CBSE Class 11 Mathematics

Sample Papers 05 (2020-21)

Maximum Marks: 80

Time Allowed: 3 hours

General Instructions:

i. This question paper contains two parts A and B. Each part is compulsory. Part A carries 24 marks and Part B carries 56 marks

ii. Part-A has Objective Type Questions and Part -B has Descriptive Type Questions

iii. Both Part A and Part B have choices.

Part – A:

i. It consists of two sections- I and II.

ii. Section I comprises of 16 very short answer type questions.

iii. Section II contains 2 case studies. Each case study comprises of 5 case-based MCQs. An examinee is to attempt any 4 out of 5 MCQs.

Part – B:

i. It consists of three sections- III, IV and V.

ii. Section III comprises of 10 questions of 2 marks each.

iii. Section IV comprises of 7 questions of 3 marks each.

iv. Section V comprises of 3 questions of 5 marks each.

v. Internal choice is provided in 3 questions of Section –III, 2 questions of SectionIV and 3 questions of Section-V. You have to attempt only one of the alternatives in all such questions.

Part - A Section - I

1. State whether $A \subset B$ or $A \not\subset B$: A = {x : x is an isosceles triangle in a plane}, B = {x : x is an equilateral triangle in the same plane}

OR

Write the set {5,25,125,625} in the set-builder form.

2. A point is on the x-axis. What are its y-coordinates and z-coordinates?

3. Prove that $\frac{\sin(180^\circ+\theta)\cos(90^\circ+\theta)\tan(270^\circ-\theta)\cot(360^\circ-\theta)}{\sin(360^\circ-\theta)\cos(360^\circ+\theta)\operatorname{cosec}(-\theta)\sin(270^\circ+\theta)} = 1$

OR

Prove that: $\frac{\sin(A-B)}{\sin A\sin B} + \frac{\sin(B-C)}{\sin B\sin C} + \frac{\sin(C-A)}{\sin C\sin A} = 0.$

4. If $\frac{a+ib}{c+id} = x + iy$, prove that $\frac{a-ib}{c-id} = x - iy$.

5. How many triangles can be obtained by joining 12 points, five of which are collinear?

OR

Evaluate: ${}^{11}C_8$

6. Write the sum of first n even natural numbers.

7. Find the equation of line joining the points (1, 1)and (2, 3).

OR

Find the equation of a straight line which cuts off an intercept of 5 units on negative direction of y-axis and makes an angle of 120° with the positive direction of x-axis.

8. The equation of the ellipse with foci at ($\pm$5, 0) and $x = \frac{36}{5}$ as one of the directrices.

9. In a group of 800 people, 550 can speak Hindi and 450 can speak English. How many can speak both Hindi and English?

OR

If A = {1, 2, 3, 5}, and C = {7, 8, 9, 10,11}. Find A∪C.

10. A coin is tossed. If it shows a tail, we draw a ball from a box which contains 2 red and 3 black balls. If it shows head, we throw a die. Find the sample space for this experiment.

11. Find the coordinate of the point P which is five - sixth of the way from A (- 2, 0, 6) to B (10, - 6, - 12).

12. If ${}^{15}P_r$ = 2730, find the value of r.

13. If $\tan\alpha = \frac{1}{1+2^{-x}}$ and $\tan\beta = \frac{1}{1+2^{x+1}}$, then write the value of $\alpha + \beta$ lying in the interval $(0, \frac{\pi}{2})$.

14. Find the degree measure corresponding to $\frac{\pi}{32}$ rad.

15. Solve: $|x - 2| > 5$

16. Justify whether the given information is a **Set** or **Not**? The collection of all even integers.

Section - II

17. **Read the Case study given below and attempt any 4 sub parts:**

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.

Answer the following equations:

i. By 12:00 PM total how many people were informed about the arrival of the circus?
   a. 131000
   b. 131017
   c. 141000
   d. 65536

ii. By 10:00 AM total how many people were informed about the arrival of the circus?
   a. 511
   b. 256
   c. 300
   d. 500

iii. From 10:00 AM to 11:00 AM how many people were informed about the circus?
   a. 8000

b. 7000

c. 7680

d. 7936

iv. What are the three terms between 16 and 256?

a. 64,32,128

b. 16,32,256

c. 32,64,128

d. 16,32,64

v. At 10:30 AM how many people were informed about the circus?

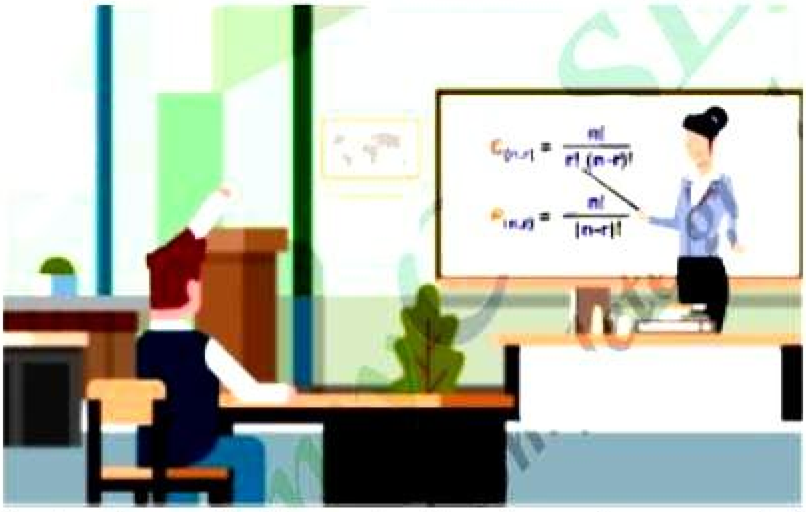
a. 512

b. 1024

c. 2048

d. 2047

18. **Read the Case study given below and attempt any 4 sub parts:**



During the math class, a teacher clears the concept of permutation and combination to the 11th standard students. After the class was over she asks the students some questions, one of the question was: how many numbers between 99 and 1000 (both excluding) can be formed such that:

i. every digit is either 3 or 7.

a. 8 ways

b. 2 ways

c. 27ways

d. 16 ways

ii. there is no restriction.

a. 1000 ways
b. 900 ways
c. 800 ways
d. 700 ways

iii. no digit is repeated.

a. 684 ways
b. 600 ways
c. 648 ways
d. 729 ways

iv. the digit in hundred's place is 7.

a. 70 ways
b. 80 ways
c. 90 ways
d. 100 ways

v. at least one of the digits is 7.

a. 252 ways
b. 525 ways
c. 200 ways
d. 500 ways

Part - B Section - III

19. Let B be a subset of a set A and let P(A : B) = {X $\in$ P (A) : X $\supset$ B}. Show that: P (A : ϕ) = P (A)
20. Let f be a relation on the set N of natural numbers defined by f = {(n, 3n) n $\in$ N}, Is f a function from N to N. If so, find the range of f.

