 2018

- a.  $-13$      b.  $-23$     c.  $13$     d.  $23$

02. if  $a, -3, b, 5, c$  are in A.P. , then value of  $c =$  JUNE 2017

- a.  $-7$     b.  $1$      c.  $9$     d.  $13$

03. if 20 A.M.s are inserted between 3 and 51 then sum of these 20 A.M.s is MTP 1 – MAY 2023

- a. 540    b. 1080    c. 270    d. none of these

**Q7**

01. If  $1/b+c, 1/c+a, 1/a+b$  are in AP then  $a^2, b^2, c^2$  are in

- a. AP    b. GP    c. Both AP & GP    d. none of these JUNE 2016

02. If  $b+c-a/a, c+a-b/b, a+b-c/c$  are in A.P. then  $a, b$  and  $c$  are in

- a. AP    b. GP     c. HP    d. none DEC 2019

**Q8**

01. MTP - NOV 2022

sum of  $x$  terms of two AP's are in ratio  $3x+5:5x+3$  , then ratio of their  $10^{\text{th}}$  term is

- a. 31:49    b. 30:49    c. 28:49    d. none

02. JUNE 2019

the ratio of sum on  $n$  terms of two A.P.'s is  $n+1/n-1$  , then the ratio of their  $m^{\text{th}}$  terms is

- a.  $m+1:2m$     b.  $m+1:m-1$     c.  $2m-1:m+1$      d.  $m:m-1$

GEOMETRIC PROGRESSION

**Q1**  $t_n = ar^{n-1}$   
eg :  $t_8 = ar^7$  ,  $t_{10} = ar^9$  .....

01. **JUNE 2022**  
In GP , 2<sup>nd</sup> term is 12 and 6<sup>th</sup> term is 192 . Find 11<sup>th</sup> term  
a. 6411   **b.** 6144   c. 6414   d. none

02. **DEC 2022**  
In GP 5<sup>th</sup> term = 27 , 8<sup>th</sup> term = 729 .  
Find  $t_{11}$   
a. 19683   b. 16893   **c.** 19863   d. none

03. **JAN 2021**  
3rd term of a GP is 1 and 6th term is  $-\frac{1}{8}$  , then the 1st term and common ratio is  
a. 4,  $\frac{1}{2}$    b. 4,  $-\frac{1}{4}$    **c.** 4,  $-\frac{1}{2}$    d. 4,  $\frac{1}{4}$

04. **DEC 2011**  
In a GP , if the 5<sup>th</sup> term is  $\sqrt[3]{3}$  , then product of first 9 terms is  
a. 8   **b.** 27   c. 243   d. 9

05. **JUNE 2019**  
In a GP , if the 4<sup>th</sup> term is 3 , then product of first 7 terms is  
a.  $3^5$    **b.**  $3^7$    c.  $3^6$    d.  $3^8$

**Q2** 3 nos. in GP :  $\frac{a}{r}$  , a , ar  
5 nos. in GP :  $\frac{a}{r^2}$  ,  $\frac{a}{r}$  , a , ar , ar<sup>2</sup>

01. **DEC 2020**  
3 numbers in GP with their sum is 130 and their product is 27000 are  
a. 90,30,10   b. 10,30,90   **c.** a & b

02. **DEC 2021**  
If the sum and product of three numbers in GP are 7 and 8 respectively , then the 4<sup>th</sup> term of the series is  
a. 6   b. 4   c. 8   **d.** 16

03. **JULY 2021**  
sum of 3 nos. in G.P. is 28 . When 7,2,and 1 are subtracted from first , second and third number respectively , then the resulting numbers are in A.P. Find sum of squares of original three nos.  
a. 510   b. 456   c. 400   **d.** 336

$$S_n = \frac{a(1-r^n)}{1-r} , r < 1$$

$$S_n = \frac{a(r^n-1)}{r-1} , r > 1$$

**Q3** **DEC 2021**

$\frac{1}{2} + \frac{1}{2^2} + \dots + \frac{1}{2^n} < 0.998$   
Find the largest value of n  
a. 9   b. 6   c. 7   **d.** 8

02. a person borrows 8000 at 2.76% p.a. SI . The principal and interest are to be paid in 10 monthly instalments . If each instalment is double the preceding one , find the value of first and the last instalment  
ans 8 , 4096

03. **SEPT 2024**  
a person borrows 9000 at 2.76% p.a. SI . The principal and interest are to be paid in 10 monthly instalments . If each instalment is double the preceding one , find the value of first and the last instalment  
a.1024   **b.** 4608   c. 9207   d. 4096

**Q4**  $S_n = a \frac{r^n - 1}{r - 1}$

01. **JUNE 22**  
sum of first 8 terms of a GP is 5 times the sum of first 4 terms . The common ratio is  
 a.  $\pm 2$      b.  $\pm 3$      c.  $\pm \sqrt{2}$      d.  $\pm \sqrt{3}$
02. **JUNE 2017**  
Sum of first 20 terms of a GP is 1025 times the sum of first 10 terms , then the common ratio is  
 a. 2     b.  $2\sqrt{2}$      c.  $\frac{1}{2}$      d.  $\sqrt{2}$

**Q5**

01. **JUNE 2014 , JUNE 2015 , MAY 2018**  
Sum of m terms of the series  $1 + 11 + 111 + \dots$  m terms is  
 a.  $\frac{1}{81}(10^{m+1} - 9m - 10)$   
 b.  $\frac{1}{27}(10^{m+1} - 9m - 10)$   
 c.  $10^{m+1} - 9m - 10$   
 d. none of these

02. **MTP1 – MAY 23 , MAR 21**  
 $7 + 77 + 777 + \dots$   
 a.  $\binom{7}{81}(10^{n+1} + 10) - \binom{7}{9}n$   
 b.  $\binom{7}{81}(10^{n+1} - 10) + \binom{7}{9}n$   
 c.  $\binom{7}{81}(10^{n+1} - 10) - \binom{7}{9}n$   
 d. None

