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PRE BOARD-1 SET 3

Class X Session 2024-25

MATHEMATICS STANDARD (Code No.041)

<u>MARKING SCHEME</u>

1. C
2. c
3. a
4. c
5. a
6. c
7. c
8. a
9. a
10. c
11. c
12. c
13. c
14. c
15. b
16. d
17. c
18. d
19. d
20. a

21. Let $3 + 2\sqrt{5}$ be a rational number.

Then the co-primes x and y of the given rational number where ($y \neq 0$) is such that:

$3 + 2\sqrt{5} = x/y$

Rearranging, we get,

$2\sqrt{5} = (x/y) - 3$

$\sqrt{5} = 1/2[(x/y) - 3]$

Since x and y are integers, thus, $1/2[(x/y) - 3]$ is a rational number.

Therefore, $\sqrt{5}$ is also a rational number. But this confronts the fact that $\sqrt{5}$ is irrational.

Thus, our assumption that $3 + 2\sqrt{5}$ is a rational number is wrong.

Hence, $3 + 2\sqrt{5}$ is irrational.

22. Let P(x, 0) be a point on the x-axis.

Given that point, P is equidistant from points A(-2, 0) and B(6, 0).

AP = BP

Squaring on both sides,

$(AP)^2 = (BP)^2$

Using distance formula,

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

$x^2 + 4x + 4 = x^2 - 12x + 36$

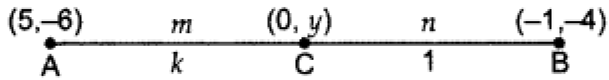
$4x + 12x = 36 - 4$

$16x = 32$

$x = 2$

Therefore, the coordinates of a point on the x-axis = (2, 0).

23.



Let AC: CB = m : n = k : 1.

$$\text{Coordinates of C} = \left(\frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n}\right)$$

$$= \left(\frac{-k+5}{k+1}, \frac{-4k-6}{k+1}\right) \qquad ...(i)$$

Point C lies on y-axis $\quad \therefore \quad \frac{-m+5}{m+1} = 0$

$\Rightarrow \quad -k + 5 = 0 \qquad$ or $\quad \boldsymbol{k = 5}$

$\therefore$ **Required ratio** $= k : 1 =$ **5 : 1**

From (i), required point C,

$$\Rightarrow \quad \left(\frac{-5+5}{5+1}, \frac{-20-6}{5+1}\right) = \left(0, \frac{-26}{6}\right) = \left(\mathbf{0}, \frac{\mathbf{-13}}{\mathbf{3}}\right)$$

24. Given, 7sin2A + 3cos2A = 4

Dividing both sides by cos2A,

we get 7 tan2A + 3 = 4 sec2A [∵ sec2 θ = 1 + tan2 θ]

⇒ 7 tan2A + 3 = 4(1 + tan2A)

⇒ 7 tan2A + 3 = 4 + 4 tan2A

⇒ 3tan2A = 1

⇒ tan2A = 1/3

⇒ tan A = 1/√3

25. Let the number of blue balls be x.

Total number of balls in the bag = 5 + x

∴ Probability of drawing a red ball = 5/(5 + x)

and probability of drawing a blue ball = x /(5+ x)

Given probability of drawing a blue ball = 3 × probability of drawing a red ball

3. 5/(5+x)= x/ (5+x)

× = 15

⇒Number of blue balls = 15

Or

One card is drawn at random from a well-shuffled deck of 52 playing cards.

Find the probability that the card drawn is (i) either a red card or a king, (ii) neither a red card nor a queen.

Ans: Total number of cards = 52

(i) Number of either red card or a king card = 28 Required Probability = 28 7 52 13 =
(ii) Number of cards neither a red card or a queen card = 52 – 28 = 24 Required Probability = 24 6 52 13Or

26. we need to find the Least Common Multiple (LCM)
LCM of 20,16 and 10 is 80

27. Let the length of the shortest side be x meters.
According to question hypotenuse = (2x+6)
Third side = (2x +6-2) =2x +4
By the Pythagoras theorem $(\text{Hypo})^2 = B^2 + P^2$
$(2x+6)^2 = x^2 + (2x+4)^2$
Then equation: $x^2 - 8x - 20 = 0$
x = 10, -2, but the length cannot be negative.
So x= 10 m.
Hypo =26, B =10, P=24