OR

Let $A \times B$ = {(a, b) : b = 3a - 2}. If (x, -5) and (2, y) belong to $A \times B$, find the values of x and y.

21. Find the real and imaginary parts of the conjugate of the following complex number - $5i^{-15} - 6i^{-8}$.
22. For any two complex numbers z_1 and z_2 and any two real numbers a, b, find the value of $|az_1 - bz_2|^2 + |az_2 + bz_1|^2$.
23. Solve: $8x^2 - 9x + 3 = 0$.

OR

Solve the quadratic equation: $x^2 - (\sqrt{2} + i)x + \sqrt{2}i = 0$.

24. Three coins are tossed together. Find the probability of getting at least one head and one tail.

25. Differentiate: $\left(\frac{x^2+3x-1}{x+2}\right)$.

26. A bag contains 7 white, 5 black and 4 red balls. If two balls are drawn at random, find the probability that one ball is black and the other red.

27. Let $x_1, x_2, x_3, \ldots, x_n$ be n values of a variable X. If these values are changed to $x_1 + a, x_2 + a, \ldots, x_n + a$, where $a \in R$, show that the variance remains unchanged.

28. Prove that cot x - 2 cot 2x = tan x.

OR

Prove that: $\frac{\sin x - \sin y}{\cos x + \cos y} = \tan \frac{x-y}{2}$

Section - IV

29. Let $x_1, x_2, x_3, \ldots, x_n$ be n values of a variable X, and let $X_j = a + hu_i$, i = 1, 2 , . . n, where $u_1, u_2, \ldots, u_n$ are the values of variable U. Then, prove that Var (X) = h^2 Var (U), $h \neq 0$.

30. Write the domain and the range of the function, $f(x) = \frac{ax+b}{bx-a}$

31. If the p^{th} and q^{th} terms of a GP are q and p respectively, then show that $(p + q)^{th}$ term is $\left(\frac{q^p}{p^q}\right)^{\frac{1}{p-q}}$.

OR

If S_1, S_2 and S_3 be respectively the sum of n, 2n and 3n terms of a GP then prove that $S_1(S_3 - S_2) = (S_2 - S_1)^2$.

32. Find the equation of the circle the end points of whose diameter are the centres of the circles $x^2 + y^2 + 6x - 14y - 1 = 0$ and $x^2 + y^2 - 4x + 10y - 2 = 0$.

33. In an examination hall there are four rows of chairs. Each row has 8 chairs one behind the other. There are two classes sitting for the examination with 16 students in each class. It is desired that in each row, all students belong to the same class and that no two adjacent rows are allotted to the same class. In how many ways can these 32 students be

seated?

34. If the angle between two lines is $\frac{\pi}{4}$ and slope of one of the lines is $\frac{1}{2}$, then find the slope of the other line.

OR

Find the length of the perpendicular from the origin to the straight line joining the two points whose coordinates are (a cos α, a sin α) and (a cos β, a sin β).

35. In a group of 1000 people, there are 750 who can speak Hindi and 400 who can speak Bengali. How many can speak Hindi only? How many can speak Bengali? How many can speak both Hindi and Bengali?

Section - V

36. Evaluate: $\lim_{x\to 0} \frac{1-\cos x \cos 2x \cos 3x}{\sin^2 2x}$

OR

Differentiate each of the from first principles: $e^{\sqrt{2x}}$.

37. Find the domain and the range of the real function f defined by f(x) = |x - 1|.

OR

Find the domain of each of the following function:

i. $\frac{1}{\sqrt{x-2}}$
ii. $\sqrt{4-x^2}$

38. Solve the system of inequality graphically: $3x + 2y \leq 12, x \geq 1, y \geq 2$

OR

Solve the given system of linear inequations graphically:

$x - y \leq 1, x + 2y \leq 8, 2x + y \geq 2, x \geq 0, y \geq 0$

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Solution

Part - A Section - I

1. The answer is $A \not\subset B$

   Explanation: since all isosceles triangles are not equilateral triangles. Therefore set of the isosceles triangle is not contained in the set of an equilateral triangle.

   OR

   Let C = {5, 25, 125, 625}

   All objects of the set are natural numbers that are powers of 5.

   $\therefore$C = {$x : x = 5^n, n \in N$ and $1 \leqslant n \leqslant 4$}

2. We know that coordinates of any point on the x-axis will be (x, 0, 0) . Thus y-coordinate and z-coordinate of the point are zero.

3. Take L.H.S we have

   L.H.S = $\frac{\sin(180^\circ+\theta)\cos(90^\circ+\theta)\cdot\tan(270^\circ-\theta)\cot(360^\circ-\theta)}{\sin(360^\circ-\theta)\cos(360^\circ-\theta)\cdot\operatorname{cosec}(-\theta)\sin(270^\circ+\theta)}$

   $= \frac{\sin\theta\cdot-\sin\theta\cdot\cot\theta\cdot-\cot\theta}{-\sin\theta\cdot-\sin\theta-\operatorname{cosec}\theta\cdot-\cos\theta}$

   $= \cot\theta\cdot\tan\theta.\cot\theta.\tan\theta = 1$

   Hence proved.

   OR

   We have to prove $\frac{\sin(A-B)}{\sin A\sin B}+\frac{\sin(B-C)}{\sin B\sin C}+\frac{\sin(C-A)}{\sin C\sin A}$ = 0

   Take LHS

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

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

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

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

   = cot B - cot A + cot C - cot B + cot A - cot C

   = 0

   RHS

Hence proved.

4. $\left(\frac{a+ib}{c+id}\right) = (x+iy)$

=> $\overline{\left(\frac{a+ib}{c+id}\right)} = \overline{(x+iy)}$

$\Rightarrow \frac{\overline{(a+ib)}}{\overline{(c+id)}} = (x-iy)$

$\Rightarrow \frac{(a-ib)}{(c-id)} = (x-iy)$

5. Out of 12 points, 5 points are collinear and 3 points are required to form a triangle.

Required ways = ${}^{12}C_3 - {}^{5}C_3$

= $\frac{12}{3} \times \frac{11}{2} \times \frac{10}{1}$ - $\frac{5}{3} \times \frac{4}{2} \times \frac{3}{1}$

= 220 - 10 = 210

OR

${}^{11}C_8 = {}^{11}C_{(11-8)} = {}^{11}C_3 = \frac{11\times10\times9}{3!} = \frac{11\times10\times9}{3\times2\times1}$ = 165 [$\because {}^{n}C_r = {}^{n}C_{n-r}$]

6. Even natural numbers are

2, 4, 6, 8 ....