**Q6**  $S_\infty = \frac{a}{1-r}$  ,  $|r| < 1$

01. **JUNE 2014**  
 $1 + \frac{1}{3} + \frac{1}{9} + \frac{1}{27} + \dots$   
 a. 1.95     b. 1.5     c. 1.75     d. none
02. **DEC 2019**  
 $\frac{1}{2} + \frac{1}{3^2} + \frac{1}{2^3} + \frac{1}{3^4} + \frac{1}{2^5} + \frac{1}{3^6} + \dots$   
 a.  $\frac{25}{24}$      b.  $\frac{19}{24}$      c.  $\frac{1}{12}$      d. none

03. **JUNE 2019**  
If  $y = 1 + x + x^2 + \dots \infty$  then  $x =$   
 a.  $y^{-1}/y$      b.  $y^{+1}/y$      c.  $y/y+1$      d.  $y/y-1$

**Q7**

01. **DEC 2012**  
The first term of a G.P. where second term is 2 and sum of infinite term is 8 will be  
 a. 6     b. 3     c. 4     d. 1

02. **DEC 2023**  
Given an infinite geometric series with first term a and common ratio r . If its sum is 4 and second term is  $\frac{3}{4}$  , then one of the correct option is  
 a  $a = 1$  &  $r = \frac{1}{4}$      b  $a = 3$  &  $r = \frac{3}{4}$   
 c  $a = 3$  &  $r = \frac{1}{4}$      d  $a = 1$  &  $r = \frac{1}{2}$

03. **SEPT 2024**  
infinite geometric series with first term a and common ratio r . If its sum is 8 and second term is  $\frac{7}{8}$  , then one of the correct option is  
 a  $a = 3$  &  $r = \frac{7}{24}$      b  $a = 4$  &  $r = \frac{7}{16}$   
 c  $a = 7$  &  $r = \frac{1}{8}$      d  $a = 2$  &  $r = \frac{7}{32}$

**Q8** A.M. of (a,b) =  $\frac{a+b}{2}$   
G.M. of (a,b) =  $\sqrt{ab}$

01. **DEC 2022**  
AM and GM of 2 numbers is 5 and 4 respectively . The numbers are  
 a. 2,3     b. 2,8     c. 4,6     d. 1,16
02. **2011**  
AM and GM of 2 numbers is 12.5 and 10 respectively . The numbers are  
 a. 20,5     b. 10,5     c. 5,4     d. none



03. **DEC 2015**

Find nos whose G.M. is 5 and A.M. is 7.5

- a. 12,13    b. 13.09,1.91   c. 14,11  
d. 17,19

$$1 + 2 + 4 + 8 + 16 + 32 + 64$$

$$(1,8,64), (2,8,32), (4,8,16) \dots$$

$$\text{satisfies } B^2 = AC$$

$$8 = \text{G.M. OF } (1,64), (2,32), (4,16)$$

NOTE

8 is GM of any 2 terms in G.P. which stand equidistant on either side of 8.

05. **SEPT 2024**

the numbers  $x, 8, y$  are in GP and the numbers  $x, y, -8$  are in AP. The value of  $x$  and  $y$  are

- a.  $-8, -8$     b. 16,4   c. 8,8   d. none

04. **JUN 2023**

$4^{\text{th}}, 7^{\text{th}}$  and  $10^{\text{th}}$  term of GP are  $p, q, r$

then

a.  $p^2 = q^2 + r^2$    b.  $p^2 = qr$     c.  $q^2 = pr$

d.  $pqr + pq + 1 = 0$

**Q9**

**J.K. SHAH**  
CLASSES

a **Veranda**  
Enterprise

01. **DEC 2014**

If  $x, y, z$  are in GP then,

$x^2 + y^2, xy + yz, y^2 + z^2$  are in

- a. AP    b. GP   c. HP   d. none

02. **JUNE 2018**

if  $a, b, c, d$  are in GP then the value of

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

- a.  $(a-b)^2$     b.  $(a-d)^2$    c.  $(c-d)^2$

d. none

03.  $a, b, c$  are in AP and  $x, y, z$  are in

GP, then value of  $x^{b-c} \cdot y^{c-a} \cdot z^{a-b}$  is

- a. 1   b. 0   c.  $b(c-a)$    d. none

04. **JUNE 2018**

If the  $p^{\text{th}}, q^{\text{th}}$  and  $r^{\text{th}}$  terms of a GP be  $a, b, c$  respectively then

$$(q-r)\log a + (r-p)\log b + (p-q)\log c =$$

- a. 0   b. 1   c. 2   d. none

SETS - RELATION - FUNCTION

**Q1 SETS - VENN DIAGRAM**

01. **JUNE 2011**  
in a class of 40 students , 30 passed in English , 25 of them passed in Math and 15 passed in both . Every student has passed in atleast one subject . How many have passed in English but not in Math  
**a.** 15      b. 20      c. 10      d. 25
02. **JUNE 2014**  
in a class of 50 students , 35 students have taken mathematics , 37 have taken commerce . Find the number of the students who have taken both .  
a. 13      b. 15      **c.** 22      d. 28
03. **JUNE 2017**  
in a class of 35 students , 24 play cricket and 16 play football . Also each student likes to play at least one game . How many students like to play both cricket and foot ball  
**a.** 5      b. 11      c. 12      d. 17
04. **JUNE 2017**  
in a class , 80 students speak Hindi , 60 speak English and 40 speak both Hindi & English . Find no. of students in the class  
**a.** 100      b. 120      c. 140      d. 180
05. **JUN '23**  
Survey shows 74% of Indians like grapes where as 68% like bananas What % of Indians like both if everybody likes either of the two  
a. 32      b. 26      c. 6      **d.** 42

06. **JULY 2021**  
 $n(U) = 650$  ,  $n(A) = 310$  ,  $n(A \cap B) = 95$  ,  
 $n(B) = 190$  , find  $n(\overline{A} \cap \overline{B})$   
a. 400      b. 200      c. 300      **d.** 245
07. **DEC 2015**  
in a class of 80 students , 35% students can play only cricket , 45% play only table tennis and the remaining students can play both the games . In all how many students can play cricket  
a. 86      b. 54      c. 36      d. 44

