CBSE

MATHEMATICS, Class-X

SOLUTIONS

Sample Question Paper

For 2021 Examination

Section 'A'

1. Correct option (c) **1**

Detailed Solution :

Since $$\frac{11}{2^3 \times 5} = \frac{11}{8 \times 5} \times \frac{25}{25}$$

$$\frac{275}{10^3} = 0.275$$

Thus, $\frac{11}{2^3 \times 5}$ will terminate after 3 decimal places.

Commonly Made Error

- Students commit errors in converting the fraction into decimal.

Answering Tip

- First convert the fraction into decimal, then give the answer.

2. Correct option : (a)

Explanation : The product of a non-zero rational with and an irrational number is always irrational. **1**

3. Correct option : (b)

Explanation : Let $f(x) = ax^3 + bx^2 + cx + d$

If α, β, γ are the zeroes of $f(x)$, then

$$\alpha\beta + \beta\gamma + \gamma\alpha = \frac{c}{a}$$

One root is zero (given) so, $\alpha = 0$. $\beta\gamma = \frac{c}{a}$ **1**

4. Correct option : (d)

Explanation :

$$x^3 - x^2 = x^3 - 1 - 3x(x-1)$$

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

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

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

It is of the form of $ax^2 + bx + c = 0$. **1**

5. Correct option : (b)

Explanation : The distance between two points (x_1, y_1) and (x_2, y_2) is given as,

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

where, $x_1 = 0, y_1 = 6$ and $x_2 = 0, y_2 = -2$

So, distance between $A(0, 6)$ and $B(0, -2)$:

$$AB = \sqrt{(0-0)^2 + (-2-6)^2}$$

$$= \sqrt{0 + (-8)^2}$$

$$= \sqrt{8^2}$$

$$= 8$$ **1**

6. Correct option : (c)

Explanation : Since $\Delta ABC \sim \Delta EDF$, then we get $\frac{AB}{ED} = \frac{AC}{EF} = \frac{BC}{DF}$.

From first two, $AB \times EF = AC \times DE$. Option (b) is correct.

From last two, $BC \times EF = AC \times FD$. Option (a) is correct.

From first and last, $BC \times DE = AB \times FD$. Option (d) is correct.

Thus, option (c) is incorrect. **1**

7. Correct option : (c)

Explanation : Since, the angle between chord and tangent is equal to the angle subtended by the same chord in alternate segment of circle.

$\Rightarrow$ $\angle BAT = 50°$. **1**

8. Correct option : (b)

Explanation : According to the given condition,

Area of circle = Area of first circle + Area of second circle

$$\pi R^2 = \pi R_1^2 + \pi R_2^2$$

$$R^2 = R_1^2 + R_2^2$$ **1**

9. Correct option : (a)

Explanation : The sharpened part of the pencil is cone and unsharpened part is cylinder. **1**

10. Correct option : (d)

Explanation : An event that cannot occur has 0 probability, such an event is called impossible event. **1**

11. 2,520

Required number = LCM (1, 2, 3, 4, 5, 6, 8, 9, 10)

$= 1 \times 2 \times 2 \times 2 \times 3 \times 3 \times 5 \times 7$

$= 2,520$ **1**

12. Positive

Explanation : Let $f(x) = x^2 + kx + k, k \neq 0$

On comparing the given polynomial with $ax^2 + bx + c$,

we get $a = 1, b = k, c = k$

If α and β be the zeroes of the polynomial $f(x)$.

We know that,

Sum of zeroes,

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

$$\alpha + \beta = -k \quad ...(i)$$

And product of zeroes

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

$$\alpha\beta = \frac{k}{1} = k \quad ...(ii)$$

Case I : If k is negative, $\alpha\beta$ [from equation (ii)] is negative. It means α and β are of opposite sign.