S = $\frac{n}{2} \times [4 + 2 \times (n - 1)]$

Therefore, S = $n^2 + n$

7. The equation of a line passing through two points (x_1, y_1) and (x_2, y_2) is

$y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$

Substitute the given points and simplify it

$\Rightarrow \quad y - 1 = \frac{3-1}{2-1}(x-1)$ [put (x_1, y_1) = (1, 1) and (x_2, y_2) = (2, 3)]

$\Rightarrow$ y - 1 = 2(x - 1) $\Rightarrow$ y - 1 = 2x - 2

$\Rightarrow$ 2x - y - 1 = 0

OR

According to the given condition, m = tan 120° = tan (90 + 30°) = - cot 30° = - $\sqrt{3}$ and c = - 5.

Substituting these values in y = mx + c, we obtain that the equation of the line is

y = - $\sqrt{3}$x - 5 or, $\sqrt{3}$x + y + 5 = 0

8. We have foci = (±5, 0) = (±ae, 0)

$\Rightarrow$ ae = 5,

x = $\frac{36}{5}$, x = $\frac{a}{e} = \frac{36}{5}$ which give a^2 = 36 or a = 6. Therefore $e = \frac{5}{6}$

Now, $b = a\sqrt{1-e^2} = 6\sqrt{1-\frac{25}{36}} = \sqrt{11}$.

Thus, the equation of the ellipse is $\frac{x^2}{36} + \frac{y^2}{11} = 1$

9. Let H denote the set of people speaking Hindi and E denote the set of people speaking English.

We are given that: n (H) = 550, n(E) = 450 and n (H ∪ E) = 800 and we have to find n(H ∩ E).

Now, n(H ∪ E) = n(H) + n (E) - n(H ∩ E)

$\Rightarrow \quad n(H \cap E) = n(H) + n(E) - n(H \cup E)$

= 550 + 450 - 800 = 200.

Hence, 200 persons can speak both Hindi and English

OR

A∪C = [x : x∈B or X ∈ C}

={1,2,3,4,5,7,8,9,10,11}.

10. When a coin is tossed then outcomes are H, T.

When the coin shows T then a ball drawn from a box

containing 2 red and 3 black balls,

then the outcomes are R_1, R_2, R_1, R_2, R_3

When the coin shows H then a die is thrown,

then the outcomes are 1., 2, 3, 4, 5, 6

Hence the required sample space (S) is given by

S= {TR_1, TR_2, TB_1, TB_2, TB_3, H1, H2, H3, H4, H5, H6}.

11. Let P (x, y, z) be the required point, i.e., P divides AB in the ratio 5:1.

Then, P(x, y, z) $= \left(\frac{5\times10+1\times-2}{5+1}, \frac{5\times-6+1\times0}{5+1}, \frac{5\times-12+1\times6}{5+1}\right)$ = (8, - 5, - 9) [using section formula]

12. We have,

$^{15}P_r = 2730$

$\Rightarrow {}^{15}P_r = 15 \times 182$

$\Rightarrow {}^{15}P_r = 15 \times 14 \times 13$ ... (up to 3 factors)

$\Rightarrow r = 3$

13. We have given that $\tan\alpha = \frac{1}{1+2^{-x}}$ and $\tan\beta = \frac{1}{1+2^{x+1}}$

$\tan(\alpha+\beta) = \frac{\tan\alpha+\tan\beta}{1-\tan\alpha\tan\beta}$

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

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

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

$= 1$

Therefore, $\alpha+\beta = \tan^{-1}(1) = \frac{\pi}{4}$

14. Degree measure = $\frac{180}{\pi} \times$ radian measure

$= \left(\frac{180}{\pi} \times \frac{\pi}{32}\right)^\circ = \left(\frac{45}{8}\right)^\circ = \left(5\frac{5}{8}\right)^\circ = 5^\circ\left(\frac{5}{8} \times 60\right)' = 5^\circ\left(\frac{75}{2}\right)'$

$= 5^\circ\left(37\frac{1}{2}\right)' = 5^\circ 37'\left(\frac{1}{2} \times 60\right)'' = 5^o 37' 30''$

15. We know that: $|x - a| > r \Rightarrow x < a - r$, or $x > a + r$

$\therefore |x - 2| > 5$

$x \leq 2 - 5$, or $x \geq 2 + 5$

$\Rightarrow x \leq -3$ or $x \geq 7$

$\Rightarrow x \in (-\infty, -3]$ or $x \in [7, -\infty)$

Hence the solution set is $(-\infty, -3] \cup [7, -\infty)$.

16. The collection of all even integers is {...., - 4, - 2, 0, 2, 4...} which is well defined and hence it forms a set.

Section - II

17. i. (b) 131017

ii. (a) 511

iii. (d) 7936

iv. (c) 32,64,128

v. (b) 1024

18. i. (a) 8 ways

ii. (b) 900 ways

iii. (c) 648 ways

iv. (d) 100 ways

v. (a) 252 ways

Part - B Section - III

19. We have, P (A : B) = {X ∈ P (A) : X ⊃ B

= X ∈ P (A) : B ⊂ X}

= Set of all those subsets of A which contain B

∴ P(A : ϕ) Set of all those subsets of A which contain ϕ

= Set of all subsets of set A = P (A).

20. Since for each n ∈ N, there exists a unique 3n ∈ N such that (n, 3n) ∈ f. Therefore, f is a function from N to N.

Clearly, Range of = (f(n) : n ∈ N) = $\{3n : n \in N]$.

Hence the required answer.

OR

Here we have, $A \times B$ ={(a, b): b = 3a - 2} and {(x, 5), (2, y)} ∈ $A \times B$

For (x, -5) ∈ $A \times B$, we have

b = 3a - 2 ⇒ -5 = 3(x) - 2 ⇒ - 3 = 3x ⇒ x = -1

For (2, y) ∈ $A \times B$, we have

b = 3a - 2 ⇒ y = 3(2) - 2 ⇒y = 4

Hence, the value of x = -1 and y = 4.

