CBSE SAMPLE PAPER - 02

Class 11 - Mathematics

Time Allowed: 3 hours **Maximum Marks: 80**

General Instructions:

1. This Question paper contains - five sections A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.
2. Section A has 18 MCQ's and 02 Assertion-Reason based questions of 1 mark each.
3. Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each.
4. Section C has 6 Short Answer (SA)-type questions of 3 marks each.
5. Section D has 4 Long Answer (LA)-type questions of 5 marks each.
6. Section E has 3 source based/case based/passage based/integrated units of assessment (4 marks each) with sub parts.

Section A

1. The domain of the function $f(x) = \sqrt{x-1} + \sqrt{6-x}$ **[1]**

a) (-∞, 6) b) [2, 6]

c) [1, 6] d) none of these

2. If a, b, α, β are real and (a + bi)^9 = $\alpha + i\beta$ then (b + ia)^9 = **[1]**

a) $\beta - i\alpha$ b) $-\alpha - i\beta$

c) $\alpha - i\beta$ d) $\beta + i\alpha$

3. The solution set of the inequation: $\frac{2x-1}{3} - \frac{3x}{5} + 1 < 0, x \in W$ is: **[1]**

a) none of these b) x ∈ N

c) null set d) x ∈ W

4. If two different numbers are taken from the set {0, 1, 2, 3, ...,10}, then the probability that their sum as well as absolute difference are both multiple of 4, is **[1]**

a) $\frac{7}{55}$ b) $\frac{14}{55}$

c) $\frac{6}{55}$ d) $\frac{12}{55}$

5. Let F_1 be the set of parallelograms, F_2 the set of rectangles, F_3 the set of rhombuses, F_4 the set of squares and F_5 the set of trapeziums in a plane. Then F_1 may be equal to **[1]**

a) $F_2 \cap F_3$ b) $F_3 \cap F_4$

c) $F_2 \cup F_5$ d) $F_2 \cup F_3 \cup F_4 \cup F_1$

6. $\lim_{x\to\infty} a^x \sin\left(\frac{b}{a^x}\right)$, a, b > 1 is equal to [1]

a) b
b) b $\log_e a$
c) a $\log_e b$
d) a

7. The number of terms in the expansion of $(a + b + c)^{10}$ is [1]

a) 55
b) 21
c) 11
d) 66

8. The mean and standard deviation of 100 items are 50, 5 and that of 150 items are 40, 6 respectively. What is the variance of all 250 items? [1]

a) 53.3
b) 55.6
c) 59.3
d) 50.6

9. The sum of an infinite GP is $\frac{80}{9}$ and its common ratio is $-\frac{4}{5}$. The first term of the GP is [1]

a) 16
b) 8
c) 20
d) 12

10. If $\frac{\pi}{2} < x < \frac{3\pi}{2}$, then $\sqrt{\frac{1-\sin x}{1+\sin x}}$ is equal to [1]

a) sec x + tan x
b) None of these
c) sec x - tan x
d) tan x - sec x

11. The intercept cut off by a line from y-axis is twice than that from x-axis, and the line passes through the point (1, 2). The equation of the line is [1]

a) 2x + y = 4
b) 2x + y + 4 = 0
c) 2x – y = 4
d) 2x – y + 4 = 0

12. $\lim_{x\to 4} \frac{3-\sqrt{5+x}}{1-\sqrt{5-x}} =$ [1]

a) does not exist
b) 0
c) $-\frac{1}{3}$
d) $\frac{1}{3}$

13. If $f(z) = \frac{7-z}{1-z^2}$, where z = 1 + 2i, then |f (z)| is [1]

a) |z|
b) $\frac{|z|}{2}$
c) 2|z|
d) none of these

14. The coordinates of the foot of the perpendicular drawn from the point (2, - 3, 4) on the y-axis is: [1]

a) (2, 0, 4)
b) (2, 3, 4)
c) (-2, -3, -4)
d) (0, -3, 0)

15. If the line 3x + 4y - 24 = 0 intersects the X-axis at the point A and the Y-axis at the point B, then the incentre of the triangle OAB, where O is the origin, is [1]

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

16. If ${}^{18}C_{15} + 2({}^{18}C_{16}) + {}^{17}C_{16} + 1 = {}^{n}C_3$ then n is equal to: [1]

a) 20 b) 18

c) 19 d) 24

17. $\lim_{x\to\infty} \frac{|x|}{x}$ is equal to **[1]**

a) 0 b) 1

c) None of these d) -1

18. The solution set for |x| > 7 **[1]**

a) $(-\infty,-7)\cap(7,\infty)$ b) none of these

c) $(7, \infty)$ d) $(-\infty,-7)\cup(7,\infty)$

19. **Assertion (A):** The value of $\sin(-690^o)\cos(-300^o) + \cos(-750^o)\sin(-240^o) = 1$. **[1]**

Reason (R): The values of sin and cos is negative in third and fourth quadrant respectively.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

20. **Assertion (A):** $\left(\sum_{r=0}^{100} {}^{500-r}C_3\right) + {}^{400}C_4 = {}^{501}C_4$ **[1]**

Reason (R): ${}^nC_r + {}^nC_{r-1} = {}^{n+1}C_r$

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

Section B

21. Prove that: $\frac{\tan A+\tan B}{\tan A-\tan B} = \frac{\sin(A+B)}{\sin(A-B)}$. **[2]**

22. For any two sets, prove that: $A \cup (A \cap B) = A$. **[2]**

23. An urn contains 5 white, 7 red, and 8 black balls. If four balls are drawn one by one with replacement, what is the probability that all are white? **[2]**

OR

If A and B are mutually exclusive event, P (A) = 0.35 and P (B) = 0.45, find P (B′)

24. What are the points on X-axis whose perpendicular distance from the straight line $\frac{x}{a}+\frac{y}{b}=1$ is a? **[2]**

25. Let A = {3, 5, 7}, B = {2, 6, 10} and R be a relation from A to B defined by R = {(x, y) : x and y are relatively prime}. Then, write R and R^{-1}. **[2]**

Section C

26. Evaluate : $\sqrt{-5+12i}$. **[3]**

27. Solve the inequality $x+\frac{x}{2}+\frac{x}{3}<11$ for real x. **[3]**

OR

Solve systems of linear inequation: $\frac{4}{x+1} \le 3 \le \frac{6}{x+1}, x > 0$

28. In the expansion of $(x + a)^n$, sums of odd and even terms are P and Q respectively, prove that **[3]**

i. $2(P^2 + Q^2) = (x + a)^{2n} + (x - a)^{2n}$

ii. $P^2 - Q^2 = (x^2 - a^2)^n$

OR

Find the number of integral terms in the expansion of $(5^{1/2} + 7^{1/8})^{1024}$.