Case II : If k is positive, then $\alpha\beta$ [from equation (ii)] is positive but $\alpha + \beta$ is negative. If, the product of two numbers is positive, then either both are negative or both are positive. But the sum of these numbers is negative, so numbers must be negative.

Hence, in any case of zeroes of the given quadratic polynomial cannot both be positive. **1**

13. 0, 8

Explanation : Given equation is $2x^2 - kx + k = 0$

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

$a = 2, b = -k, c = k$

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

$$(-k)^2 - 4(2)(k) = 0$$

$$(-k)^2 - 8k = 0$$

$$k = 0, 8$$

Hence, the required values of k are 0 and 8. **1**

14. We have,

$$a = \frac{1}{m}$$

$$d = \frac{1+m}{m} - \frac{1}{m} = 1$$

$$\therefore \quad a_n = \frac{1}{m} + (n-1)1$$

Hence, $a_n = \dfrac{1}{m} + n - 1 = \dfrac{1+(n-1)}{m}m$ **1**

OR

Given sequence is an A.P.

$\sqrt{2}, \sqrt{8}, \sqrt{18}, ...$

$$= \sqrt{2}, 2\sqrt{2}, 3\sqrt{2} ...$$

Hence, $a = \sqrt{2}$, $d = \sqrt{2}$ and $n = 10$

$\because \quad a_n = a + (n-1)d$

or, $a_{10} = \sqrt{2} + (10-1)\sqrt{2}$

$$= \sqrt{2} + 9\sqrt{2}$$

$$= 10\sqrt{2}$$

Hence, $a_{10} = \sqrt{200}$. **1**

15. 2 : 5

Explanation :

Here, $BQ = \dfrac{5}{7}AB$

or, $\dfrac{BQ}{AB} = \dfrac{5}{7} \Rightarrow \dfrac{AB}{BQ} = \dfrac{7}{5}$

or, $\dfrac{AB}{BQ} - 1 = \dfrac{7}{5} - 1$

or, $\dfrac{AB - BQ}{BQ} = \dfrac{AQ}{BQ} = \dfrac{7-5}{5} = \dfrac{2}{5}$

$\therefore \quad AQ : BQ = 2 : 5$ **1**

16. In $DAOP$

$$\angle AOP = \frac{120°}{2} = 60°$$

$\angle APB = 90°$ (given)

$AP = BP$ (tangents)

$\therefore \quad \angle OAP = \angle OBP = 90°$

$\therefore \angle APO + \angle OAP + \angle AOP = 180°$

or, $\angle APO + 90° + 60° = 180°$

or, $\angle APO = 180° - 150° = 30°$. **1**

[CBSE Marking Scheme, 2014]

17. Given, $\sec\theta . \sin\theta = 0$

or, $\dfrac{\sin\theta}{\cos\theta} = 0$

or, $\tan\theta = 0 = \tan 0°$

$\therefore \quad \theta = 0°$ **1**

[CBSE Marking Scheme, 2016]

OR

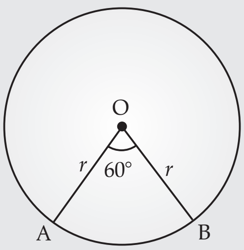
$$\frac{1+\tan^2 A}{1+\cot^2 A} = \frac{1+\tan^2 A}{1+\dfrac{1}{\tan^2 A}}$$

$$= \frac{\tan^2 A(1+\tan^2 A)}{(\tan^2 A+1)}$$

$$= \tan^2 A$$ **1**

18. Perimeter of the sector $= 2r + \dfrac{2\pi r\theta}{360°}$

$$= 10.5 \times 2 + 2 \times \frac{22}{7} \times \frac{10.5 \times 60°}{306°}$$



$= 21 + 11 = 32$ cm. **1**

[CBSE Marking Scheme, 2016]

19. Here, $h = 40$ cm, circumference $= 22$ cm

$$2\pi r = 22$$

or, $r = \dfrac{22 \times 7}{2 \times 22}$

or, $r = \dfrac{7}{2}$

$= 3.5$ cm **1**

20. Given, median = mean + 3

Since, Mode = 3Median – 2Mean

= 3(Mean + 3) – 2Mean

$\Rightarrow$ Mode = Mean + 9

Hence, mode exceeds the mean by 9. **1**

Section 'B'

21. Let $5\sqrt{6}$ be a rational number, which can be expressed as $\dfrac{a}{b}$, where $b \neq 0$ and a and b are integers.