21. We have, - $5i^{-15}$ - $6i^{-8}$

Let Z = $\frac{-5}{i^{15}} - \frac{6}{i^8} = \frac{-5}{(i^4)^3 \cdot i^3} - \frac{6}{(i^4)^2}$

= $\frac{-5}{(1)^3 \cdot i^2 \cdot i} - \frac{6}{(1)^2}$ [put i^4 = 1]

= $\frac{-5}{1(-1)i} - \frac{6}{1} = \frac{-5}{-i} - 6 = \frac{5}{i} - 6 = \frac{5-6i}{i} = \frac{(5-6i)i}{i^2}$

[multiplying numerator and denominator by i]

= $\frac{5i-6i^2}{i^2} = \frac{5i+6}{-1}$ = - 6 - 5i [∵ i^2 = - 1]

∴ $\overline{Z}$ = - 6 + 5i

Hence, Re ($\overline{Z}$) = - 6 and Im ($\overline{Z}$) = 5

22. $|az_1 - bz_2|^2 + |az_2 + bz_1|^2$ = $(az_1 - bz_2)\overline{(az_1 - bz_2)}$ + $(az_2 + bz_1)\overline{(az_2 + bz_1)}$

= $(az_1 - bz_2)\,(a\bar{z}_1 - b\bar{z}_2) + (az_2 + bz_1)\,(a\bar{z}_2 + b\bar{z}_1)$

= $\left(a^2 z_1\bar{z}_2 - abz_1\bar{z}_2 - abz_2\bar{z}_1 + b^2 z_2\bar{z}_2\right) + \left(a^2 z_2\bar{z}_2 + abz_1\bar{z}_2 + abz_2\bar{z}_1 + b^2 z_1\bar{z}_1\right)$

= $\left[\left(a^2+b^2\right) z_1\bar{z}_1 + \left(a^2+b^2\right) z_2\bar{z}_2\right]$

$= \left[\left(a^2+b^2\right)\left(z_1\bar{z}_1 + z_2\bar{z}_2\right)\right]$

$= \left[\left(a^2+b^2\right)\left(|z_1|^2 + |z_2|^2\right)\right]$

Hence,

$|az_1 - bz_2|^2 + |az_2 + bz_1|^2 = (a^2 + b^2)\left(|z_1|^2 + |z_2|^2\right)$

23. Given: $8x^2 - 9x + 3 = 0$

Comparing $8x^2 - 9x + 3 = 0$ with the general form of the quadratic equation $ax^2 + bx + c = 0$,

we get a = 8, b = -9 and c = 3.

Substituting these values in $\alpha = \frac{-b+\sqrt{b^2-4ac}}{2a}$ and $\beta = \frac{-b-\sqrt{b^2-4ac}}{2a}$, we get

$\alpha = \frac{9+\sqrt{81-4\times8\times3}}{2\times8}$ and $\beta = \frac{9-\sqrt{81-4\times8\times3}}{2\times8}$

$\Rightarrow \alpha = \frac{9+\sqrt{81-96}}{16}$ and $\beta = \frac{9-\sqrt{81-96}}{16}$

$\Rightarrow \alpha = \frac{9+\sqrt{-15}}{16}$ and $\beta = \frac{9-\sqrt{-15}}{16}$

$\Rightarrow \alpha = \frac{9+\sqrt{15i^2}}{16}$ and $\beta = \frac{9-\sqrt{15i^2}}{16}$

$\Rightarrow \alpha = \frac{9+i\sqrt{15}}{16}$ and $\beta = \frac{9-i\sqrt{15}}{16}$

$\Rightarrow \alpha = \frac{9}{16} - \frac{\sqrt{15}}{16}i$ and $\beta = \frac{9}{16} + \frac{\sqrt{15}}{16}i$

Hence, the roots of the equation are $\frac{9}{16} \pm \frac{\sqrt{15}}{16}i$

OR

$x^2 - (\sqrt{2}+i)x + \sqrt{2}i = 0$

Comparing $x^2 - (\sqrt{2}+i)x + \sqrt{2}i = 0$ with the general form $ax^2 + bx + c = 0$, we get

a = 1, b = $-(\sqrt{2}+i)$ and c = $\sqrt{2}i$

$x = \frac{-b\pm\sqrt{b^2-4ac}}{2a}$

$\Rightarrow x = \frac{(\sqrt{2}+i)\pm\sqrt{(\sqrt{2}+i)^2-4\sqrt{2}i}}{2}$

$\Rightarrow x = \frac{(\sqrt{2}+i)\pm\sqrt{1-2\sqrt{2}i}}{2}$

$\Rightarrow x = \frac{(\sqrt{2}+i) \pm \sqrt{(\sqrt{2})^2 - 1^2 - 2\sqrt{2}i}}{2}$

$\Rightarrow x = \frac{(\sqrt{2}+i) \pm \sqrt{(\sqrt{2}-i)^2}}{2}$

$\Rightarrow x = \frac{(\sqrt{2}+i) \pm (\sqrt{2}-i)}{2}$

$\Rightarrow x = \sqrt{2}$ or i

So, the roots of the given quadratic equation are $\sqrt{2}$ and i.

24. We have to find the probability of getting at least one head and one tail.

Let E be the event of getting at least one head and one tail.

E = {(H, T, T), (T, H, T), (T, T, H), (H, H, T), (H, T, H), (T, H, H)}

n(E) = 6

$P(E) = \frac{n(E)}{n(S)}$

$P(E) = \frac{6}{8} = \frac{3}{4}$

25. Let u = $(x^2 + 3x - 1)$ and v = (x + 2)

$u' = \frac{du}{dx} = \frac{d(x^2+3x-1)}{dx} = 2x + 3$

$v' = \frac{dv}{dx} = \frac{d(x+2)}{dx} = 1$

Put the above obtained values in the formula:-

$\left(\frac{u}{v}\right)' = \frac{u'v - uv'}{v^2}$ where $v \neq 0$ (Quotient rule)

$\left(\frac{x^2+3x-1}{x+2}\right)' = \frac{(2x+3)\times(x+2)-(x^2+3x-1)\times 1}{(x+2)^2}$

$= \frac{2x^2+7x+6-x^2-3x+1}{(x+2)^2}$

$= \frac{x^2+4x+7}{(x+2)^2}$

26. We have to find the probability that one ball is black and the other red.

Given: bag which contains 4 red, 5 black, and 7 white balls

Formula: $P(E) = \frac{\text{favourable outcomes}}{\text{total possible outcomes}}$

two balls are drawn at random, therefore

total possible outcomes are $^{16}C_2$

therefore n(S) = 120

Let E be the event of getting one black and one red ball

E= {(B), (R)}

n(E) = $^5C_1\ ^4C_1$ = 20

$P(E) = \frac{n(E)}{n(S)}$

$P(E) = \frac{20}{120} = \frac{1}{6}$

27. Let $u_i = x_i + a$, i = 1, 2, ..., n be the n values of variable U. Then,

$$\bar{U} = \frac{1}{n}\sum_{i=1}^{n} u_i = \frac{1}{n}\sum_{i=1}^{n}(x_i + a) = \frac{1}{n}\left\{\sum_{i=1}^{n} x_i + na\right\} = \frac{1}{n}\sum_{i=1}^{n} x_i + a = \bar{X} + a$$

$$\therefore \quad u_i - \overline{U} = (x_i + a) - (\overline{X} + a) = x_i - \overline{X}, i = 1, 2, \ldots, n$$

$$\Rightarrow \quad \sum_{i=1}^{n}\left(u_i - \bar{U}\right) = \sum_{i=1}^{n}\left(x_i - \bar{X}\right)$$

$$\Rightarrow \quad \frac{1}{n}\sum_{i=1}^{n}\left(u_i - \bar{U}\right)^2 = \frac{1}{n}\sum_{i=1}^{n}\left(x_i - \bar{X}\right)^2$$

$$\Rightarrow \quad \operatorname{Var}(U) = \operatorname{Var}(X)$$

28. To prove: cot x - 2 cot 2x = tan x.

Now L.H.S = cot x - 2 cot 2x

$= \frac{\cos x}{\sin x} - 2\left(\frac{\cos 2x}{\sin 2x}\right)$

$= \frac{\cos x}{\sin x} - 2\left(\frac{\cos 2x}{2\sin x\cos x}\right)$

$= \frac{\cos x}{\sin x} - \left(\frac{\cos 2x}{\sin x\cos x}\right) = \frac{\cos x(\cos x) - \cos 2x}{\sin x\cos x}$