29. Find the coordinates of the foot of perpendicular drawn from the point A (-1,8,4) to the line joining the points B (0,-1,3) and C(2,-3,-1). Hence, find the image of the point A in the line BC. **[3]**

OR

Show that the points (0, 7, 10), (-1, 6, 6) and (-4, 9, 6) are the vertices of a right angled isosceles triangle.

30. If the letters of the word ASSASSINATION are arranged at random. Find the probability that: No two A's are coming together **[3]**

31. Find the range of the function $f(x) = \frac{|x+4|}{x+4}$. **[3]**

Section D

32. Find the mean and standard deviation for the following data: **[5]**

Class interval	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Frequency	3	2	4	6	5	5	5	2	8	5

33. A class has 175 students. The following description gives the number of students studying one or more of the subjects in this class: mathematics 100, physics 70, chemistry 46; mathematics and physics 30; mathematics and chemistry 28; physics and chemistry 23; mathematics, physics and chemistry 18. Find **[5]**

i. how many students are enrolled in mathematics alone, physics alone and chemistry alone,
ii. the number of students who have not offered any of these subjects.

OR

In a survey of 25 students, it was found that 12 have taken physics, 11 have taken chemistry and 15 have taken mathematics; 4 have taken physics and chemistry; 9 have taken physics and mathematics; 5 have taken chemistry and mathematics while 3 have taken all the three subjects. Find the number o f students who have taken

i. physics only;
ii. chemistry only;
iii. mathematics only;
iv. physics and chemistry but not mathematics;
v. physics and mathematics but not chemistry;
vi. only one of the subjects;
vii. at least one of the three subjects;
viii. none of the three subjects.

34. Find the vertex, axis, focus, directrix and length of latusrectum of parabola $y^2 - 8y - x + 19 = 0$. **[5]**

OR

Find the equation of the hyperbola whose foci are (4, 2) and (8,2) and eccentricity is 2.

35. Differentiate If $y = \sqrt{\frac{\sec x - \tan x}{\sec x + \tan x}}$ show that $\frac{dy}{dx} = (\sec x \tan x + \sec x)$ **[5]**

Section E

36. **Read the text carefully and answer the questions:** **[4]**

One morning a big circus arrived in the Ramleela maidan at Delhi. The arrival of the circus was seen in the morning at 08:00 AM by Gopal. He passed this information on 08:15 to 2 other residents of the city.

Each of these 2 people then informed the other 2 residents at 08:30, and again at 08:45, they reported the arrival of the circus every 2 to other uninformed residents

This chain continued the same way till 12:00 PM. By 12:00 PM enough people were informed about the arrival of the circus.

(i) By 12:00 PM total how many people were informed about the arrival of the circus?

a) 131017
b) 131000
c) 65536
d) 141000

(ii) By 10:00 AM total how many people were informed about the arrival of the circus?

a) 500
b) 300
c) 511
d) 256

(iii) From 10:00 AM to 11:00 AM how many people were informed about the circus?

a) 7936
b) 7000
c) 8000
d) 7680

OR

What are the three terms between 16 and 256?

a) 32,64,128
b) 64,32,128
c) 16,32,64
d) 16,32,256

37. **Read the text carefully and answer the questions:** **[4]**

A restaurant offers 5 choices of appetizer, 10 choices of the main meal, and 4 choices of dessert. A customer can choose to eat just one course, or two different courses, or all the three courses. Assuming all choices are available.

Using the above information answer the following questions:

(i) If the customer has a 2-course meal, the number of ways of doing this is:

a) 38 b) 110

c) 200 d) 329

(ii) If the customer has a 3-course meal, the number of combinations is:

a) 300 b) 200

c) 110 d) 57

(iii) How many different possible meals do the restaurant offer i.e.The number of possible meals is:

a) 300 b) 329

c) 310 d) 200

OR

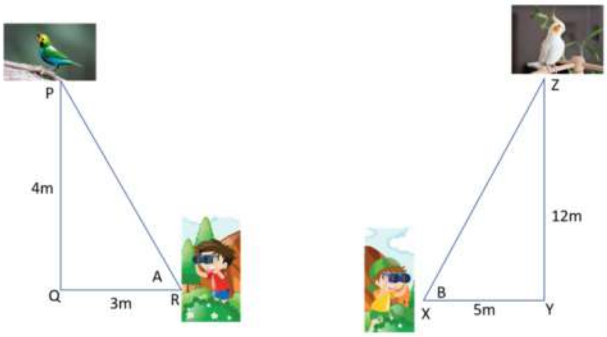
A person who eats an appetizer and the main meal has:

a) 20 choices b) 50 choices.

c) 40 choices d) 60 choices

38. **Read the text carefully and answer the questions:** **[4]**

Anand and Sri went for walking. Anand observes a bird on a top tree with an angle of elevation A. The distance between Anand and the tree on the ground is 3 m and height of the tree on which bird is sitting is 4m. At the same time Sri observes another bird on the top of house with angle of elevation B. The distance between Sri and house on the ground is 5m and height of the house where bird is sitting is 12m.



(i) Find the value of cos A + sin B.

(ii) Find the value of sin(A + B).

Solution

CBSE SAMPLE PAPER - 02

Class 11 - Mathematics

Section A

1. **(c)** [1, 6]

   Explanation: For f(x) to be real, we must have,

   $x - 1 \geqslant 0 \text{ and } 6 - x \geqslant 0$

   $\Rightarrow x \geqslant \varphi \text{ and } x - 6 \leqslant 6$

   $\therefore$ Domain = [1, 6]

2. **(d)** $\beta + i\alpha$

   Explanation: $(a + bi)^9 = \alpha + i\beta \Rightarrow i(\alpha + i\beta) = i(a + bi)^9$

   $\Leftrightarrow i\alpha - \beta = (ia - b)^9$ ...$[i = i^9]$

   Take conjugate

   $-i\alpha - \beta = (-ia - b)^9 = -(ia + b)^9$

   $\Rightarrow (b + ia)^9 = i\alpha + \beta$

3. **(c)** null set

   Explanation: $\frac{2x-1}{3} - \frac{3x}{5} + 1 < 0$

   $\Rightarrow 15.\frac{2x-1}{3} - 15.\frac{3x}{5} + 15 < 0$ [Multiply the inequality throughout by the L.C.M]

   $\Rightarrow 5(2x - 1) - 3(3x) + 15 < 0$

   $\Rightarrow 10x - 5 - 9x + 15 < 0$

   $\Rightarrow x + 10 < 0$

   $\Rightarrow x < -10$, but given $x \in W$

   Hence the solution set will be null set.