**Q2 SETS - VENN DIAGRAM**

01. **DEC 2013**  
out of 200 candidates who were interviewed for a position at call centre , 100 had a two wheeler , 70 had a credit card and 140 had a mobile phone . 40 of them had both two wheeler and a credit card , 30 had both a credit card and mobile phone , 60 had both a two wheeler and mobile phone . 10 had all three . How many candidates had none of the three  
a. 0      b. 20      **c.** 10      d. 18
02. **DEC 2012**  
For a group of 200 persons , 100 are interested in music , 70 in phototgraphy 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 three . How many are interested in photography but not music and swimming  
a. 30      b. 15      c. 25      **d.** 20

03. **MAY 2018**

in a town of 20,000 families , 40% buy newspaper A , 20% buy B , 10% buy C , 5% buy A and B , 3% buy B and C and 4% buy A and C . If 2% buy all three newspaper then number of families which buy only A

- a. 6600     b. 6300     c. 5600     d. 600

04. **DEC 2020**

$n(A) = 40$  ,  $n(B) = 32$  ,  $n(C) = 50$  ,  
 $n(A \cap B) = 4$  ,  $n(A \cap C) = 5$  ,  $n(B \cap C) = 7$  ,  
 $n(A \cap B \cap C) = 2$  . How many are in only one set     a. 65     b. 110     c. 96     d. 84

05. **DEC 23**

In a survey of 100 boys , it was found that 50 used white shirts , 40 red shirts and 30 blue shirts , 20 were using white and red shirts , 15 were using both red and blue shirts and 10 were using both blue and white shirts . Find number of boys using all colours

- a 20     b 25     c 30     d 35

06. **DEC 2021**

Out of a group of 20 teachers in a school , 10 teach Mathematics , 9 teach Physics & 7 teach Chemistry . 4 teach Math & Physics but none teach both Math and Chemistry . How many teach Chemistry & Physics . How many teach only Physics

- a. 2,3     b. 3,2     c. 4,6     d. 6,4

### Q3 SETS

01. **JUNE 19**

$$A = \{1,2,3,4,5,6,7,8,9\}$$

$$B = \{1,3,4,5,7,8\} , \quad C = \{2,6,8\}$$

Find  $(A-B) \cup C$

ans  $\{2,6,8,9\}$

02. **JUNE 2016**

$$A = \{x : \frac{x}{2} \in \mathbb{Z} , 0 \leq x \leq 10\}$$

$$B = \{x : x \text{ is one digit prime number}\}$$

$$C = \{x : \frac{x}{3} \in \mathbb{N} , x \leq 12\}$$

$$A \cap (B \cap C)$$

- a.  $\phi$      b. A     b. B     c. C

03. **JUNE 2018**

$$A = \{x/x=3^n-2n-1, n \in \mathbb{N}\}$$

$$B = \{x/x=4(n-1), n \in \mathbb{N}\}$$

- a.  $A \subset B$      b.  $B \subset A$      c.  $A=B$      d. none

### Q4

#### SUBSETS , NON EMPTY SUBSETS & PROPER SUBSETS

$$A = \{1,2,3\}$$

Write the possible subsets of A

$$\{ \} , \left\{ \begin{array}{l} \{1\} , \{2\} , \{3\} , \{1,2\} , \{1,3\} , \{2,3\} \\ \{1,2,3\} \end{array} \right\}$$

PROPER SUBSETS

NOTE 1 : an empty set and the set itself are too subsets of any set

NOTE 2 :

$$n(A) = 3$$

$$\text{No. of subsets formed} = 2^3 = 8 \dots (2^n)$$

No. of NON EMPTY SUBSETS

$$\{1\} , \{2\} , \{3\} , \{1,2\} , \{1,3\} , \{2,3\} , \{1,2,3\}$$

$$= 7 = (2^n - 1)$$

No. of NON EMPTY PROPER SUBSETS

$$\{1\} , \{2\} , \{3\} , \{1,2\} , \{1,3\} , \{2,3\}$$

$$= 6 = (2^n - 2)$$

01. DEC 22

No. of subsets of  $\{0,1,2,3\}$

- a. 2    b. 4    c. 8    **d. 16**

02. JUNE 19

No. of subsets of  $\{3,4,5\}$

- a. 2    b. 4    **c. 8**    d. 16

03. DEC 23 , MAY 18

$B = \{1,2,3,4,5\}$  , then the number of proper subsets of B is

- a) 120    b) 30    **c) 31**    d) 32

04. DEC 22

$A = \{1,2,3,4,5,7,8,9\}$

$B = \{2,4,6,7,9\}$

How many proper subsets of  $A \cap B$  can be created

- a. 16    **b. 15**    c. 32    d. 31

05. JUNE 2016

the number of subsets of the word formed from the letters of the word ALLAHABAD

- a. 128    b. 16    **c. 32**    d. 64

06. JUNE 22 , DEC 20

Two finite sets with  $a$  and  $b$  elements . The total number of subsets of the first set is 56 more than the total numbers subsets of the 2<sup>nd</sup> set . Find  $a$  ,  $b$

- a. 6,3**    b. 3,6    c. 8,4    d. 6,4

07. Two finite sets with  $p$  and  $q$  as elements . The total number of subsets of the first set is 64 more than the total number of subsets of the second . The values of  $p$  and  $q$  are `

- a. 5,7    **b. 7,6**    c. 8,7    d. 9,7

### Q5 CARTESIAN PRODUCT OF 2 SETS

ALL ELEMENTS OF A ARE MAPPED TO ALL ELEMENTS OF B

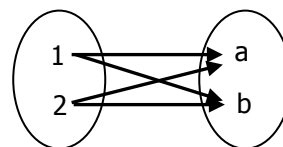
Let A and B be two non empty sets then the cartesian product of A and B is defined as a set of ordered pairs  $(a,b)$  such that  $a \in A$  ,  $b \in B$

Its denoted as  $A \times B$  , read as 'A cross B'