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

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

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

$= \frac{\sin^2 x}{\sin x\cos x} = \frac{\sin x}{\cos x}$ = tan x = RHS

∴ LHS = RHS

Hence proved

OR

To prove: $\frac{\sin x - \sin y}{\cos x + \cos y} = \tan\frac{x-y}{2}$

Taking L.H.S., we have

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

We know,

cos A + cos B = 2 cos $\frac{(A+B)}{2}\cos\frac{(A-B)}{2}$ & sin A - sin B = 2 cos $\frac{(A+B)}{2}\sin\frac{(A-B)}{2}$

LHS = $\frac{2\cos\frac{x+y}{2}\sin\frac{x-y}{2}}{2\cos\frac{x+y}{2}\cos\frac{x-y}{2}} = \frac{\sin\frac{x-y}{2}}{\cos\frac{x-y}{2}}$

LHS = $\tan\frac{x-y}{2}$

$\therefore$ LHS = RHS

Hence, proved.

Section - IV

29. From given information We have,

$x_i = a + h u_i$, i = 1, 2, ... , n

$\Rightarrow \sum_{i=1}^{n} x_i = \sum_{i=1}^{n} (a + h u_i)$

$\Rightarrow \sum_{i=1}^{n} x_i = na + h \sum_{i=1}^{n} u_i$

$\Rightarrow \frac{1}{n} \sum_{i=1}^{n} x_i = a + h \left(\frac{1}{n} \sum_{i=1}^{n} u_i\right)$

$\Rightarrow \bar{X} = a + h\bar{u}$ [$\left[\because \bar{X} = \frac{1}{n} \sum_{i=1}^{n} x_i \text{ and } \bar{U} = \frac{1}{n} \sum_{i=1}^{n} u_i\right]$

$\therefore x_i - \bar{X} = (a + h u_i) - (a + h \bar{U})$, i = 1, 2, ..., n

$\Rightarrow x_i - \bar{X} = h (u_i - \bar{U})$, i = 1, 2, ..., n

$\Rightarrow (x_i - \bar{X})^2 = h^2 (u_i - \bar{U})^2$, i = 1, 2, ..., n

$\Rightarrow \sum_{i=1}^{n} (x_i - \bar{X})^2 = h^2 \sum_{i=1}^{n} (u_i - \bar{U})^2$

$\Rightarrow \frac{1}{n} \Sigma \left(x_i - \bar{X}\right)^2 = h^2 \left\{\frac{1}{n} \sum_{i=1}^{n} \left(u_i - \bar{U}\right)^2\right\}$ [Dividing both sides by n]

$\Rightarrow$ Var (X) = h^2 Var (U)

Hence proved.

30. Here the given function is, $f(x) = \frac{ax+b}{bx-a}$

(i) Domain $f(x) = \frac{ax+b}{bx-a}$

As f(x) is a polynomial function whose domain is R except for the points where the denominator becomes 0.

Hence $x \neq \frac{a}{b}$

Domain is R - $\{\frac{a}{b}\}$

(ii) **Range:**

Let $y = \frac{ax+b}{bx-a}$

y(bx - a) = ax + b

by x - a y = ax + b

by x - ax = ay + b

x(by - a) = ay + b

x = $\frac{ay+b}{by-a}$

x is not defined when denominator is zero.

by -a $\neq$ 0

y $\neq \frac{a}{b}$

Range is R - {$\frac{a}{b}$}.

31. Let first term be A and common ratio be R of a GP.

Given, p^{th} term, $T_p = q$ and q^{th} term, $T_q = p$

Then, $AR^{p-1} = q$ and $AR^{q-1} = p$ ...(i)

$\therefore \frac{AR^{p-1}}{AR^{q-1}} = \frac{q}{p}$

$\Rightarrow R^{p-q} = \frac{q}{p} \Rightarrow R = \left(\frac{q}{p}\right)^{\frac{1}{p-q}}$ [$\because$ rasisint power $\frac{1}{p-q}$ on both sides]

On putting the value of R in Eq. (i), we get

$A \cdot \left(\frac{q}{p}\right)^{\frac{p-1}{p-q}} = q$

$\Rightarrow A = q \cdot \left(\frac{p}{q}\right)^{\frac{p-1}{p-q}}$

Now, $(p + q)^{th}$ term,

$T_{p+q} = AR^{p+q-1} = q \cdot \left(\frac{p}{q}\right)^{\frac{p-1}{p-q}} \times \left(\frac{q}{p}\right)^{\frac{p+q-1}{p-q}}$

$= \frac{q^{1-\frac{p-1}{P-q}+\frac{p+q-1}{p-q}}}{p^{\frac{p+q-1}{p-q}-\frac{p-1}{p-q}}} = \frac{\frac{p-q-p+1+p+q-1}{p-q}}{\frac{p+q-1-p+1}{p-q}}$

$= \frac{q^{\frac{p}{p-q}}}{p^{\frac{q}{p-q}}} = \left(\frac{q^p}{p^q}\right)^{\frac{1}{p-q}}$

Hence proved.