28. α *and* β *are the zeros of quadratic polynomial* $2x^2 - 8x + 5$

$$\alpha + \beta = -\left(\frac{-8}{2}\right) = 4,\ \alpha\beta = \frac{5}{2}$$

$$\left(\alpha + \frac{1}{\beta}\right)\left(\beta + \frac{1}{\alpha}\right) = \frac{(\alpha\beta+1)^2}{\alpha\beta} = \frac{49}{10}$$

Or

Given polynomial is $(x - 3)^2 - 4$
Now, expand this expression.
=> $x^2 + 9 - 6x - 4$
$= x^2 - 6x + 5$
As the polynomial has a degree of 2, the number of zeroes will be 2.
Now, solve $x^2 - 6x + 5 = 0$ to get the roots.
So, $x^2 - x - 5x + 5 = 0$
=> $x(x - 1) - 5(x - 1) = 0$
=> $(x - 1)(x - 5) = 0$
x = 1, x = 5
So, the roots are 1 and 5.

29. Proof of Thales Theorem.
30. $\sin\theta + \cos\theta = \sqrt{3}$
$(\sin\theta + \cos\theta)^2 = 3$
$\text{Sin}^2\theta + \cos^2\theta + 2\sin\theta\cos\theta = 3$
$1 + 2\sin\theta\cos\theta = 3$
$2\sin\theta.\cos\theta = 2$
$\sin\theta.\cos\theta = 1 = \sin^2\theta + \cos^2\theta$

$1 = (\sin^2\theta + \cos^2\theta)/ \sin\theta + \cos\theta = \sin\theta/\cos\theta + \cos\theta/\sin\theta = \tan\theta + \cot\theta = 1$

Or

$\tan \theta + \cot \theta = 5$

$\tan^2 \theta + \cot^2 \theta + 2 \tan \theta \cot \theta = 25$ … (Squaring both sides)

$\tan^2\theta + \cot^2\theta + 2 = 25$

$\therefore \tan^2 \theta + \cot^2 \theta = 23$

31. Equates $1250 \pi/9 \text{ cm}^2 = \theta/360 \ \pi \times 20^2$

Finding $\Theta = 125^0$

$\beta = 12.5^0$

32.

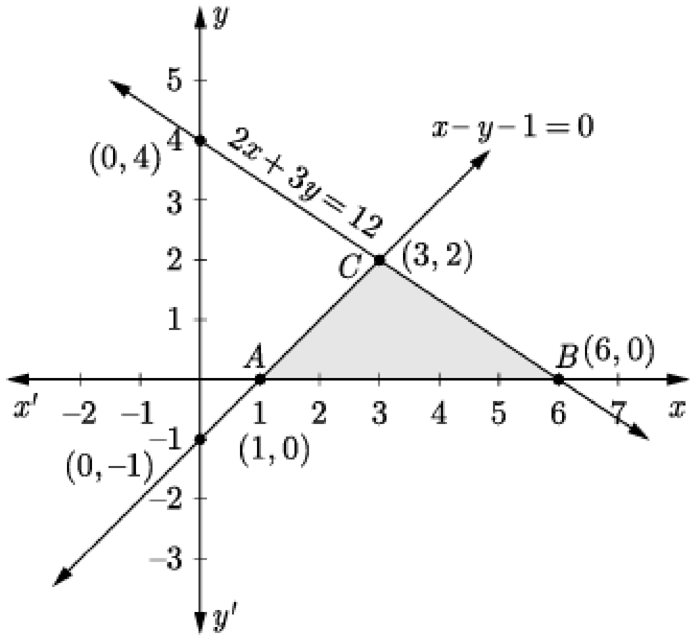
We have $2x + 3y = 12 \Rightarrow y = \dfrac{12 - 2x}{3}$

x	0	6	3
y	4	0	2

also $x - y = 1 \Rightarrow y = x - 1$

x	0	1	3
y	-1	0	2

Plotting the above points and drawing lines joining them, we get the following graph.



The two lines intersect each other at point $(3,2)$,
Hence, $x=3$ and $y=2$.
ΔABC is the region between the two lines represented by the given equations and the X-axis.