4. **(c)** $\frac{6}{55}$

   Explanation: Total number of ways of selecting 2 different numbers from {0, 1, 2, ..., 10} = $^{11}C_2 = 55$

   Let two numbers selected be x and y

   Then, x + y = 4m ...(i)

   and x - 4 = 4n ...(ii)

   $\Rightarrow 2x = 4(m + n)$ and $2y = 4(m - n)$

   $\Rightarrow x = 2(m + n)$ and $y = 2(m - n)$

   $\therefore$ x and y both are even numbers

x	y
0	4, 8
2	6,10
4	0, 8
6	2, 10
8	0, 4
10	2, 6

   $\therefore$ Required probability $= \frac{6}{55}$

5. **(d)** $F_2 \cup F_3 \cup F_4 \cup F_1$

   Explanation: We know that

   Every rectangle, square and rhombus is a parallelogram

   But, no trapezium is a paralleogrm

   Thus, $F_1 = F_2 \cup F_3 \cup F_4 \cup F_1$

6. **(a)** b

Explanation: $\lim_{x\to\infty} a^x \sin\left(\frac{b}{a^x}\right)$

$= \lim_{x\to\infty} b\left(\frac{\sin\frac{b}{a^x}}{\frac{b}{a^x}}\right)$

Let $\frac{b}{a^x} = y$

$x \to \infty$

$\therefore y \to 0$

$= \lim_{y\to 0} \frac{b\sin y}{y} = b$

7. **(d)** 66

Explanation: The number of terms in the expansion of (a + b + c)^{10} = $\frac{(10+1)(10+2)}{2} = \frac{11\times 12}{2}$

$= \frac{132}{2}$ = 66

8. **(b)** 55.6

Explanation: Given that, mean of 100 items, $\overline{x}_{100}$ = 50

Mean of 150 items, $\overline{x}_{150}$ = 40 and standard deviation of 100 items, σ_{100} = 5

Standard deviation of 150 items, σ_{150} = 6

Variance of all the 250 items

= $(\sigma_{250})^2$ = $(7.456)^2$ = 55.59 $\approx$ 55.6

9. **(a)** 16

Explanation: Here, we have r = $\frac{-4}{5}$ and therefore |r| = = $\frac{4}{5} < 1$.

$S_\infty = \frac{80}{9} \Rightarrow \frac{a}{(1-r)} = \frac{80}{9} \Rightarrow \frac{a}{\left(1+\frac{4}{5}\right)} = \frac{80}{9}$

$\Rightarrow \frac{5a}{9} = \frac{80}{9} \Rightarrow a = \left(\frac{80}{9}\times\frac{9}{5}\right) = 16$.

$\therefore$ the first term = 16.

10. **(d)** tan x - sec x

Explanation: $\sqrt{\frac{1-\sin x}{1+\sin x}}$

$= \sqrt{\frac{(1-\sin x)(1-\sin x)}{(1+\sin x)(1-\sin x)}}$

$= \sqrt{\frac{(1-\sin x)^2}{1-\sin^2 x}}$

$= \sqrt{\frac{(1-\sin x)^2}{\cos^2 x}}$

$= \frac{(1-\sin x)}{-\cos x}$ [as, $\frac{\pi}{2} < x < \frac{3\pi}{2}$, so cos θ will be negative]

= -(sec x - tan x)

= -sec x + tan x

11. **(a)** 2x + y = 4

Explanation: Suppose the line make intercept ‘a’ on x-axis. Then, it makes intercept ‘2a’ on y-axis.

Thuse, the equation of the line is given by $\frac{x}{a} + \frac{y}{2a} = 1$

It passes through (1, 2), so, we get

$\frac{1}{a} + \frac{2}{2a} = 1$ or $a = 2$

Thus, the required equation of the line is given by $\frac{x}{2} + \frac{y}{4} = 1$ or 2x + y = 4

12. **(c)** $-\frac{1}{3}$

Explanation: Equation is in the form of $\frac{0}{0}$

Using L' Hospital rule we get $\frac{-\frac{1}{2\sqrt{5+x}}}{\frac{1}{2\sqrt{5-x}}}$

Substituting x = 4 we get $\frac{-1}{3}$

13. **(b)** $\frac{|z|}{2}$

Explanation: Given f(z) = $\frac{7-z}{1-z^2}$ where z = 1 + 2i

$\Rightarrow |z| = \sqrt{1^2+2^2} = \sqrt{5}$

$\Rightarrow f(z) = \frac{7-z}{1-z^2}$

$= \frac{7-(1+2i)}{1-(1+2i)^2}$

$= \frac{7-(1+2i)}{1-(1+2i)^2}$

$= \frac{6-2i}{4-4i}$

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

$= \frac{3-i}{2-2i} \times \frac{2+2i}{2+2i}$

$= \frac{6+6i-2i-2i^2}{4-4i}$

$= \frac{6+4i+2}{4+4}$

$= \frac{8+4i}{8}$

$= 1 + \frac{1}{2}i$

$\Rightarrow |f(z)| = \sqrt{1^2 + \left(\frac{1}{2}\right)^2}$

$= \sqrt{1 + \frac{1}{4}}$

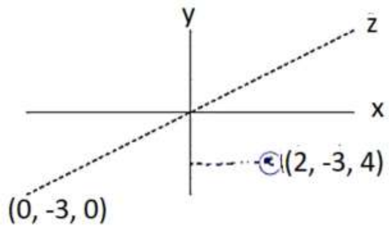
$= \frac{\sqrt{5}}{2}$

$= \frac{|z|}{2}$

14. **(d)** (0, -3, 0)

Explanation:

for y-axis ..x = 0, y = ?, z = 0



15. **(d)** (2, 2)

Explanation: Given equation of line is

3x + 4y - 24 = 0

For intersection with X-axis put y = 0

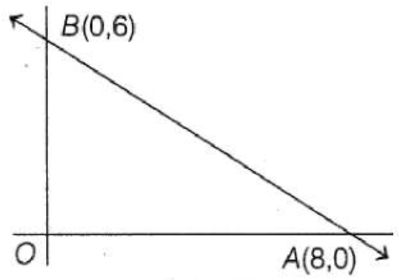
$\Rightarrow$ 3x - 24 = 0

$\Rightarrow$ x = 8

For intersection with Y-axis, put x = 0

$\Rightarrow$ 4y - 24 = 0 $\Rightarrow$ y = 6

$\therefore$ A(8, 0) and B (0, 6)



Let AB = c = $\sqrt{8^2 + 6^2} = 10$

OB = a = 6

and OA = b = 8

Also, let incentre is (h k). then

$h = \frac{ax_1+bx_2+cx_3}{a+b+c}$ (here, $x_1 = 8$, $x_2 = 0$, $x_3 = 0$)

$= \frac{6\times8+8\times0+10\times0}{6+8+10} = \frac{48}{24} = 2$

and $k = \frac{ay_1+by_2+cy_3}{a+b+c}$ (here, $y_1 = 0$, $y_2 = 6$, $y_3 = 0$)

$= \frac{6\times0+8\times6+10\times0}{6+8+10} = \frac{48}{24} = 2$

$\therefore$ Incentre is (2, 2)