OR

Suppose a be the first term and r be the common ratio of the given GP. Then,

$S_1(S_3 - S_2) = \frac{a(1-r^n)}{(1-r)} \times \left\{\frac{a(1-r^{3n})}{(1-r)} - \frac{a(1-r^{2n})}{(1-r)}\right\}$

$= \frac{a(1-r^n)}{(1-r)} \times \frac{(a-ar^{3n}-a+ar^{2n})}{(1-r)}$

$= \frac{a(1-r^n)}{(1-r)} \times \frac{ar^{2n}(1-r^n)}{(1-r)}$

$= \frac{a^2r^{2n}(1-r^n)^2}{(1-r)^2}$

And, $(S_2 - S_1)^2 = \left\{ \frac{a(1-r^{2n})}{(1-r)} - \frac{a(1-r^n)}{(1-r)} \right\}^2$

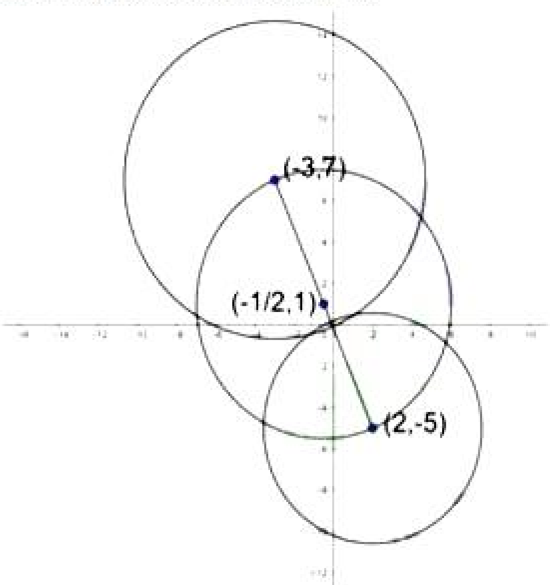
$= \frac{(a-ar^{2n}-a+ar^n)^2}{(1-r)^2}$

$= \frac{\{ar^n(1-r^n)\}^2}{(1-r)^2}$

$= \frac{a^2r^{2n}(1-r^n)^2}{(1-r)^2}$

Therefore, $S_1(S_3 - S_2) = (S_2 - S_1)^2$

32. Given that we need to find the equation of the circle whose end points of a diameter are the centres of the circles



$x^2 + y^2 + 6x - 14y - 1 = 0$ .... - (i) and

$x^2 + y^2 - 4x + 10y - 2 = 0$ ...... - (ii)

Let us assume A and B are the centres of the 1st and 2nd circle.

We know that for a circle $x^2 + y^2 + 2ax + 2by + c = 0$ ...... (iii)

Centre = (- a, - b)

Radius = $\sqrt{a^2 + b^2 - c}$

Comparing (i) with (iii) we get,

$\Rightarrow$ Centre(A) = $\left(\frac{-6}{2}, \frac{-(-14)}{2}\right)$

$\Rightarrow$ A = (- 3,7)

Comparing (ii) with (iii) we get,

$\Rightarrow$ Centre(B) = $\left(\frac{-(-4)}{2}, \frac{-10}{2}\right)$

$\Rightarrow$ B = (2, - 5)

We know that the centre is the midpoint of the diameter.

$\Rightarrow$ Centre(C) = $\left(\frac{-3+2}{2}, \frac{7-5}{2}\right)$

$\Rightarrow C = \left(\frac{-1}{2}, 1\right)$

We have a circle with centre $\left(\frac{-1}{2}, 1\right)$ and passing through the point (2, - 5).

We know that the radius of the circle is the distance between the centre and any point on the radius. So, we find the radius of the circle.

Let us assume r is the radius of the circle.

$\Rightarrow r = \sqrt{\left(\frac{-1}{2} - 2\right)^2 + (1 - (-5))^2}$

$\Rightarrow r = \sqrt{\left(\frac{-5}{2}\right)^2 + (6)^2}$

$\Rightarrow r = \sqrt{\frac{25}{4}} + 36$

$\Rightarrow r = \sqrt{\frac{169}{4}}$

$\Rightarrow r = \frac{13}{2}$

We know that the equation of the circle with centre (p, q) and having radius 'r' is given by:

$\Rightarrow (x - p)^2 + (y - q)^2 = r^2$

Now we substitute the corresponding values in the equation:

$\Rightarrow \left(x - \left(-\frac{1}{2}\right)\right)^2 + (y - 1)^2 = \left(\frac{13}{2}\right)^2$

$\Rightarrow x^2 + x + \frac{1}{4} + y^2 - 2y + 1 = \frac{169}{4}$

$\Rightarrow x^2 + y^2 + x - 2y - 41 = 0$

$\therefore$The equation of the circle is $x^2 + y^2 + x - 2y - 41 = 0$.

33. Let the two classes be C_1 and C_2 and the four rows be R_1 R_2 R_3, R_4. There are 16 students in each class. So, there are 32 students. According to the given conditions there are two different ways in which 32 students can be seated:

	R_1	R_2	R_3	R_4
I	C_1	C_2	C_1	C_2
II	C_2	C_1	C_2	C_1

Since the seating arrangement can be completed by using any one of these two ways. So, by the fundamental principle of addition,

Total number of seating arrangements = No. of arrangement in I case + No. of arrangements in II case.

In case 1, 16 students of class C_1 can be seated in R_1 and R_3 in $^{16}P_8 \times 8! = 16!$ ways. And

16 students of class C_2 can be seated in R_2 and R_4 in $^{16}P_8 \times 8! = 16!$ ways

$\therefore$ Number of seating arrangements in case I = $16! \times 16!$

Similarly, Number of seating arrangements in case II = $16! \times 16!$

Hence, Total number of seating arrangements = $(16! \times 16!) + (16! \times 16!) = 2\,(16! \times 16!)$.

34. We know that, the acute angle θ between two lines with slopes m_1 and m_2 is given by

$\tan\theta = \left|\frac{m_2 - m_1}{1 + m_1 m_2}\right|$ ...(i)

Let $m_1 = \frac{1}{2}, m_2 = m$ and $\theta = \frac{\pi}{4}$.

Now, putting these values in Eq. (i). we get

$$\frac{m - \frac{1}{2}}{1 + \frac{1}{2}m} = 1 \text{ or } \frac{m - \frac{1}{2}}{1 + \frac{1}{2}m} = -1$$

$$\Rightarrow \quad m - \frac{1}{2} = 1 + \frac{1}{2}m \text{ or } m - \frac{1}{2} = -1 - \frac{1}{2}m$$

$$\Rightarrow \quad \left(1 - \frac{1}{2}\right)m = 1 + \frac{1}{2} \text{ or } m\left(1 + \frac{1}{2}\right) = -1 + \frac{1}{2} \Rightarrow \quad m = 3 \text{ or } m = -\frac{1}{3}$$