$\therefore$ $5\sqrt{6} = \dfrac{a}{b}$ ½

$\sqrt{6} = \dfrac{a}{5b}$

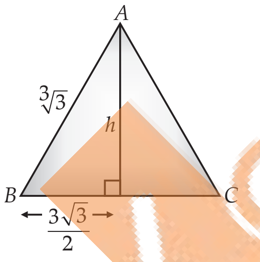
or $\sqrt{6}$ = rational ½

But $\sqrt{6}$ is an irrational number.

Thus, our assumption is wrong.

Hence, $5\sqrt{6}$ is an irrational number. **1**

22.



1

$$(3\sqrt{3})^2 = h^2 + \left(\frac{3\sqrt{3}}{2}\right)^2$$

or, $27 = h^2 + \dfrac{27}{4}$

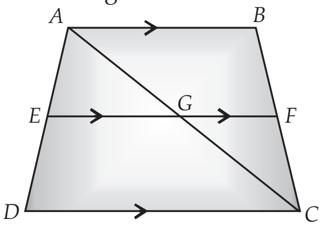
or, $h^2 = 27 - \dfrac{27}{4}$

or, $h^2 = \dfrac{81}{4}$

$\therefore$ $h = \dfrac{9}{2} = 4.5$ cm **1**

OR

Draw AC intersecting EF at G.



In ΔCAB, $GF \,||\, AB$

or, $\dfrac{AG}{CG} = \dfrac{BF}{FC}$ (By BPT)...(i) **1**

In ΔADC, $EG \,||\, DC$

or, $\dfrac{AE}{ED} = \dfrac{AG}{CG}$ (By BPT)...(ii)

From equations (i) and (ii),

$\dfrac{AE}{ED} = \dfrac{BF}{FC}$. **Hence Proved. 1**

23. $\dfrac{3\tan^2 30° + \tan^2 60° + \text{cosec } 30° - \tan 45°}{\cot^2 45°}$

$$= \frac{3 \times \left(\frac{1}{\sqrt{3}}\right)^2 + (\sqrt{3})^2 + 2 - 1}{(1)^2} \quad \mathbf{1}$$

$$= \frac{3 \times \frac{1}{3} + 3 + 2 - 1}{1}$$

$= 1 + 3 + 2 - 1 = 5$ **1**

[CBSE Marking Scheme, 2016]

Commonly Made Error

- Sometimes students get confused with the values of trigonometric angles. They substitute wrong values which leads to the wrong result.

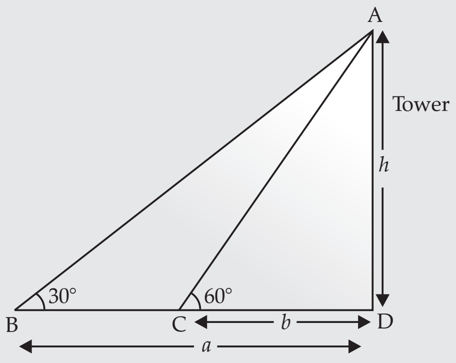
Answering Tip

- Memorize the values of trigonometric angles properly and practice more such problems to not to get confused.