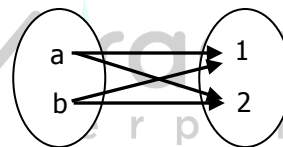
$$A \times B = \{(a,b) / a \in A , b \in B\}$$

01.  $A = \{1,2\}$  ,  $B = \{a,b\}$

$$A \times B = \{(1,a),(1,b),(2,a),(2,b)\}$$



$$B \times A = \{(a,1),(a,2),(b,1),(b,2)\}$$



NOTE : 1.  $A \times B \neq B \times A$

$$2. n(A \times B) = n(B \times A)$$

$$3. n(A) = 2 , n(B) = 3 , n(A \times B) = n(B \times A) = 2 \times 3 = 6$$

02. DEC 2011

$A = \{1,2,3,4,5\}$  ,  $B = \{2,4\}$  ,  $C = \{1,3,5\}$  then  $(A-C) \times B$

- 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.  $\{(2,2),(2,4),(4,2),(4,4)\}$**

03. JUNE 23

$A = \{a,b,c\}$  ,  $B = \{b,c,d\}$  ,  $C = \{a,d,c\}$  then  $(A-B) \times (B \cap C)$  is

- a.  $\{(a,d),(c,d)\}$   
**b.  $\{(a,c),(a,d)\}$**   
 c.  $\{(c,a),(d,a)\}$     d.  $\{(a,c),(a,d),(b,d)\}$

04. **DEC 23**

If  $A = \{1,2\}$  ,  $B = \{3,4\}$  ,  $C = \{5,6\}$

then  $A \times (B \cup C)$

a)  $\{(1,2),(3,4),(5,6)\}$

$\{(1,3),(2,3),(1,4),(2,4),(2,5),(1,5),$   
 $(1,6),(2,6)\}$

c)  $\{(1,3),(2,3),(1,4),(2,4),(2,5),(1,5)\}$

d)  $\{(3,1),(2,3),(4,1),(2,4),(2,5),(1,5),$   
 $(1,6),(2,6)\}$

05. **DEC 23**

$A = \{2,4\}$  ,  $B = \{1,2,3\}$  then

$(A \cup B) \times (A \cap B)$

a)  $\{(1,2),(2,2),(3,2)\}$

b)  $\{(1,2),(2,2),(2,3),(2,4)\}$

c)  $\{(2,1),(2,2),(2,4)\}$

$\{(1,2),(2,2),(3,2),(4,2)\}$

## Q6 INVERSE RELATION

INVERSE RELATION ( $R^{-1}$ )

If  $R:A \rightarrow B$  then inverse relation  $R^{-1}:B \rightarrow A$

$R \subseteq A \times B$  then  $R^{-1} \subseteq B \times A$

$R = \{(1,a) , (2,b) , (3,c)\}$

then

$R^{-1} = \{(a,1) , (b,2) , (c,3)\}$

domain of  $R = \text{range of } R^{-1}$

range of  $R = \text{domain of } R^{-1}$

01.  $A = \{2,3,5,7\}$   $B = \{4,6,9,10,11\}$

$R$  is a relation defined as 'is a divisor of' from  $A$  to  $B$ .

find the domain and range of  $R^{-1}$

ans  $\{4,6,9,10\}$  ,  $\{2,3,5\}$

02. **JUNE 19**

$A = \{1,2,3,4,\dots,10\}$

$R$  is a relation on  $A$

$R = \{(x,y)/x+y=10 , x \in A , y \in A , x \geq y\}$

Find domain of  $R^{-1}$

ans  $\{1,2,3,4,5\}$

## Q7 REFLEXIVE - SYMMETRIC & TRANSITIVE RELATION

$A = \{1,2,3\}$  ,  $R:A \rightarrow A$

IS REFLEXIVE if  $(a,a) \in R$  for all  $a \in A$

$R = \{(1,1),(2,2),(3,3)\}$

IS SYMMETRIC if  $(a,b) \in R$  then  $(b,a) \in R$

$R = \{(1,2),(2,1),(2,3),(3,2)\}$

IS TRANSITIVE

if  $(a,b),(b,c) \in R$  then  $(a,c) \in R$

$R = \{(1,2) , (2,3) , (1,3)\}$

If  $R$  is REFLEXIVE , SYMMETRIC & TRANSITIVE the  $R$  has attained EQUIVALENCE

01.  $A = \{1,2,3\}$  ,  $R : A \rightarrow A$

$R = \{(1,1),(2,2),(3,3),(1,2),(2,3),(1,3)\}$

$R$  is

DEC 22

a. Symmetric & Transitive

b. Reflexive but not Transitive

c. Reflexive but not Symmetric

d. Neither Symmetric not Transitive

02. **JUNE 22**

$R = \{(3,3),(6,6),(9,9),(12,12),(6,12),$   
 $(3,9),(3,12),(3,6)\}$

defined on  $A = \{3,6,9,12\}$  then  $R$  is

a. Equivalence

b. Reflexive & Transitive only

c. Reflexive

d. Reflexive & Symmetric only

03. **JUNE 23**

$R = \{(1,2),(2,3)\}$  defined on set  $A = \{1,2,3\}$ . Find minimum no. of ordered pairs which when added to  $R$  will make it equivalence relation  
a. 5    b. 7   c. 6   d. 8

04. **DEC 21**

' $aRb$ ',  $(a-b)$  is an even integer, then relation  $R$  is

- a. Symmetric, reflexive but not transitive
- b. symmetric, transitive but not reflexive
- c. transitive, reflexive but not symmetric

d. Equivalence relation

05. **JUN 23**

' $xRy$ ',  $(x-y)$  is  $\div$  by 5.  $x, y \in \mathbb{N}$ , then relation  $R$  is

a. Equivalence

- b. Not Symmetric
- c. Symmetric but not Transitive
- d. Symmetric but not Reflexive