OR

Equation of the line passing through $(a\cos\alpha,\ a\sin\alpha)$ and $(a\cos\beta, a\sin\beta)$ is

$$y - a\sin\alpha = \frac{a\sin\beta - a\sin\alpha}{a\cos\beta - a\cos\alpha}(x - a\cos\alpha)$$

$$\Rightarrow y - a\sin\alpha = \frac{\sin\beta - \sin\alpha}{\cos\beta - \cos\alpha}(x - a\cos\alpha)$$

$$\Rightarrow y - a\sin\alpha = \frac{2\cos\left(\frac{\beta+\alpha}{2}\right)\sin\left(\frac{\beta-\alpha}{2}\right)}{2\sin\left(\frac{\beta+\alpha}{2}\right)\sin\left(\frac{\alpha-\beta}{2}\right)}(x - a\cos\alpha)$$

$$\Rightarrow y - a\sin\alpha = -\cot\left(\frac{\beta+\alpha}{2}\right)(x - a\cos\alpha)$$

$$\Rightarrow y - a\sin\alpha = -\cot\left(\frac{\alpha+\beta}{2}\right)(x - a\cos\alpha)$$

$$\Rightarrow x\cot\left(\frac{\alpha+\beta}{2}\right) + y - a\sin\alpha - a\cos\alpha\cot\left(\frac{\alpha+\beta}{2}\right) = 0$$

The distance of the line from the origin is

$$d=\left|\frac{-a\sin\alpha-a\cos\alpha\cot\left(\frac{\alpha+\beta}{2}\right)}{\sqrt{\cot^2\left(\frac{\alpha+\beta}{2}\right)+1}}\right|$$

$$\Rightarrow d=\left|\frac{a\sin\alpha+a\cos\alpha\cot\left(\frac{\alpha+\beta}{2}\right)}{\sqrt{\operatorname{cosec}^2\left(\frac{\alpha+\beta}{2}\right)}}\right|\ (\because \operatorname{cosec}^2\theta=1+\cot^2\theta)$$

$$\Rightarrow d=a\left|\sin\left(\frac{\alpha+\beta}{2}\right)\sin\alpha+\cos\alpha\cos\left(\frac{\alpha+\beta}{2}\right)\right|$$

$$\Rightarrow d=a\left|\sin\alpha\sin\left(\frac{\alpha+\beta}{2}\right)+\cos\alpha\cos\left(\frac{\alpha+\beta}{2}\right)\right|$$

$$\Rightarrow d=a\left|\cos\left(\frac{\alpha+\beta}{2}-\alpha\right)\right|=a\cos\left(\frac{\beta-\alpha}{2}\right)=a\cos\left(\frac{\alpha-\beta}{2}\right)$$

Therefore, the required distance is $a\cos\left(\frac{\alpha-\beta}{2}\right)$

35. Let,

n(P) denote the total number of people,

n(H) denote the number of people who speak Hindi

and n(B) denote the number of people who speak Bengali

Then,

n(P) = 1000, n(H) = 750, n(B) = 400

We have,

$P=(H\cup B)$

$\therefore\quad n(P)=n(H\cup B)$

= n(H) + n(B) - n(H∩B)

⇒ 1000 = 750 + 400 - n(H∩B)

⇒1000 = 1150 - n(H∩B)

$\Rightarrow n(H\cap B)$ = 150

Hence, 150 people can speak both Hindi and Bengali now H = (H - B)∪$(H\cap B)$, the union being disjoint

$\therefore\quad n(H)=n(H-B)+n(H\cap B)$

$\Rightarrow\quad 750=n(H-B)+150$

$\Rightarrow\quad n(H-B)=750-150$

= 600

Hence, 600 people can speak Hindi Only.

On similar lines, we have

$B=(B-H)\cup(H\cap B)$

$\Rightarrow \quad n(B) = n(B - H) + n(H \cap B)$

$\Rightarrow \quad 400 = n(B - H) + 150$

$\Rightarrow \quad n(B - H) = 400 - 150$

= 250

Hence, 250 people can speak Bengali only.

Section - V

36. Clearly,

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

= $\frac{1}{2}$ {(2 cos x cos 2x) cos 3x}

= $\frac{1}{2}$ {(cos 3x + cosx) cos 3x}

= $\frac{1}{2}$ {$\cos^2$ 3x + cos 3x cos x}

= $\frac{1}{4}$ {2 $\cos^2$ 3x + 2 cos 3x cos x}

= $\frac{1}{4}$ {1 + cos 6x + cos 4x + cos 2x}

$\therefore \lim_{x \to 0} \frac{1 - \cos x \cos 2x \cos 3x}{\sin^2 2x}$

= $\lim_{x \to 0} \frac{1 - \frac{1}{4}(1 + \cos 6x + \cos 4x + \cos 2x)}{\sin^2 2x}$

= $\lim_{x \to 0} \frac{4 - 1 - \cos 6x - \cos 4x - \cos 2x}{4\sin^2 2x}$

= $\lim_{x \to 0} \frac{(1 - \cos 6x) + (1 - \cos 4x) + (1 - \cos 2x)}{4\sin^2 2x}$

= $\lim_{x \to 0} \frac{2\sin^2 3x + 2\sin^2 2x + 2\sin^2 x}{4\sin^2 2x}$

= $\lim_{x \to 0} \frac{\frac{\sin^2 3x}{x^2} + \frac{\sin^2 2x}{x^2} + \frac{\sin^2 x}{x^2}}{2\left(\frac{\sin^2 2x}{x^2}\right)}$

= $\lim_{x \to 0} \frac{\left(\frac{\sin 3x}{x}\right)^2 + \left(\frac{\sin 2x}{x}\right)^2 + \left(\frac{\sin x}{x}\right)^2}{2\left(\frac{\sin 2x}{x}\right)^2}$

= $\lim_{x \to 0} \frac{9 \times \left(\frac{\sin 3x}{3x}\right)^2 + 4 \times \left(\frac{\sin 2x}{2x}\right)^2 + \left(\frac{\sin x}{x}\right)^2}{2 \times 4\left(\frac{\sin 2x}{2x}\right)^2}$

= $\frac{9 \times 1 + 4 \times 1 + 1}{8} = \frac{14}{8} = \frac{7}{4}$

OR

We need to find derivative of f(x) = $e^{\sqrt{2x}}$ by first principle.

Derivative of a function f(x) is given by -

f'(x) = $\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ [where h is a very small positive number]

∴ derivative of f(x) = $e^{\sqrt{2x}}$ is given as,

$\Rightarrow \mathrm{f}'(\mathrm{x}) = \lim_{\mathrm{h}\to 0}\frac{e^{\sqrt{2(x+h)}}-e^{\sqrt{2x}}}{h}$

$\Rightarrow \mathrm{f}'(\mathrm{x}) = \lim_{\mathrm{h}\to 0}\frac{e^{\sqrt{2x+2h}}-e^{\sqrt{2x}}}{h}$

$\Rightarrow \mathrm{f}'(\mathrm{x}) = \lim_{\mathrm{h}\to 0}\frac{e^{\sqrt{2x}}\left(e^{\sqrt{2x+2h}-\sqrt{2x}}-1\right)}{h}$

Using algebra of limits –

$\Rightarrow \mathrm{f}'(\mathrm{x}) = \lim_{\mathrm{h}\to 0} e^{\sqrt{2x}} \times \lim_{h\to 0}\frac{\left(e^{\sqrt{2x+2h}-\sqrt{2x}}-1\right)}{h}$

$\Rightarrow$ f'(x) = $e^{\sqrt{2x}}\lim_{h\to 0}\frac{\left(e^{\sqrt{2x+2h}-\sqrt{2x}}-1\right)}{h}$

As one of the limits $\lim_{h\to 0}\frac{\left(e^{\sqrt{2x+2h}-\sqrt{2x}}-1\right)}{h}$ can't be evaluated by directly putting the value of h as it will take 0/0 form.