24. Let the height of tower be h metre.

From ΔABD, $\dfrac{h}{a} = \tan 30°$

$h = a \times \dfrac{1}{\sqrt{3}} = \dfrac{a}{\sqrt{3}}$ ...(i) ½



From ΔACD, $\dfrac{h}{b} = \tan 60°$

$\therefore$ $h = b \times \sqrt{3} = b\sqrt{3}$ ...(ii) ½

From (i), $a = \sqrt{3}\,h$

From (ii), $b = \dfrac{h}{\sqrt{3}}$

$$\therefore \quad a \times b = \sqrt{3}\, h \times \frac{h}{\sqrt{3}}$$

$$\Rightarrow \quad h^2 = ab$$

$$\Rightarrow \quad h = \sqrt{ab}\ \text{m} \qquad \mathbf{1}$$

Hence, the height of the tower = $\sqrt{ab}$ m

[CBSE Marking Scheme, 2014]

25. Here, circumference = 88 cm

$$2\pi r = 88 \text{ cm}$$

or, $r = 14$ cm

Now, area = πr^2 **1**

$$= \pi \times 14 \times 14$$

$$= \frac{22}{7} \times 14 \times 14$$

$$= 616 \text{ cm}^2 \qquad \mathbf{1}$$

26. Modal class is 30 – 35, $l = 30$, $f_1 = 25$, $f_0 = 10$, $f_2 = 7$ and $h = 5$

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$$

$$\Rightarrow \quad \text{Mode} = 30 + \frac{25-10}{50-10-7} \times 5$$

$$= 30 + 2.27 \text{ or } 32.27 \text{ approx.}$$

[CBSE Marking Scheme, 2015] 2

OR

$$x_1 = 5 + 7 = 12$$

$$x_2 = 18 - x_1 = 18 - 12 = 6$$

$$x_3 = 18 + 5 = 23$$

and $x_4 = 30 - x_3 = 30 - 23 = 7$

[CBSE Marking Scheme, 2016] ½ × 4 = 2

Section 'C'

27. Given, polynomial $f(x) = ax^2 - 5x + c$

Let the zeroes of $f(x)$ be α and β, then according to the question

Sum of zeroes = (α + β) and product of zeroes = (αβ) = 10

Since, $\alpha + \beta = -\dfrac{\text{Coeff. of } x}{\text{Coeff. of } x^2} \Rightarrow -\dfrac{-5}{a}$ **1**

So, $10 = \dfrac{+5}{a}$

$\therefore \quad a = \dfrac{1}{2}$

and $\alpha\beta = \dfrac{\text{Constant term}}{\text{Coeff. of } x^2}$ **1**

$\Rightarrow \quad \dfrac{c}{a} = 10$

$\Rightarrow \quad \dfrac{c}{\frac{1}{2}} = 10$

$2c = 10$

$\therefore \quad c = 5$

Hence, $a = \dfrac{1}{2}$ and $c = 5$ **1**

28. Let one man can finish the work in x days and one boy can finish the same work in y days.

Then, work done by one man in one day = $\dfrac{1}{x}$ and

work done by one boy in one day = $\dfrac{1}{y}$

According to the problem,

$$\frac{2}{x} + \frac{7}{y} = \frac{1}{4} \qquad \text{...(i)}$$

and

$$\frac{4}{x} + \frac{4}{y} = \frac{1}{3} \qquad \text{...(ii)}$$

Let $\dfrac{1}{x}$ be a and $\dfrac{1}{y}$ be b, then

$$2a + 7b = \frac{1}{4} \qquad \text{...(iii)}$$

and

$$4a + 4b = \frac{1}{3} \qquad \text{...(iv) } \mathbf{1}$$

On multiplying eqn. (iii) by 2 and subtract eqn. (iv) from it

$$10b = \frac{1}{6} \qquad \mathbf{1}$$

or $b = \dfrac{1}{60} \Rightarrow \dfrac{1}{y} = \dfrac{1}{60}$

$\Rightarrow \quad y = 60$ days.