06. **JAN 21**

In the set of all straight lines on a plane which of the following is not TRUE

- a. 'Parallel to' is an equivalence relation
- b. 'Perpendicular to' is a symmetric relation

c. 'Perpendicular to' is an equivalence relation

d. 'Parallel to' is a reflexive relation

**FUNCTION**

**Q8**

IF EVERY ELEMENT OF SET  $A$  IS RELATED / MAPPED TO ONE AND ONLY ONE ELEMENT OF  $B$ , THEN  $R:A \rightarrow B$  IS CALLED  $f:A \rightarrow B$

01. **DEC 2015**

Which of these is a function from  $A \rightarrow B$

$A = \{x, y, z\}$ ,  $B = \{a, b, c, d\}$

- a.  $\{(x,a),(x,b),(y,c)\}$
- b.  $\{(x,a),(x,b),(y,c),(z,d)\}$
- c.  $\{(x,a),(y,b),(z,d)\}$
- d.  $\{(a,x),(b,z),(c,y)\}$

02. **JUNE 19**

which  $R:A \rightarrow B$  is function

$A = \{a, b, c, d\}$ ,  $B = \{p, q, r, s\}$

- a)  $R_1 \equiv \{(a,p), (b,q), (c,s)\}$
- b)  $R_2 \equiv \{(b,p), (c,s), (b,r)\}$

c)  $R_3 \equiv \{(a,p), (b,r), (c,q), (d,s)\}$

d) all the above

03. **DEC 18**

which  $R$  is function

a)  $R_1 \equiv \{(1,1),(1,2),(1,3)\}$

b)  $R_2 \equiv \{(1,1),(2,1),(2,3)\}$

c)  $R_3 \equiv \{(1,2),(2,2),(3,2),(4,2)\}$

d) none

04. **JUNE 2011**

$A = \{\pm 2, \pm 3\}$ ,  $B = \{1,4,9\}$  and

$f = \{(2,4),(-2,4),(3,9),(-3,9)\}$

then  $f$  is defined as

- a. one to one function from  $A$  into  $B$
- b. one to one function from  $A$  onto  $B$

c. many to one function from  $A$  into  $B$

d. many to one function from  $A$  onto  $B$

**Q9**

01. JAN 2021

$$f(x) = \begin{cases} 2x & , x > 3 \\ x^2 & , 1 < x \leq 3 \\ 3x & , x \leq 1 \end{cases}$$

Find  $f(-1) + f(2) + f(4)$

- a. 9    b. 14    c. 5    d. 6

02. DEC 2010

$f : \mathbb{R} \rightarrow \mathbb{R}, f(x) = x+1,$   
 $g : \mathbb{R} \rightarrow \mathbb{R}, g(x) = x^2+1,$  then  $f \circ g(-2)$

- a. 6     b. 5    c. -2    d. none

03. JULY 21

$f(x) = x^2-1, g(x) = |2x+3|$   
then  $f \circ g(3) - g \circ f(-3) = ?$

- a. 71     b. 61    c. 41    d. 51

04. JUNE 19

$f(x) = x^2, g(x) = \sqrt{x},$  then

- a.  $g \circ f(3) = 3$     b.  $g \circ f(-3) = 9$   
c.  $g \circ f(9) = 3$     d.  $g \circ f(-9) = 3$

**Q11 RANGE OF FUNCTION**

01. DEC 18

$A = \{1,2,3,4\}$

$B = \{1,4,9,16,25\}$

$f:A \rightarrow B, f(x) = x^2.$  Find the range of the  $f(x)$

- a.  $\{1,2,3,4\}$      b.  $\{1,4,9,16\}$   
c.  $\{1,4,9,16,25\}$     d. none

02. JULY 2021

The range of the function  $f$  defined as  $f(x) = \sqrt{16-x^2}$

- a.  $[-4,0]$     b.  $[-4,4]$      c.  $[0,4]$   
d.  $(-4,4)$

03. JUNE 2017

Find range of  $f(x) = \frac{x}{x^2+1}$

- a.  $(-1/2, 1/2)$     b.  $[-1/2, 1/2]$   
 c.  $[-1/2, 1/2]$     d. none

04. JUNE 2018

Find range of  $f(x) = \frac{x^6}{x^{12}+1}$

- a.  $(0, \infty)$     b.  $[-1/2, 1/2]$   
 c.  $[0, 1/2]$     d.  $(0, 1/2)$

**Q10 COMPOSITE FUNCTIONS**

01. JUNE 2017

$f(x) = \frac{1}{1-x} \quad g(x) = \frac{x-1}{x}$

Find  $g \circ f(x)$

- a.  $x-1$      b.  $x$     c.  $1-x$     d.  $-x$

02. JUNE 2011

$f(x) = \frac{x}{\sqrt{1+x^2}} \quad g(x) = \frac{x}{\sqrt{1-x^2}}$

$f \circ g(x) = ?$

- a.  $x$     b.  $1/x$     c.  $x/\sqrt{1-x^2}$   
d.  $x \cdot \sqrt{1-x^2}$

03. DEC 2017

$f(x) = \frac{x+1}{x+2} \quad f[f(1/x)]$

- a.  $\frac{2x+3}{3x+2}$     b.  $\frac{2x+5}{3x+2}$      c.  $\frac{3x+2}{5x+3}$     d.  $\frac{5x+2}{2x+3}$

**Q12 INVERSE OF A FUNCTION**

01. JUNE 23

$f(x) = 4x+3, \forall x \in \mathbb{N},$  then  $f^{-1}(x)$  is

- a.  $4 + \frac{(x+3)}{4}$     b.  $\frac{(x+3)}{4}$      c.  $\frac{(x-3)}{4}$   
d.  $\frac{(3x+4)}{4}$

02. JUNE 22

$f(p) = \frac{1}{1-p}, f^{-1}(p) =$

- a.  $\frac{1}{p-1}$     b.  $1-p$     c.  $\frac{1-p}{p}$      d.  $\frac{p-1}{p}$

03. **DEC 22**

$$u(x) = \frac{1}{1-x}, \quad u^{-1}(x) =$$

- a.  $\frac{1}{x-1}$     b.  $1-x$      c.  $1-\frac{1}{x}$     d.  $\frac{1-1}{x}$