16. **(a)** 20

Explanation: ${}^{18}C_{15} + 2({}^{18}C_{16}) + {}^{17}C_{16} + 1 = {}^{n}C_3$

${}^{18}C_{15} + {}^{18}C_{16} + {}^{18}C_{16} + {}^{17}C_{16} + 1 = {}^{n}C_3$ [$\because {}^{n}C_{r+1} + {}^{n}C_r = {}^{n+1}C_r$]

${}^{19}C_{16} + {}^{18}C_{16} + {}^{17}C_{16} + {}^{17}C_{17} = {}^{n}C_3$

${}^{19}C_{16} + {}^{18}C_{16} + {}^{18}C_{17} = {}^{n}C_3$

${}^{19}C_{16} + {}^{19}C_{17} = {}^{n}C_3$

${}^{20}C_{17} = {}^{n}C_3$

${}^{20}C_3 = {}^{n}C_3$

n = 20

17. **(b)** 1

Explanation: We know that,

$|x| = \begin{cases} x, & \text{if } x \geq 0 \\ -x, & \text{if } x < 0 \end{cases}$

$\therefore \frac{|x|}{x} = \begin{cases} \frac{x}{x}, & \text{if } x \geq 0 \\ \frac{-x}{x}, & \text{if } x < 0 \end{cases} = \begin{cases} 1, & \text{if } x \geq 0 \\ -1, & \text{if } x < 0 \end{cases}$

Now, for all $x \geq 0$ (however, x may large be).

$\frac{|x|}{x} = 1$

$\therefore \lim_{x\to\infty} \frac{|x|}{x} = 1$

18. **(d)** $(-\infty, -7) \cup (7, \infty)$

Explanation: |x| > 7

$\Rightarrow$ -7 > x > 7

$\Rightarrow$ x < -7 or x > 7 [$\because$ |x| > a $\Leftrightarrow$ x < -a or x > a]

$\Rightarrow x \in (-\infty, -7)$ or $x \in (7, \infty)$

$\Rightarrow x \epsilon (-\infty, -7) \cup (7, \infty)$

19. **(c)** A is true but R is false.

Explanation: Assertion:

sin (-690^o) cos(-300^o) + cos(-750^o) sin(-240^o) - sin(360 × 2 - 30) cos(360 - 60) + cos(360 × 2 + 30) [-sin(180 + 60)]

+ sin 30 × cos 60 + cos 30 [-sin (-60)]

sin 30 × cos 60 - cos 30 [+ sin 60]

$\frac{1}{2} \times \frac{1}{2} + \frac{\sqrt{3}}{2} \times \frac{\sqrt{3}}{2}$

$\frac{1}{4} + \frac{3}{4} \Rightarrow \frac{4}{4} \Rightarrow 1$

Reason: The value of cos is positive in fourth quadrant.

20. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation: $\sum_{r=0}^{100} {}^{500-r}C_3 + {}^{400}C_4$

$= {}^{500}C_3 + {}^{499}C_3 + ... + {}^{401}C_3 + {}^{400}C_3 + {}^{400}C_4$

$= {}^{500}C_3 + {}^{499}C_3 + ... {}^{401}C_3 + {}^{401}C_4$

$= {}^{500}C_3 + {}^{499}C_3 + ... + {}^{402}C_4$

Similarly,

${}^{500}C_3 + {}^{500}C_4$

${}^{501}C_4$ = RHS

Section B

21. To prove: $\frac{\tan A+\tan B}{\tan A-\tan B}=\frac{\sin(A+B)}{\sin(A-B)}$

L.H.S $=\frac{\tan A+\tan B}{\tan A-\tan B}$

$=\frac{\frac{\sin A}{\cos A}+\frac{\sin B}{\cos B}}{\frac{\sin A}{\cos A}-\frac{\sin B}{\cos B}}$

$=\frac{\frac{\sin A\cos B+\cos A\sin B}{\cos A\cos B}}{\frac{\sin A\cos B-\cos A\sin B}{\cos A\cos B}}$

$=\frac{\sin A\cos B+\cos A\sin B}{\sin A\cos B-\cos A\sin B}$

$=\frac{\sin(A+B)}{\sin(A-B)}$

= R.H.S

Hence proved.

22. A ∪ (A ∩ B) [∵ union is distributive over intersection]

Therefore, we get,

= (A ∪ A) ∩ (A ∪ B) [∵ A ∪ A = A]

= A ∩ (A ∪ B)

= A

23. Let p denote the probability of drawing a white ball from an urn containing 5 white, 7 red and 8 black balls. Then,we have,

$p=\frac{{}^5C_1}{{}^{20}C_1}=\frac{5}{20}=\frac{1}{4}$ so, $q=1-p=1-\frac{1}{4}=\frac{3}{4}$

Let X be a random variable denoting the number of white balls in 4 draws with replacement. Then, X is a binomial variate with parameters n = 4 p $=\frac{1}{4}$ such that

$P(X=r)$ = Probability that r balls are white = ${}^4C_r\left(\frac{1}{4}\right)^r\left(\frac{3}{4}\right)^{4-r}$,r = 0,1, 2, 3, 4

Now,

Probability that all are white = $P(X=4)$

= ${}^4C_4\left(\frac{1}{4}\right)^4\left(\frac{3}{4}\right)^{4-4}=\left(\frac{1}{4}\right)^4$ [Using (i)]

OR

We know that,

P (B) + P (B') = 1

⇒ 0.45 + P(B') = 1

⇒ P(B') = 1 – 0.45

⇒ P(B') = 0.55

24. Suppose (t, 0) be a point on the x-axis.

It is given that the perpendicular distance of the line $\frac{x}{a}+\frac{y}{b}=1$ from a point is a.

$\therefore\left|\frac{\frac{t}{a}+0-1}{\sqrt{\frac{1}{a^2}+\frac{1}{b^2}}}\right|=a$

$\Rightarrow a^2\left(\frac{1}{a^2}+\frac{1}{b^2}\right)=\frac{t^2}{a^2}+1-\frac{2t}{a}$

$\Rightarrow 1+\frac{a^2}{b^2}=\frac{t^2}{a^2}+1-\frac{2t}{a}$

$\Rightarrow \frac{a^2}{b^2}=\frac{t^2}{a^2}-\frac{2t}{a}$

⇒ $b^2t^2 - 2ab^2t - a^4 = 0$

$\Rightarrow t=\frac{2ab^2\pm2\sqrt{a^2b^4+b^2a^4}}{2b^2}$

$\Rightarrow t=\frac{a}{b}(b\pm\sqrt{a^2+b^2})$

Therefore, the required points on the x-axis are

$\left(\frac{a}{b}(b-\sqrt{a^2+b^2}),0\right)$ and $\left(\frac{a}{b}(b+\sqrt{a^2+b^2}),0\right)$

25. Given A = {3, 5, 7}, B = {2, 6, 10} and R = {(x, y) : x and y are relatively prime }

According to the condition, x and y are prime numbers.