Putting $b = \dfrac{1}{60}$ in equation (iii),

$$2a + \frac{7}{60} = \frac{1}{4}$$

$$\Rightarrow \quad 2a = \frac{1}{4} - \frac{7}{60}$$

$$\Rightarrow \quad a = \frac{1}{15}$$

So $\dfrac{1}{15} = \dfrac{1}{x}$

$\therefore \quad x = 15$ days.

Hence, one man can finish it in 15 days and one boy in 60 days.

Commonly Made Error

- Some candidates, are not able to frame this word problem into equation.

Answering Tip

- Emphasis on solving such type of application based problem.

29. Here,
$$\frac{x^2+3x+2+x^2-3x+2}{x^2+x-2} = \frac{4x-8-2x-3}{x-2} \quad \mathbf{1}$$
$$(2x^2+4)(x-2) = (2x-11)(x^2+x-2)$$
$$\Rightarrow \quad 5x^2+19x-30 = 0 \quad \mathbf{1}$$
$$\Rightarrow \quad (5x-6)(x+5) = 0$$
$$\Rightarrow \quad x = -5 \text{ or } \frac{6}{5} \quad \mathbf{1}$$

[CBSE Marking Scheme, 2016]

OR

20. $A = (a^2+b^2)$, $B = -2(ac+bd)$ $C = (c^2+d^2)$

as roots are equal,

$D = B^2 - 4AC = 0.$

$B^2 = 4AC$

$[-2(ac+bd)]^2 = 4(a^2+b^2)(c^2+d^2)$

$(\cancel{a^2c^2} + 2abcd + \cancel{b^2d^2}) = \cancel{4}(\cancel{a^2c^2} + a^2d^2 + b^2c^2 + \cancel{b^2d^2})$

$2abcd = a^2d^2 + b^2c^2$

$0 = a^2d^2 - 2abcd + b^2c^2$

$0 = (ad - bc)^2$

$0 = ad - bc$

$ad = bc$

$\Rightarrow \boxed{\frac{a}{b} = \frac{c}{d}}$

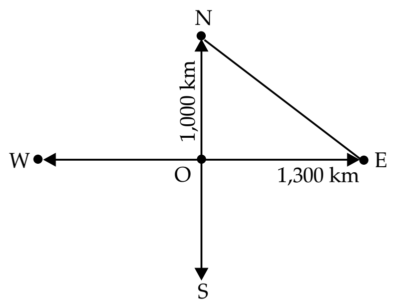
Hence, proved.

[Topper's Answer, 2017]

30.
$$S_n = \frac{3n^2+13n}{2}$$
$$a_n = S_n - S_{n-1}$$
or, $$a_{25} = S_{25} - S_{24}$$
$$= \frac{3(25)^2+13(25)}{2} - \frac{3(24)^2+13(24)}{2} \quad \mathbf{1}$$
$$= \frac{1}{2}\{3(25^2-24^2)+13(25-24)\} \quad \mathbf{1}$$
$$= \frac{1}{2}(3 \times 49 + 13) = 80 \quad 1$$

[CBSE Marking Scheme, 2016]

31.



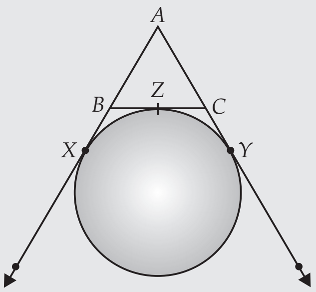
Distance covered by first aeroplane due North after two hours = 500 × 2 = 1,000 km. **1**

Distance covered by second aeroplane due East after two hours = 650 × 2 = 1,300 km. **1**

Distance between two aeroplanes after 2 hours
$$NE = \sqrt{ON^2+OE^2}$$
$$= \sqrt{(1000)^2+(1300)^2}$$
$$= \sqrt{1000000+1690000}$$
$$= \sqrt{2690000}$$
$$= 1640.12 \text{ km} \quad \mathbf{1}$$