04. **DEC 2019**

$$f(x) = 2x^3 + 1, \quad f^{-1}(x)$$

- a.  $\frac{1}{2}(x-1)^{1/3}$   
 b.  $(x-1/2)^{1/3}$   
c.  $(x-1/2)^{1/2}$   
d. none of these

05. **JULY 21**

$$A = \mathbb{R} - \{3\}, \quad B = \mathbb{R} - \{1\}$$

$$f : A \rightarrow B, \quad f(x) = \frac{x-2}{x-3}. \quad \text{Find } f^{-1}(1/2)$$

- a.  $2/3$     b.  $3/4$      c.  $1$     d.  $-1$



**DIFFERENTIAL CALCULUS**

|   |                                  |             |
|---|----------------------------------|-------------|
| $\frac{d}{dx} k$  | = 0                              | DERIVATIVES |
| $\frac{d}{dx} x$  | = 1                              | OF          |
| $\frac{d}{dx} x^2$  | = 2x                             | STANDARD    |
| $\frac{d}{dx} x^3$  | = 3x <sup>2</sup>                | FUNCTIONS   |
| $\frac{d}{dx} x^4$  | = 4x <sup>3</sup>                |             |
| $\frac{d}{dx} x^5$  | = 5x <sup>4</sup>                |             |
| $\frac{d}{dx} \frac{1}{x}$                                | = $-\frac{1}{x^2}$               |             |
| $\frac{d}{dx} \sqrt{x}$                                   | = $\frac{1}{2\sqrt{x}}$          |             |
| $\frac{d}{dx} \log x$                                     | = $\frac{1}{x}$                  |             |
| $\frac{d}{dx} e^x$  | = e <sup>x</sup>                 |             |
| $\frac{d}{dx} a^x$  | = a <sup>x</sup> .log a          |             |
| $\frac{d}{dx} 3^x$  | = 3 <sup>x</sup> .log 3          |             |
| $\frac{d}{dx} 4^x$  | = 4 <sup>x</sup> .log 4          |             |
| $\frac{d}{dx} x^x$  | = x <sup>x</sup> .(1+log x)      |             |
| $\frac{d}{dx} \log \left( x + \sqrt{x^2 \pm a^2} \right)$ | = $\frac{1}{\sqrt{x^2 \pm a^2}}$ |             |

**PRODUCT/QUOTIENT RULE**

01. **DEC 2021**  
 $y = \frac{x^4}{e^x}$ . then  $\frac{dy}{dx} =$
- a.  $x^3(4-x)/(e^x)^2$   
 b.  $x^3(4-x)/e^x$   
 c.  $x^2(4-x)/e^x$   
 d.  $x^3(4x-1)/e^x$  option b
02. **JUNE 22**  
 which of the following is the differentiation of  $e^t \cdot \log_e t$  wrt t
- a.  $e^t(t \cdot \log t)$     b.  $e^t(1+t \log_e t)/t$   
 c.  $e^t/t$     d.  $e^t(1-\log_e t)$   
 option b

**COMPOSITE FUNCTIONS**

03. **JULY 21**  
 $f(x) = 3 \cdot e^{x^4}$   
 $f'(x) - 4x^3 f(x) + \frac{1}{3} f(0) - f'(0) = ?$
- a. 0    b. e    c. 1    d. -1
04. **NOV 19**  
 if  $f(x) = a(x^2+x+1)^2$ ,  $f'(-1) = -6$ , then find a
- a. 1    b. 2    c. 3    d. 4  
 option c.

**LOGARITHMIC DIFFERENTIATION**

05. **DEC 22**  
 $y = x^x$ . Find  $\frac{dy}{dx}$  at  $x = 1$
- a. 0    b. 1    c. -1    d. 2  
 option b.

06. JUNE 2016

$$y = \frac{\sqrt{1-x}}{\sqrt{1+x}}, \text{ then } \frac{dy}{dx} =$$

- a.  $\frac{y}{x^2-1}$     b.  $\frac{y}{1-x^2}$     c.  $\frac{y}{1+x^2}$     d.  $\frac{y}{y^2-1}$

option b.

07. DEC 2016

$$y = \log_e (\sqrt{x-1} + \sqrt{x+1}) . \text{ Find } \frac{dy}{dx}$$

- a.  $\frac{1}{2\sqrt{x^2-1}}$     b.  $\frac{1}{2\sqrt{x^2+1}}$     c.  $\frac{1}{\sqrt{x-1} + \sqrt{x+1}}$

option a.

**IMPLICIT FUNCTIONS**

08. DEC 22

$$x^5 + y^5 - 5xy = 0, \text{ find } \frac{dy}{dx}$$

- a.  $\frac{y+x^4}{x+y}$     b.  $\frac{y-x^4}{y^4-x}$     c.  $\frac{x-y^4}{x-y}$     d.  $\frac{x+y^4}{x^4+y}$

option b.

09. DEC 23

$$x^3 + y^3 - 3axy = 0 . \text{ Find } \frac{dy}{dx}$$

- a)  $\frac{ay-x^2}{y^2-ax}$     b.  $\frac{x^2-ay}{y^2-ax}$     c.  $\frac{ay-x^2}{ax-y^2}$

d)  $\frac{x^2-ay}{ax-y^2}$

option a

10. JUNE 19

$$2^x - 2^y = 2^{x-y}, \text{ then } \frac{dy}{dx} \text{ at } x = y = 2$$

- a. 1    b. 2    c. 4    d. 5

option a.

**IMPLICIT FUNCTIONS**

11. DEC 18

$$x = at^3, t = a/t^3, \text{ then } \frac{dy}{dx}$$

- a.  $\frac{-3a}{t^6}$     b.  $\frac{-1}{t^6}$     c.  $\frac{1}{3at^2}$     d. none

12. DEC 23

$$x = 5t^2 + 3, y = 2t^2 + 1, \frac{dy}{dx} =$$

- a) 2    b) 1    c) 2t    d)  $\frac{2}{5}$

option d

**MAKE IMPLICIT TO EXPLICIT**

13. JUNE 23,

$$xy = 1, y^2 + \frac{dy}{dx} = ?$$

- a. 1    b. 0    c. -1    d.  $\frac{1}{2}$

option b.