So we need to take steps to find its value.

As h → 0 so, $(\sqrt{2x+2h}-\sqrt{2x}) \to 0$

Multiplying numerator and denominator by $(\sqrt{2x+2h}-\sqrt{2x})$

∴ f'(x) = $e^{\sqrt{2x}}\lim_{h\to 0}\frac{e^{\sqrt{2x+2h}-\sqrt{2x}}-1}{\sqrt{2x+2h}-\sqrt{2x}} \times \frac{\sqrt{2x+2h}-\sqrt{2x}}{h}$

$\Rightarrow$ f'(x) = $e^{\sqrt{2x}}\lim_{h\to 0}\frac{e^{\sqrt{2x+2h}-\sqrt{2x}}-1}{\sqrt{2x+2h}-\sqrt{2x}}\lim_{h\to 0}\frac{\sqrt{2x+2h}-\sqrt{2x}}{h}$

$\Rightarrow$ f'(x) = $e^{\sqrt{2x}}\lim_{h\to 0}\frac{\sqrt{2x+2h}-\sqrt{2x}}{h}$

Again we get an indeterminate form, so multiplying and dividing $(\sqrt{2x+2h}+\sqrt{2x})$ to get rid of indeterminate form.

∴ f'(x) = $e^{\sqrt{2x}}\lim_{h\to 0}\frac{\sqrt{2x+2h}-\sqrt{2x}}{h} \times \frac{\sqrt{2x+2h}+\sqrt{2x}}{\sqrt{2x+2h}+\sqrt{2x}}$

$\Rightarrow$ f'(x) = $e^{\sqrt{2x}}\lim_{h\to 0}\frac{(\sqrt{2x+2h})^2-(\sqrt{2x})^2}{h(\sqrt{2x+2h}+\sqrt{2x})}$

$\Rightarrow$ f'(x) = $e^{\sqrt{2x}}\lim_{h\to 0}\frac{2x+2h-2h}{h} \times \lim_{h\to 0}\frac{1}{\sqrt{2x+2h}+\sqrt{2x}}$

$\Rightarrow$ f'(x) = $e^{\sqrt{2x}}\lim_{h\to 0}\frac{2h}{h} \times \frac{1}{\sqrt{2x+2(0)}+\sqrt{2x}}$

$\Rightarrow$ f'(x) = $e^{\sqrt{2x}}\lim_{h\to 0} 2 \times \frac{1}{2\sqrt{2x}}$

∴ f'(x) = $\frac{e^{\sqrt{2x}}}{\sqrt{2x}}$

Hence,

Derivative of f(x) = $e^{\sqrt{2x}}$ = $\frac{e^{\sqrt{2x}}}{\sqrt{2x}}$

37. Here f (x) = |x - 1|

The function f (x) is defined for all values of x

∴Domain of f(x) = R

when x > 1

|x - 1| = x - 1 > 0

When x = 1

|x - 1| = 0

When x < 1

|x - 1| = - x + 1 > 0

Range of f(x) = all real numbers $\geqslant 0 = [0, \infty)$

OR

i. Given, $f(x) = \frac{1}{\sqrt{x-2}}$

f (x) assumes real values if x - 2 > 0 [here we take only greater than sign, since it is in rational form, so denominator should not be equal to zero]

$\Rightarrow x > 2 \Rightarrow x \in (2, \infty)$.

Hence, the domain of f is (2, ∞).

ii. Given, $f(x) = \sqrt{4 - x^2}$

Clearly, $f(x)$ assumes real values if,

$4 - x^2 \geq 0$

$\Rightarrow -(x^2 - 4) \geq 0$

$\Rightarrow x^2 - 4 \leq 0$ [multiplying by -1 on both sides]

$\Rightarrow (x - 2)(x + 2) \leq 0$ [$\because a^2 - b^2 = (a - b)(a + b)$]

$\Rightarrow$ x $\in [-2, 2]$

$\therefore$ domain of $f = [-2, 2]$

38. The given inequality is

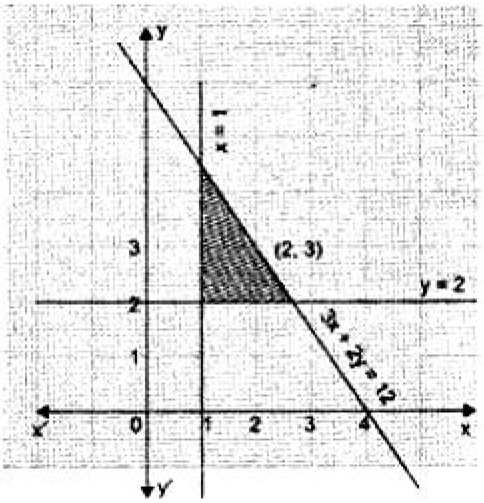
$3x + 2y \leqslant 12$,

Draw the graph of the line

3x + 2y = 12

Table of values satisfying the equation 3x + 2y = 12

	X	2	4
	Y	3	0



Putting (0, 0) in the given in equation, we have

$3 \times 0 + 2 \times 0 \leqslant 12 \Rightarrow 0 \leqslant 12$ which is true.

$\therefore$ Half plane of $3x + 2y \leqslant 12$, is towards origin.

Also the given inequality is $x \geqslant 1$.

Draw the graph of the line x = 1.

Putting (0, 0) in the given inequation, we have $0 \geqslant 1$ which is false.

$\therefore$ Half plane of $x \geqslant 1$ is away from origin.

The given inequality is $y \geqslant 2$.

Draw the graph of the line y = 2.

Putting (0, 0) in the given inequation, we have $0 \geqslant 2$ which is false.

$\therefore$ Half plane of $y \geqslant 2$ is away from origin.

OR

First, we will find the solutions of the given equations by hit and trial method and afterward we will plot the graph of the equations and shade the side with grey color containing common solutions or intersection of the solution set of each inequality,

You can choose any value but find the two mandatory values which are at x = 0 and y = 0,

$x - y \leq 1$

x	0	2	1
y	-1	1	0

$x + 2y \leq 8$

x	0	4	8
y	4	2	0

$2x + y \geq 2$

x	0	2	1
y	2	-2	0

$x \geq 0, y \geq 0$

The required region for the given inequalities is shown in the following figure.