32. Perimeter of $\Delta ABC = AB + AC + BC$
$$= (AX - BX) + (AY - CY) + (BZ + ZC). \ 1$$
$$= AX + AY - BX + BZ + ZC - CY$$

The tangents of a circle, from an external point are equal.



or, From point $B \rightarrow BX = BZ$ From $A \rightarrow AX = AY$

and from point $C \rightarrow CZ = CY$

$\therefore \quad P = AX + AY = 2AX$ **1**

or $\quad AX = \frac{1}{2}$ Perimeter of ΔABC. **1**

[CBSE Marking Scheme, 2016]

OR

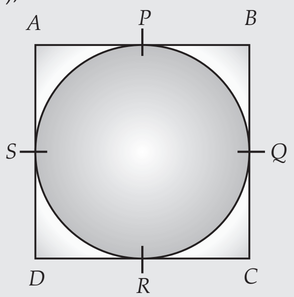
Let $ABCD$ be the || gm.

$\therefore \quad AB = CD$ and $AD = BC$ ...(i) ½

$AP + PB + DR + CR = AS + BQ + DS + CQ$ **1**

or, $\quad AB + CD = AD + BC$ ½

From (i), $\quad 2AB = 2AD$ or $AB = AD$



1

or, $ABCD$ is a rhombus.

[CBSE Marking Scheme, 2014]

33. RHS $= \dfrac{p^2 - 1}{p^2 + 1}$

$$= \frac{(\text{cosec}\,\theta + \cot\theta)^2 - 1}{(\text{cosec}\,\theta + \cot\theta)^2 + 1} \quad \mathbf{1}$$

$$= \frac{\text{cosec}^2\,\theta + \cot^2\theta + 2\,\text{cosec}\,\theta\cot\theta - 1}{\text{cosec}^2\,\theta + \cot^2\theta + 2\,\text{cosec}\,\theta\cot\theta + 1} \quad \mathbf{1}$$

$$= \frac{1 + \cot^2\theta + \cot^2\theta + 2\,\text{cosec}\,\theta\cot\theta - 1}{\text{cosec}^2\,\theta + \text{cosec}^2\,\theta - 1 + 2\,\text{cosec}\,\theta\cot\theta + 1} \quad \mathbf{1}$$

$$= \frac{2\cot\theta(\cot\theta + \text{cosec}\,\theta)}{2\,\text{cosec}\,\theta(\text{cosec}\,\theta + \cot\theta)}$$

$$= \frac{\cos\theta}{\sin\theta} \times \sin\theta = \cos\theta = \text{LHS.} \quad \mathbf{1}$$

Hence proved.

[CBSE Marking Scheme, 2012]

34. **(i)** Favourable outcomes are (2, 2) (2, 3) (2, 5) (3, 2) (3, 3) (3, 5) (5, 2) (5, 3) (5, 5) *i.e.*, 9 outcomes. **1**

P (a prime number on each die) $= \frac{9}{36}$ or $\frac{1}{4}$ ½

(ii) Favourable outcomes are (3, 6) (4, 5) (5, 4) (6, 3) (5, 6) (6, 5) *i.e.*, 6 outcomes **1**

P (a total of 9 or 11) $= \frac{6}{36}$ or $\frac{1}{6}$ ½

[CBSE Marking Scheme, 2016]

Commonly Made Error

- Many candidates commit the following errors :
  (i) Total outcomes of event are incorrect.
  (ii) Favourable outcomes are incorrect.
  (iii) The results are not given in simplest form.
  e.g., $\frac{9}{36} = \frac{1}{4}$

Answering Tip

- All necessary outcomes must be listed before finding probability and all answers must be in the simplest form.