14. DEC 2017

$$x^y = e^{x-y} . \text{ Find } \frac{dy}{dx}$$

- a.  $\frac{2\log x}{(1+\log x)^2}$     b.  $\frac{\log x}{1+\log x}$     c.  $\frac{\log x}{(1+\log x)^2}$

option c.

15. JUN 23

$$y = \frac{x}{x+5} . \text{ Find } \frac{dx}{dy}$$

- a.  $\frac{5}{(1-y)^2}$     b.  $\frac{5}{(1+y)^2}$     c.  $\frac{3}{(1-y)^2}$     d. none

option a.

**MAXIMA / MINIMA**

16. DEC 22

$$y = 2x^3 - 15x^2 + 36x + 10$$

maxima & minima occurs respectively at

- a.  $x=2, x=3$     b.  $x=1, x=3$

- c.  $x=3, x=2$     d.  $x=3, x=1$

option a

17. MAY 2018

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

- a. 3    b. 2    c. 1    d. 4

option a.

18. **JUNE 2019**

the total cost function of a firm is

$$C(x) = 150x - 5x^2 + \frac{x^3}{6}$$

Find output ,x at which marginal cost is equal to average cost

- a. 5    b. 10    c. 15    d. 20

option c.

19. **JAN 2021**

the cost function of production is given

$$C(x) = \frac{x^3}{2} - 15x^2 + 36x$$

Where x denotes the number of items produced . The level of output for which marginal cost and average cost are minimum

- a. 10,15    b. 10,12    c. 12,15    d. 15,10

20. **JULY 2021**

the cost function

$$C(x) = 125 + 500x - x^2 + \frac{x^3}{3}$$

and the demand function for the items is given

$$p(x) = 1500 - x$$

, then the marginal profit when 18 items are sold is

- a. 751    b. 571    c. 676    d. 875

INTEGRAL CALCULUS

LIST OF FORMULAE

$$\int 1 \, dx = x + C$$

$$\int x^n dx = \frac{x^{n+1}}{n+1} + c$$

$$\int \frac{1}{x} dx = \log x + C$$

$$\int \frac{1}{\sqrt{x}} dx = 2\sqrt{x} + C$$

$$\int e^x dx = e^x + C$$

$$\int a^x dx = \frac{a^x}{\log a} + C$$

$$\int \frac{1}{x^2 - a^2} dx = \frac{1}{2a} \log \left| \frac{x-a}{x+a} \right| + c$$

$$\int \frac{1}{a^2 - x^2} dx = \frac{1}{2a} \log \left| \frac{a+x}{a-x} \right| + c$$

$$\int \frac{1}{\sqrt{x^2 + a^2}} dx = \log \left| x + \sqrt{x^2 + a^2} \right| + C$$

$$\int \frac{1}{\sqrt{x^2 - a^2}} dx = \log \left| x + \sqrt{x^2 - a^2} \right| + C$$

$$\int \sqrt{x^2 + a^2} dx = \frac{x}{2} \sqrt{x^2 + a^2} + \frac{a^2}{2} \log \left| x + \sqrt{x^2 + a^2} \right|$$

$$\int \sqrt{x^2 - a^2} dx = \frac{x}{2} \sqrt{x^2 - a^2} - \frac{a^2}{2} \log \left| x + \sqrt{x^2 - a^2} \right|$$

$$\int \frac{f'(x)}{f(x)} dx = \log f(x) + k$$

$$\int e^x [f(x) + f'(x)] dx = e^x [f(x) + k]$$

$$\int uv dx = u \int v dx - \int \left( \frac{d}{dx} u \int v dx \right) dx$$

**Q1**

01. JUNE 23 – MTP I

$$\int_0^2 3x^2 dx$$

a. 7    b. -8    **c.** 8    d. -7

02. DEC 23 – MTP II

$$\int_1^4 (2x+5) dx$$

ans 30

03. NOV 19

$$\int_{-1}^1 (2x^2 - x^3) dx$$

a. 14    b. 104    c.  $\frac{2x^3 - x^4}{3/4}$     **d.** 4/3

04. JUNE 23 – MTP I

$$\int_0^1 (3x^2 + 2x + k) dx = 0$$

a. 0    b. -1    **c.** -2    d. 1

05. DEC 22

Find area under curve  $f(x) = x^2 + 5x + 2$  with limits 0 to 1

a. 3.833    b. 4.388    **c.** 4.833    d. none

06. DEC 18

$$\int_{-1}^3 (1 + 3x - x^3) dx$$

a. -3    **b.** -4    c. 3    d. 4

07. DEC 22 – MTP II

$$\int_0^1 (e^x + e^{-x}) dx$$

**a.**  $e - e^{-1}$     b.  $e^{-1} - e$     c.  $e + e^{-1}$   
d. none of these

08. DEC 23

$$\int_1^3 (e^x - 1/x^2) dx$$

- a.  $e^3 - e - \frac{2}{3}$       b.  $e^2 - e - \frac{1}{3}$   
c.  $e^3 + e + \frac{2}{3}$       d.  $e^3 - e + \frac{2}{3}$

09. NOV 19

$$\int \log_e a^x dx$$

- a.  $\log_e a^{\frac{x^2}{2}} + k$       b.  $\log_e a^{\frac{x}{2}} + k$   
c.  $x \cdot \log a^x - x + k$       d.  $x \cdot \log a^x + k$

10. DEC 2012 , JUNE 2013

$$\int 2^{3x} \cdot 3^{2x} \cdot 5^x \cdot dx$$

- a.  $\frac{2^{3x} \cdot 3^{2x} \cdot 5^x}{\log 720} + c$       b.  $\frac{2^{3x} \cdot 3^{2x} \cdot 5^x}{\log 360} + c$   
c.  $\frac{2^{3x} \cdot 3^{2x} \cdot 5^x}{\log 180} + c$       d.  $\frac{2^{3x} \cdot 3^{2x} \cdot 5^x}{\log 90} + c$