33. 24 cms.

34.

Let AB be the building and CD be the multi-storeyed building of height h m.
Here, AB = CE = 12 m and DE = (h – 12) m

In ΔACD, $\tan 60° = \frac{CD}{AC} \Rightarrow \sqrt{3} = \frac{h}{AC} \Rightarrow AC = \frac{h}{\sqrt{3}}$

In ΔBDE, $\tan 30° = \frac{DE}{BE} \Rightarrow \frac{1}{\sqrt{3}} = \frac{(h-12)}{BE}$

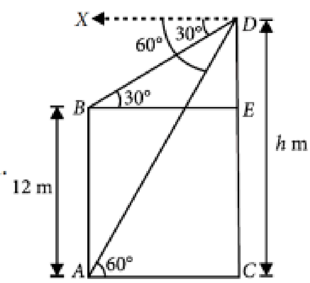
$\Rightarrow BE = (h-12)\sqrt{3}$ m

Now, $AC = BE \Rightarrow \frac{h}{\sqrt{3}} = (h-12)\sqrt{3}$

$\Rightarrow h = 3(h - 12) \Rightarrow h = 3h - 36$

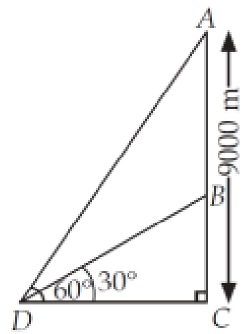
$\Rightarrow -2h = -36 \Rightarrow h = 18$

Thus, the height of the multi-storeyed building is 18 m.



Or

Let A and B be the positions of two aero planes when A is vertically above B and AC = 9000 m. Let D be the point of observation on the ground such that ∠ADC = 60° and ∠BDC = 30°.



In ΔACD, $\tan 60° = \frac{AC}{CD}$

$\Rightarrow \quad \sqrt{3} = \frac{9000}{CD}$

$\Rightarrow \quad CD = \frac{9000}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = 3000\sqrt{3}\text{ m} \quad \ldots\text{(i)}$

In ΔBCD, $\tan 30° = \frac{BC}{CD}$

$\Rightarrow \quad \frac{1}{\sqrt{3}} = \frac{BC}{3000\sqrt{3}}$ [From (i)]

$\Rightarrow \quad BC = 3000$ m

$\therefore$ Vertical distance between A and B, $AB = AC - BC$
$= 9000 - 3000 = 6000$ m

35.

From table, we have x + y + 61 = 100 ⇒ x + y = 100 – 61 ⇒ x + y = 39

Class	Frequency	Frequency
800 – 820	7	7
820 – 840	14	21
840 – 860	x	x + 21
860 – 880	25	x + 46
880 – 900	y	x + y + 46
900 – 920	10	x + y + 56
920 – 940	5	x + y + 61

Here, median = 868, therefore median class is 860 – 880

So, l = 860, cf = x + 21, f = 25, h = 20, n/2 = 50

Median= $l + \frac{\frac{n}{2} - cf}{f} h$

x=19

y=20

Or

Class	Frequency	cf
0 – 5	4	4
5 – 10	6	10
10–15	10	20
15–20	f1	20 + f1
20–25	25	45 + f1
25–30	f2	45 + f1 + f2

30–35	18	63 + f1 + f2
35–40	5	68 + f1 + f2

Now, Median = 24
(Given)

So, median class =
20 – 25

For this
class,

I = 20. h = 5, n/2 = 50, cf = 20 + $f1$, f= 25

Using, Median= $l + \frac{\frac{n}{2} - cf}{f} h$

f_1= 10

Also, Sum of of frequencies=100

$68 + f_1 + f_2 = 100 \Rightarrow f_1 + f_2 = 32 \Rightarrow 10 + f_1 = 32 \Rightarrow f_2 = 22 \therefore f_1 = 10, f_2 = 22.$

36. a). 20400
b). 21600
c). 12 Or 6600

37. a). 22m.
b). 0.7m
c). b) Their altitudes have a ratio 25:15 Or 4cm

38.

(i) 404.25 cm^3

(ii) 89.83 cm^3
(iii) Cylindrical glass, 314.42 cm^3 or 38.5 m^2