OR

P (red ball) $= \frac{1}{4}$ and P (blue ball) $= \frac{1}{3}$ ½

$\Rightarrow P$(orange ball) $= 1 - \left(\frac{1}{4} + \frac{1}{3}\right) = \frac{5}{12}$ **1**

$\Rightarrow \frac{5}{12}$ of (Total no. of balls) = 10 ½

$\Rightarrow$ Total numbers of balls $= \frac{10 \times 12}{5} = 24.$ **1**

[CBSE Marking Scheme, 2015]

Section 'D'

35. Let the first odd no. be $2x + 1$

$\therefore$ Second consecutive odd number $= 2x + 1 + 2$
$= 2x + 3$ **1**

Now, according to question,

$$(2x + 1)^2 + (2x + 3)^2 = 394$$

$\Rightarrow \quad 4x^2 + 4x + 1 + 4x^2 + 12x + 9 = 394$ **1**

$\Rightarrow \quad 8x^2 + 16x - 384 = 0$

$\Rightarrow \quad x^2 + 2x - 48 = 0$

$\Rightarrow \quad x^2 + 8x - 6x - 48 = 0$

$\Rightarrow \quad x(x + 8) - 6(x + 8) = 0$ **1**

$x = -8$ or 6

$\therefore$ First number $= 2 \times 6 + 1$
$= 13$

and second odd number $= 15$ **1**

36. Since, $A(-1, y)$ and $B(5, 7)$ lie on a circle with centre $O(2, -3y)$.

and the distance between OA and OB are equal. **1**

$\therefore \quad OA = OB$

$$\sqrt{(-1-2)^2 + (y + 3y)^2} = \sqrt{(5-2)^2 + (7 + 3y)^2}$$

or, $\quad \sqrt{9 + (4y)^2} = \sqrt{3^2 + (7 + 3y)^2}$ **1**

Squaring on both sides, we get

$$9 + 16y^2 = 9y^2 + 42y + 58$$

or, $\quad y^2 - 6y - 7 = 0$

or, $\quad (y + 1)(y - 7) = 0$

$\therefore \quad y = -1, 7$

When $\quad y = -1$

Centre $\quad O(2, -3y) = (2, 3)$

$B = (5, 7)$

Radius, $OB = \left|\sqrt{(5-2)^2+(7-3)^2}\right|$

$= \sqrt{9+16} = 5$ unit **1**

When $y = 7$

centre $(2, -3y) = (2, -21)$

$B = (5, 7)$

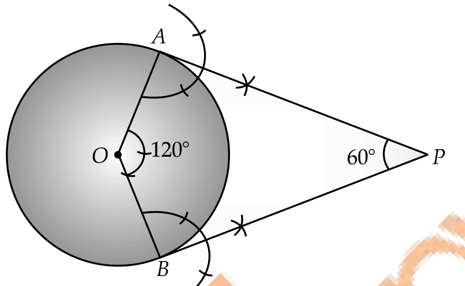
Radius, $OB = \left|\sqrt{(2-5)^2+(-21-7)^2}\right|$

$= \left|\sqrt{9+784}\right|$

$= \sqrt{793}$ unit **1**

37. Steps of construction :

1. Draw a circle of radius 4 cm with O as centre.
2. Draw two radii OA and OB inclined to each other at an angle of 120°.
3. Draw AP ⊥ OA at A and BP ⊥ OB at B. Which meet at P.
4. PA and PB are the required tangents inclined to each other an angle of 60°. **2**



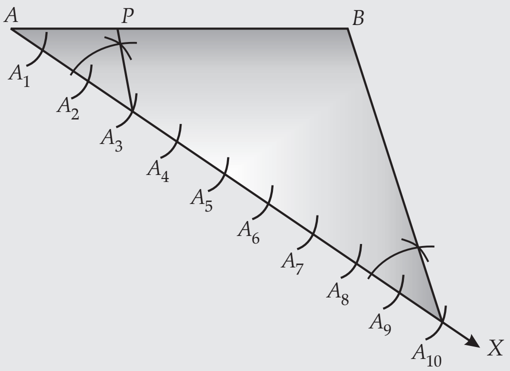
2

OR

Steps of Construction :