⇒ R= {(3, 2), (5, 2), (7, 2)}

R^{-1}= { (2, 3), (2, 5), (2, 7)}

Section C

26. Let $\sqrt{-5+12i} = (x+iy)$ ....(i)

On squaring both sides of (i), we get

- 5 + 12i = $(x + iy)^2 \Rightarrow$ - 5 + 12z = $(x^2 - y^2)$ + i(2xy). .....(ii)

On comparing real parts and imaginary parts on both sides of (ii),

we get

$x^2 - y^2 = -5$ and 2xy = 12

=> $x^2 - y^2 = -5$ and xy = 6

$\Rightarrow (x^2+y^2) = \sqrt{(x^2-y^2)^2 + 4x^2y^2} = \sqrt{(-5)^2 + 4 \times 36} = \sqrt{169} = 13$

$\Rightarrow x^2 - y^2 = -5$........(iii) and $x^2 + y^2 = 13$ ....(iv)

add equation (iii) and (iv) and subtract equation (iii) and (iv) we get,

$\Rightarrow 2x^2 = 8$ and $2y^2 = 18$

$\Rightarrow x^2 = 4$ and $y^2 = 9$

$\Rightarrow x = \pm 2$ and y = $y = \pm 3$

Since xy > 0, so x and y are of the same sign.

$\therefore$ (x = 2 and y = 3) or (x = -2 and y = -3).

Hence, $\sqrt{-5+12i} = (2+3i)$ or (-2 - 3i).

27. Here $x + \frac{x}{2} + \frac{x}{3} < 11$

$\Rightarrow \frac{6x+3x+2x}{6} < 11$

$\Rightarrow \frac{11x}{6} < 11$

Multiplying both sides by 6, we have

11x < 66

Dividing both sides by 11, we have

x < 6

Thus the solution set is $(-\infty, 6)$

OR

Given that,

$\frac{4}{x+1} \leq 3 \leq \frac{6}{x+1}, x > 0$

==> 4 $\leq$ 3(x+1) < 6 [multiply by (x+1)]

==> 4 $\leq$ 3x + 3 < 6

now, 3x + 3 $\geq$ 4 and 3x + 3 < 6

==> 3x $\geq$ 1 and 3x < 3

==> x $\geq \frac{1}{3}$ and x < 1

==> $\frac{1}{3} \leq$ x < 1

28. Here $(x + a)^n = {}^nC_0x^n + {}^nC_1x^{n-1}a + {}^nC_2x^{n-2}a^2 + \ldots + {}^nC_na^n$

= P + Q . . . (i)

where $P = {}^nC_0x^n + {}^nC_3x^{n-3}a^3 + \ldots.$

$Q = {}^nC_1x^{n-1}a + {}^nC_3x^{n-3}a^3 + \ldots.$

Also $(x-a)^n = {}^nC_0x^n - {}^nCx^{n-1}a + {}^nC_2x^{n-2}a^2 + \ldots + (-1)^n{}^nC_na^n \ldots$ (ii)

= P - Q

(i) Squaring and adding (i) and (ii) we have

$(x + a)^{2n} + (x - a)^{2n} = (P + Q)^2 + (P - Q)^2$

= $P^2 + Q^2 + 2PQ + P^2 + Q^2 - 2PQ$

= $2P^2 + 2Q^2 = 2(P^2 + Q^2)$

(ii) Multiplying(i) and (ii) we have

$(x + a)^n (x - a)^n = (P + Q)(P - Q)$

$(x^2 - a^2)^n = P^2 - Q^2$

OR

The general term T_{r+1} in the expansion of $(5^{1/2} + 7^{1/8})^{1024}$ is given by

$T_{r+1} = {}^{1024}C_r\, (5^{1/2})^{1024-r}\, (7^{1/8})^r$

$\Rightarrow T_{r+1} = {}^{1024}C_r\, 5^{512-r/2}\, 7^{r/8}$

$\Rightarrow T_{r+1} = \{{}^{1024}C_r\, 5^{512-r}\} \times 5^{r/2} \times 7^{r/8}$

$\Rightarrow T_{r+1} = \{{}^{1024}C_r\, 5^{512-r}\} \times (5^4 \times 7)^{r/8}$

Clearly, T_{r+1} will be an integer, if

r/8 is an integer such that $0 < r \leq 1024$

$\Rightarrow$ r is a multiple of 8 satisfying $0 < r \leq 1024$

$\Rightarrow r = 8, 16, 24, \ldots, 1024$

$\Rightarrow$ r can assume 128 values.

Hence, there are 128 integral terms in the expansion of $(5^{1/2} + 7^{1/8})^{1024}$.

29. The equation of a line joining the points $B(0, -1, 3)$ *and* $C(2, -3, -1)$ is

$\vec{r} = (0\hat{i} - \hat{j} + 3\hat{k}) + \lambda[(2-0)\hat{i} + (-3+1)\hat{j} + (-1-3)\hat{k}]$

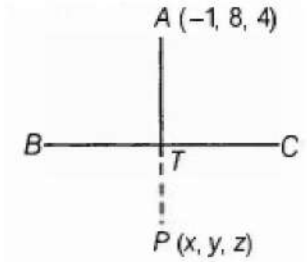
$\Rightarrow \quad \vec{r} = (-\hat{j} + 3\hat{k}) + \lambda(2\hat{i} - 2\hat{j} - 4\hat{k})$

$\Rightarrow \quad \vec{r} = (2\lambda)\hat{i} + (-2\lambda - 1)\hat{j} + (-4\lambda + 3)\hat{k}$

Any point on line BC is to the form

$(2\lambda, -2\lambda - 1, -4\lambda + 3)$

Suppose foot of the perpendicular drawn from point A to the line BC be $T(2\lambda, -2\lambda - 1, -4\lambda + 3)$



Direction Ratios of line AT is $(2\lambda + 1, -2\lambda - 1 - 8, -4\lambda - 1)$

Direction Ratios of BC is (2-0, -3+1, -1-3) = (2, -2, -4)

Since, AT is perpendicular to BC ,

$\therefore \quad 2 \times (2\lambda + 1) + (-2 \times (-2\lambda - 9) + (-4)(-4\lambda - 1) = 0 \;\; [\because a_1 a_2 + b_1 b_2 + c_1 c_2 = 0]$

$\Rightarrow \quad 4\lambda + 2 + 4\lambda + 18 + 16\lambda + 4 = 0$

$\lambda = -1$

$\therefore$ Coordinates of foot of perpendicular is

$T(2 \times (-1), -2 \times (-1) - 1, -4 \times (-1) + 3)$

$= T(-2, 1, 7)$

Suppose P(x, y, z) be the image of a point A with respect to the line BC. So, point T is the mid-point of AP.