11. DEC 22 , JUNE 23 – MTP I

$$\int (2x+3)^5 dx$$

- a.  $\frac{(2x-3)^6}{6} + c$       b.  $\frac{(2x-3)^6}{6} + c$   
c.  $\frac{(2x+3)^6}{12} + c$       d.  $\frac{(2x-3)^6}{5} + c$

12. NOV 19

$$\int (4x+5)^6 dx$$

- a.  $\frac{(4x+5)^7}{7} + c$       b.  $\frac{(4x+5)^7}{28} + c$   
c.  $(4x+5)^7 + c$       d. none of these

**Q2**  $\int \frac{f'(x)}{f(x)} dx = \log f(x) + k$

01. JULY 21 – MTP I

$$\int \frac{2x+1}{x(x+1)} dx$$

- a.  $\log(x^2-x)+k$       b.  $\log(x^2+x)+k$   
c.  $\log(x^2+1)+k$       c. none of these

02. DEC 22 , JUNE 17

$$\int_2^4 \frac{x}{x^2+1} dx$$

- a.  $\frac{1}{2} \log\left(\frac{17}{5}\right)$       b.  $2 \log\left(\frac{17}{5}\right)$       c.  $\frac{1}{2} \log\left(\frac{5}{17}\right)$   
d.  $2 \log\left(\frac{5}{17}\right)$       option a

**Q3**  $\int e^x [f(x)+f'(x)]dx = e^x [f(x) + k$

01. JUNE 22 – MTP I

$$\int e^x(x^2+2x)dx$$

- a.  $x^2 \cdot e^x + c$       b.  $x \cdot e^x + c$       c.  $-x \cdot e^x + c$   
d.  $e^{-x} + c$

02. DEC 2016

$$\int_1^e e^x (x \log x + 1)x^{-1} \cdot dx$$

- a.  $e-1$       b.  $e^e$       c.  $e^e-1$       d. none

03. DEC 2016

$$\int_1^e e^x (x^{-1} - x^{-2}) \cdot dx$$

- a.  $e^{(e/2-1)}$       b.  $e(e-1)$       c.  $e^2(e-1)$   
d. none

**Q4** SUMS ON PARTIAL FRACTION

01.  $\int \frac{1}{(x-1)(x-2)} dx$

JUNE 23

- a.  $\log[(x-2)/(x-1)] + c$
- b.  $\log[(x-2)(x-1)] + c$
- c.  $\log[(x-1)/(x-2)] + c$
- d.  $\log[(x-2)(x+1)] + c$

02. JUNE 23 – MTP II

$\int \frac{6x+4}{(x-2)(x-3)} dx$

- a.  $22\log(x-3) + 16\log(x-2) + C$
- b.  $11\log(x-3) - 8\log(x-2) + C$
- c.  $22\log(x-3) - 16\log(x-2) + C$
- d.  $16\log(x-3) - 22\log(x-2) + C$

**Q5** INTEGRATION BY PARTS

01. JUNE 22 , DEC 22 MTP I , DEC 23 MTP II  
NOV 19

$\int_0^1 x \cdot e^x \cdot dx$

- a. -1    **b. 1**    c.  $e^1$     d.  $1/e$

02. JUNE 22 – MTP II

$\int x^2 \cdot 2^x dx$

- a.  $\frac{2^x \cdot x^2}{\log 2} - \frac{x \cdot 2^{x+1}}{(\log 2)^2} + \frac{2^{x+1}}{(\log 2)^3} + c$
- b.  $\frac{2^x \cdot x^3}{3} - \frac{x^2 \cdot 2^{x+1}}{(\log 2)^2} + \frac{2^{x+1}}{(\log 3)^2} + c$
- c.  $\frac{2^x \cdot x^2}{3} - \frac{x^3 \cdot 2^x}{3} + \frac{2^{x+1}}{(\log 2)^3} + c$

d. None of the above

option a

**Q6**  $\int_a^b f(x) \cdot dx = \int_a^b f(a+b-x) \cdot dx$

01. JUNE 2014

$\int_0^5 \frac{x^2}{x^2 + (5-x)^2} dx$

ans 5/2

02. MAY 2018 , DEC 2020

$\int_0^2 \frac{\sqrt{x}}{\sqrt{x} + \sqrt{2-x}} dx$

ans 1

03. JUNE 2019

$\int_2^3 \frac{\sqrt{x}}{\sqrt{5-x} + \sqrt{x}} dx$

ans 1/2

**Q7** APP OF INTEGRATION

01. JUNE 22 ,

Determine f(x) if ,  
 $f'(x) = 12x^2 - 4x$  &  $f(-3) = 17$

- a.  $f(x) = 4x^3 - 2x^2 + 143$
- b.  $f(x) = 6x^3 - x^4 + 137$
- c.  $f(x) = 3x^4 - x^3 - 137$
- d.  $f(x) = 4x^3 - 2x^2 - 143$

02. DEC 23 MTP I

equation of the curve which passes through (1,2) and has slope  $3x-4$  at point (x,y)

- a.  $2y = 3x^2 - 8x + 9$
- b.  $y = 6x^2 - 8x + 9$
- c.  $y = x^2 - 8x + 9$
- d.  $2y = 3x^2 - 8x + c$

03. **AUG 18 – MTP**

If  $MC = 10 - 0.01x + 0.009x^2$  where  $x$  is the quantity of production and total fixed cost = 100, then the total cost is

a.  $100 + 10x - 0.05x^2 + 0.0009x^3$

b.  $100 + 10x - 0.005x^2 + 0.003x^3$

c.  $100 + 10x - 0.05x^2 + 0.009x^3$

d. none of these

04. **DEC 21 – MTP II**

Marginal cost and marginal revenue of a commodity is  $C'(x) = 8 + 6x$  and  $R'(x) = 30$ . Fixed cost = 0 Find the total profit

a.  $22x + 3x^2$   b.  $22x - 3x^2$  c.  $22x - x^2$

d. none of these