$\therefore$ Coordinates of T = Coordinates of mid-point of AP

$\Rightarrow \quad (-2, 1, 7) = \left(\frac{x-1}{2}, \frac{y+8}{2}, \frac{z+4}{2}\right)$

Equating the corresponding coordinates,

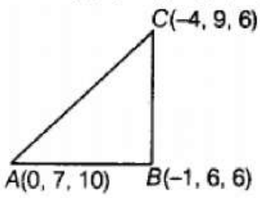
$\Rightarrow -2 = \frac{x-1}{2}, 1 = \frac{y+8}{2}$ and $7 = \frac{z+4}{2}$

$\Rightarrow x = -3, y = -6$ *and* $z = 10$

Coordinates of the foot of perpendicular is $T(-2, 1, 7)$ and image of the point A is $P(-3, -6, 10)$.

OR

Let A (0, 7, 10), B (-1, 6,6) and C (-4, 9, 6) be the given points. We have,



Now, $AB = \sqrt{(-1-0)^2 + (6-7)^2 + (6-10)^2}$ [$\because$ distance = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$]

$= \sqrt{1 + 1 + 16} = \sqrt{18} = 3\sqrt{2}$

$BC = \sqrt{(-4+1)^2 + (9-6)^2 + (6-6)^2}$

$= \sqrt{9+9+0} = \sqrt{18} = 3\sqrt{2}$

and $AC = \sqrt{(-4-0)^2 + (9-7)^2 + (6-10)^2}$

$= \sqrt{16+4+16}$

$\therefore \quad AC = \sqrt{36} = 6$ ...... (i)

Now, $AB^2 + BC^2 = (3\sqrt{2})^2 + (3\sqrt{2})^2 = 18 + 18 = 36$

$\therefore AB^2 + BC^2 = AC^2$ [from Eq. (i)]

Also, $AB = BC = 3\sqrt{2}$

Hence, ABC is a right isosceles triangle.

30. Since we have to get the probability that no two A's are coming together,

So, first we arrange the alphabets except A's

S		S		S		S		I		N		T		I		O		N	

$\therefore$ Number of ways of arranging all alphabets except A's $= \frac{10!}{4!2!2!}$

As we know that there are 11 vacant places between these alphabets.

Total A's in the word ASSASSINATION are 3

$\therefore$ 3 A's can be placed in 11 place in $^{11}C_3$ ways

$= \frac{11!}{3!(11-3)!} = \frac{11!}{3!8!}$

$\therefore$ Total number of words when no two A's together

$= \frac{11!}{3!8!} \times \frac{10!}{4!2!2!}$

$\therefore$ Required Probability $= \frac{\frac{11!}{3!8!} \times \frac{10!}{4!2!2!}}{\frac{13!}{3!4!2!2!}}$

$= \frac{11!}{3!8!} \times \frac{10!}{4!2!2!} \times \frac{3!4!2!2!}{13!}$

$= \frac{11! \times 10 \times 9 \times 8!}{8! \times 13 \times 12 \times 11!}$

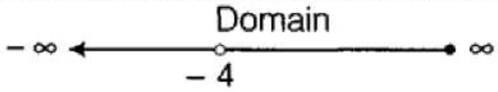
$= \frac{10 \times 9}{13 \times 12}$

$= \frac{15}{26}$

31. Given, $f(x) = \frac{|x+4|}{x+4}$

Clearly, for f to be defined, the denominator $x + 4 \neq 0$ i.e., $x \neq -4$.

$\therefore$ the domain of f is the set of all real numbers excluding -4.



Now, consider the two cases

When $x + 4 > 0$ i.e., $x > -4$

Then, $|x+4| = x + 4$,

$\Rightarrow f(x) = \frac{|x+4|}{x+4} = \frac{x+4}{x+4} = 1$ for all $x > -4$

When $x + 4 < 0$ i.e., $x < -4$

Then, $|x+4| = -(x+4)$

$\therefore \quad f(x) = \frac{|x+4|}{x+4} = \frac{-(x+4)}{(x+4)} = -1$ for all $x < -4$

$f(x) = \begin{cases} 1, & \text{if } x > -4 \\ -1, & \text{if } x < -4 \end{cases}$

$\therefore$ The range of f is $\{-1, 1\}$.

Section D

32. We make the table from the given data:

Class marks	Mid value (x_i)	$d_i = x_i - a = x_i - 45$	f_i	$f_i d_i$	d_i^2	$f_i d_i^2$
0-10	5	-40	3	-120	1600	4800
10-20	15	-30	2	-60	900	1800
20-30	25	-20	4	-80	400	1600
30-40	35	-10	6	-60	100	600

40-50	45	0	5	0	0	0
50-60	55	10	5	50	100	500
60-70	65	20	5	100	400	2000
70-80	75	30	2	60	900	1800
80-90	85	40	8	320	1600	12800
90-100	95	50	5	250	2500	12500
			$\sum f_i = 45$	$\sum f_i d_i = 460$		$\sum f_i d_i^2 = 38400$

Let a = 45.

$\therefore$ Mean $= a + \frac{\sum f_i d_i}{\sum f_i}$

$= 45 + \frac{460}{45}$

$= 45 + 10.22 = 55.22$

$\therefore$ Standard deviation $= \sqrt{\frac{\sum f_i d_i^2}{\sum f_i} - \left(\frac{\sum f_i d_i}{\sum f_i}\right)^2}$

$= \sqrt{\frac{38400}{45} - (10.22)^2}$

$= \sqrt{853.33 - 104.45}$

$= \sqrt{748.88}$

$= 27.36$

33. Here,it is given that

Number of students in class = 175

Number of students enrolled in Mathematics = 100 and we have,

Number of students enrolled in Physics = 70

Number of students enrolled in Chemistry = 46

Number of students enrolled in Mathematics and Physics = 30

Number of students enrolled in Physics and Chemistry = 23

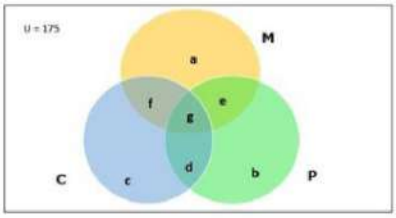
Number of students enrolled in Mathematics and Physics = 28

Number of students enrolled in all three subjects = 18

We have to find:

i. Number of students enrolled in Mathematics alone, Physics alone and Chemistry alone

Venn diagram:



Number of students enrolled in Mathematics = 100 = n(M)

Number of students enrolled in Physics = 70 = n(P)

Number of students enrolled in Chemistry = 46 = n(C)

Number of students enrolled in Mathematics and Physics = 30 = $n(M \cap P)$

Number of students enrolled in Mathematics and Chemistry = 28 = $n(M \cap C)$

Number of students enrolled in Physics and Chemistry = 23 = $n(P \cap C)$

Number of students enrolled in all the three subjects = 18 = $n(M \cap P \cap C) = g$

Therefore, we have,

$n(M \cap P) = e + g$

$30 = e + 18$

$e = 30 - 18 = 12$

$n(M \cap C) = f + g$

$28 = f + 18$

$f = 28 - 18 = 10$

$n(P \cap C) = d + g$

23 = d + 18

d = 23 - 18 = 5

a = Number of students enrolled only in Mathematics

b = Number of students enrolled only in Physics

c = Number of students enrolled only in Chemistry

Therefore, we have,

M = a + e + f + g

100 = a + 12 + 10 + 18

a = 100 - 40

a = 60

Thus, Number of students enrolled only in Mathematics = 60

P = b + e + d + g

70 = b + 12 + 5 + 18

b = 70 - 35

b = 35

Thus, Number of students enrolled only in Physics = 35

C = c + f + d + g

46 = c + 10 + 5 + 18

c = 46 - 33

c = 13

Thus, Number of students enrolled only in Chemistry = 13

ii. Number of students who have not offered any of these subjects

Number of students who have not offered any of these subjects

$= 175 - \{n(M) + n(P) + n(C) - n(M \cap P) - n(M \cap C) - n(P \cap C) + n(M \cap P \cap C)\}$

= 175 - (100 + 70 + 46 - 30 - 28 - 23 + 18)

= 175 - 153 = 22

Thus, Number of required students who have not offered any of these subjects = 22

OR

Let P, C and M be the sets of students who have taken physics, chemistry and mathematics respectively. Let a, b, c, d, e ,f and g denote the number of students in the respective regions, as shown in the adjoining Venn diagram.

As per data given, we have

a + b + c + d = 12,

b + c + e + f= 11,

c + d + f + g + 15,

b + c = A ,

c + d = 9,

c+ f = 5,

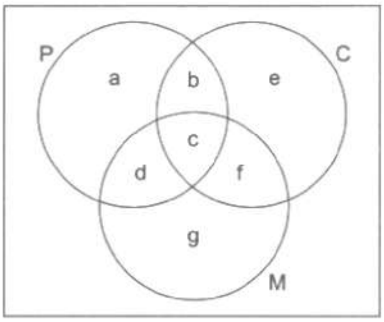
c = 3.

From these equations, we get

c = 3, f = 2 , d = 6,b = 1.

Now, $c + d + f + g = 15 \Rightarrow 3 + 6 + 2 + g = 15 \Rightarrow g = 4$;

$b + c + e + f = 11 \Rightarrow 1 + 3 + e + 2 = 11 \Rightarrow e = 5$;



$a + b + c + d = 12 \Rightarrow 0 + 1 + 3 + 6 = 12 \Rightarrow 0 = 2$;

∴ a = 2, b = 1, c = 3, d = 6, e = 5, f = 2 and g = 4.

So, we have:

i. Number of students who offered physics only = 0 = 2.
ii. Number of students who offered chemistry only = e = 5.
iii. Number of students who offered mathematics only g = 4.
iv. Number of students who offered physics and chemistry but not mathematics = b = 1.
v. Number of students who offered physics and mathematics but not chemistry = d = 6.
vi. Number of students who offered only one of the given subjects = (0 + e + g) = (2 + 5 + 4) = 11.
vii. Number of students who offered at least one of the given subjects = (a + b + c + d + e + f + g) = (2 + l + 3 + 6 + 5 + 2 + 4) = 23.
viii. Number of students who offered none of the three given subjects = (25 - 23) = 2

34. Given equation is

$y^2 - 8y - x + 19 = 0$

$\Rightarrow y^2 - 8y + 16 = x - 19 + 16$

$\Rightarrow (y - 4)^2 = x - 3$ ...(i)

Let y - 4 = Y and x - 3 = X

Then, Eq. (i) becomes,

$Y^2 = X$ ...(ii)

Now, from Eq. (ii), coordinates of vertex are,

X = 0 and Y = 0

$\Rightarrow$ x - 3 = 0 and y - 4 = 0

$\Rightarrow$ x = 3 and y = 4

On comparing Eq. (ii) with $Y^2 = 4aX$, we get

$4a = 1 \Rightarrow a = \frac{1}{4}$

Coordinates of focus of parabola (ii) are,

X = a, Y = 0

$\Rightarrow x - 3 = \frac{1}{4}, y - 4 = 0$

$\Rightarrow x = \frac{1}{4} + 3, y = 4 \Rightarrow x = \frac{13}{4}, y = 4$

Equation of directrix of parabola (ii) is,

X = - a

$\Rightarrow x - 3 = -\frac{1}{4}$

$\Rightarrow x = -\frac{1}{4} + 3 \Rightarrow x = \frac{11}{4}$

Length of latusrectum = $|4a| = \left|4 \cdot \frac{1}{4}\right| = 1$

Hence, for given parabola vertex = (3, 4), axis, y = 4, focus $= \left(\frac{13}{4}, 4\right)$, directrix, $x = \frac{11}{4}$ and the length of latusrectum = 1.

OR

The centre of the hyperbola is the mid-point of the line joining the two foci.

So, the coordinates of the centre are $\left(\frac{4+8}{2}, \frac{2+2}{2}\right)$ i.e., (6, 2).

Let 2a and 2b be the length of transverse and conjugate axes and let e be the eccentricity.

Then, the equation of the hyperbola is

$\frac{(x-6)^2}{a^2} - \frac{(y-2)^2}{b^2} = 1$ ...(i)

Now, the distance between two foci = 2ae

$\Rightarrow \sqrt{(8-4)^2 + (2-2)^2} = 2ae$ [∵ foci = (4, 2) and (8, 2)]

$\Rightarrow \sqrt{(4)^2} = 2ae$

$\Rightarrow 2ae = 4$

$\Rightarrow 2 \times a \times 2 = 4$ [∵ e = 2]

$\Rightarrow a = \frac{4}{4} = 1$

$\Rightarrow a^2 = 1$

Now,

$b^2 = a^2 (e^2 - 1)$

$\Rightarrow b^2 = 1(2^2 - 1)$ [$\because$ e = 2]

$\Rightarrow b^2 = 4 - 1$

$\Rightarrow b^2 = 3$

Putting $a^2 = 1$ and $b^2 = 3$ in equation (i), we get

$\frac{(x-6)^2}{1} - \frac{(y-2)^2}{3} = 1$

$\Rightarrow \frac{3(x-6)^2-(y-2)^2}{3} = 1$

$\Rightarrow 3(x - 6)^2 - (y - 2)^2 = 3$

$\Rightarrow 3[x^2 + 36 - 12x] - [y^2 + 4 - 4y] = 3$

$\Rightarrow 3x^2 + 108 - 36x - y^2 - 4 + 4y = 3$

$\Rightarrow 3x^2 - y^2 - 36x + 4y + 101 = 0$

This is the equation of the required hyperbola.

35. We have to show that $\frac{dy}{dx} = (\sec x \tan x + \sec x)$

where, it is given that

$y = \sqrt{\frac{\sec x-\tan x}{\sec x+\tan x}}$

$y = \sqrt{\frac{\frac{1}{\cos x}\ \frac{\sin x}{1}}{\cos x} + \frac{\sin x}{\cos x}} = \sqrt{\frac{1-\sin x}{1+\sin x}}$

$u = 1 - \sin x,\ v = 1 + \sin x,\ x = \frac{1-\sin x}{1+\sin x}$

if $z = \frac{u}{v}$

$\frac{dz}{dx} = \frac{v\times\frac{du}{dx} - u\times\frac{dv}{dx}}{v^2}$

$= \frac{(1+\sin x)\times(-\cos x)-(1-\sin x)\times(\cos x)}{(1+\sin x)^2}$

$= \frac{-\cos x-\sin x\cos x-\cos x+\sin x\cos x}{(1+\sin x)^2}$

$= \frac{-2\cos x}{(1+\sin x)^2}$

According to the chain rule of differentiation

$\frac{dy}{dx} = \frac{dy}{dz} \times \frac{dz}{dx}$

$= \left[-\frac{\cos x}{1} \times \left(\frac{1-\sin x}{1}\right)^{-\frac{1}{2}}\right] \times \left[\frac{1}{(1+\sin x)^{2-\frac{1}{2}}}\right]$

$= \left[\cos x \times (1+\sin x)^{-\frac{1}{2}}\right] \times (1-\sin x)^{-\frac{3}{2}} \times \left(\frac{1+\sin x}{1+\sin x}\right)^{\frac{3}{2}}$

Multiplying and dividing by $(1+\sin x)^{\frac{3}{2}}$

$= \left[\cos x \times (1+\sin x)^{\frac{2}{2}-\frac{1}{2}}\right] \times (1-\sin x)^{-\frac{2}{2}} \times \left(\frac{1}{1+\sin x}\right)^{\frac{3}{2}}$

$= \left[\cos x \times (1+\sin x)^{\frac{2}{2}-\frac{1}{2}}\right] \times (1-\sin x)^{-\frac{2}{2}} \times (1+\sin x)^{-\frac{2}{2}}$

$= \left[\cos x \times (1+\sin x)^{1}\right] \times (1-\sin^2 x)^{-\frac{3}{2}}$

$= \left[\cos x \times (1+\sin x)^{1}\right] \times (\cos^2 x)^{-\frac{3}{2}}$

$= \left[\cos x \times (1+\sin x)^{1}\right] \times (\cos x)^{-3}$

$= \left[(1+\sin x)^{1}\right] \times (\cos x)^{-3+1}$

$= \frac{1+\sin x}{\cos^2 x}$

$= \frac{1}{\cos^2 x} \times \frac{1+\sin x}{\cos^2 x}$

$= \sec x\left(\frac{1}{\cos x} + \frac{\sin x}{\cos x}\right)$

= sec x (sec x + tan x)

Hence proved

Section E

36. **Read the text carefully and answer the questions:**

One morning a big circus arrived in the Ramleela maidan at Delhi. The arrival of the circus was seen in the morning at 08:00 AM by Gopal. He passed this information on 08:15 to 2 other residents of the city.

Each of these 2 people then informed the other 2 residents at 08:30, and again at 08:45, they reported the arrival of the circus every 2 to other uninformed residents

This chain continued the same way till 12:00 PM. By 12:00 PM enough people were informed about the arrival of the circus.

(i) **(a)** 131017

Explanation: 131017

(ii) **(c)** 511

Explanation: 511

(iii) **(a)** 7936

Explanation: 7936

OR

(a) 32,64,128

Explanation: 32,64,128

37. **Read the text carefully and answer the questions:**

A restaurant offers 5 choices of appetizer, 10 choices of the main meal, and 4 choices of dessert. A customer can choose to eat just one course, or two different courses, or all the three courses. Assuming all choices are available.

Using the above information answer the following questions:

(i) **(b)** 110

Explanation: 110

(ii) **(b)** 200

Explanation: 200

(iii) **(b)** 329

Explanation: 329

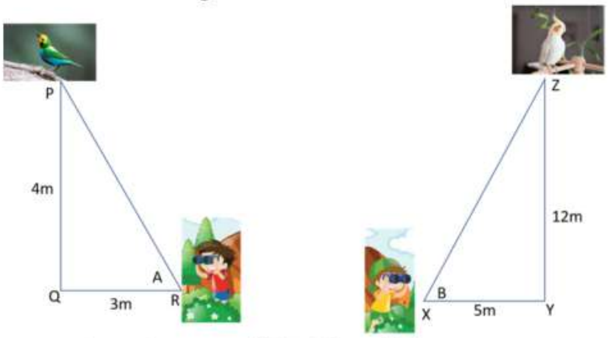
OR

(b) 50 choices.

Explanation: 50 choices.

38. **Read the text carefully and answer the questions:**

Anand and Sri went for walking. Anand observes a bird on a top tree with an angle of elevation A. The distance between Anand and the tree on the ground is 3 m and height of the tree on which bird is sitting is 4m. At the same time Sri observes another bird on the top of house with angle of elevation B. The distance between Sri and house on the ground is 5m and height of the house where bird is sitting is 12m.



(i) from fig PR = $\sqrt{16+9} = \sqrt{25}$ = 5 m

and XZ = $\sqrt{144+25} = \sqrt{169}$ = 13 m

$\Rightarrow$ sin A = $\frac{3}{5}$ and cos B = $\frac{5}{13}$

$\therefore$ cos A = $\sqrt{1-\sin^2 A}$ [$\because$ A lies in 1st quadrant]

$= \sqrt{1-\left(\frac{4}{5}\right)^2} = \sqrt{1-\frac{16}{25}}$

$\Rightarrow$ cos A = $\sqrt{\frac{9}{25}} = \frac{3}{5}$

and cos B = $\frac{5}{13}, 0 < B < \frac{\pi}{2}$

$\therefore$ sin B = $\sqrt{1-\cos^2 B}$ [$\because$ B lies in Ist quadrant]

$= \sqrt{1-\left(\frac{5}{13}\right)^2} = \sqrt{1-\frac{25}{169}}$

$\Rightarrow$ sin B = $\sqrt{\frac{144}{169}} = \frac{12}{13}$

$\therefore$ cos A + sin B $= \frac{3}{5} + \frac{12}{13} = \frac{39+60}{65} = \frac{99}{65}$

(ii) from fig PR = $\sqrt{16+9}$ = $\sqrt{25}$ = 5 m

and XZ = $\sqrt{144+25} = \sqrt{169}$ = 13 m

$\Rightarrow$ sin A = $\frac{3}{5}$ and cos B = $\frac{5}{13}$

and cos A = $\frac{4}{5}$ and sin B = $\frac{12}{13}$

sin (A + B) = sin A cos B + cos A sin B

$= \frac{4}{5} \times \frac{5}{13} + \frac{3}{5} \times \frac{12}{13} = \frac{20}{65} + \frac{36}{65} = \frac{56}{65}$