1. Draw a line segment $AB = 5$ cm.
2. Draw any ray AX making an acute angle down ward with AB.
3. Mark the points $A_1, A_2, A_3, \ldots A_{10}$ on AX such that $AA_1 = A_1A_2 = \ldots = A_9A_{10}$.
4. Join BA_{10}.
5. Through the point A_3 draw a line parallel to BA_{10}. To meet AB at P

Hence $AP : PB = 3 : 7$. **2**



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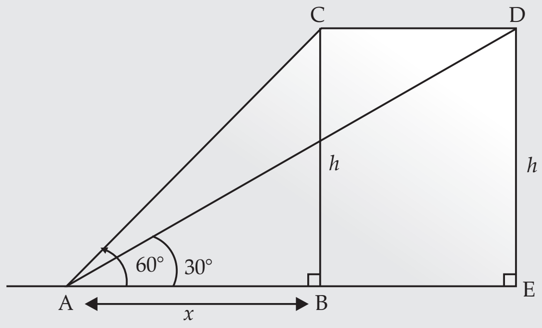
[CBSE Marking Scheme, 2015]

38.



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In 3600 sec distance travelled by plane

$= 648000$ m

In 10 sec distance travelled by plane

$= \dfrac{648000}{3600} \times 10$

$= 1800$ m

In ΔABC,

$\dfrac{h}{x} = \tan 60°,$

$\dfrac{h}{x} = \sqrt{3},$

$\Rightarrow h = x\sqrt{3}$ ...(i)

In ΔAED,

$\dfrac{h}{x+1800} = \tan 30°$

$\dfrac{h}{x+1800} = \dfrac{1}{\sqrt{3}}$ **1**

$\Rightarrow h = \dfrac{x+1800}{\sqrt{3}}$ ...(ii)

From equation (i) and (ii), we get

$x\sqrt{3} = \dfrac{x+1800}{\sqrt{3}}$ **1**

$\Rightarrow 3x = x + 1800$

$\Rightarrow 2x = 1800$

$\Rightarrow x = 900$ m

$h = x\sqrt{3}$

$= 900 \times 1.732$

$= 1558.8$ m

∴ Hence, the height of jet = 1558.8 m. **1**

[CBSE Marking Scheme, 2012]

Commonly Made Error

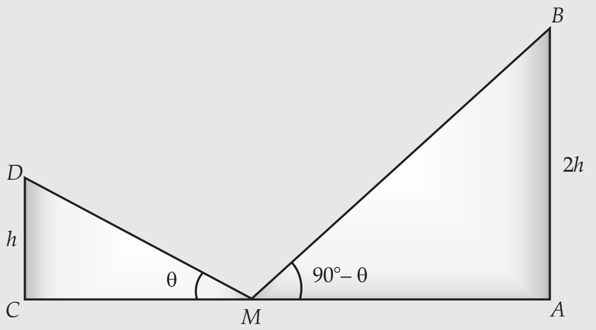
- Some candidates do calculation errors while solving the sum. Some take $\sqrt{3} = 1.73$ instead of 1.732 and hence write inaccurate answer.

Answering Tip

- Students should do rounding off at the end while calculating the final answer.

OR

Let AB and CD be the two posts such that $AB = 2\,CD$. Let M be the mid-point of CA. Let $\angle CMD = \theta$ and $\angle AMB = 90° - \theta$



1

Clearly, $CM = MA = \frac{1}{2}k$

Let $CD = h$ m, then $AB = 2h$ m

Now, $\frac{AB}{AM} = \tan(90° - \theta) = \cot\theta$

$\Rightarrow \quad \frac{2h}{\left(\frac{k}{2}\right)} = \cot\theta$

$\Rightarrow \quad \cot\theta = \frac{4h}{k}$ ...(i) **1**

Also in ΔCMD, $\frac{CD}{CM} = \tan\theta$

$\Rightarrow \quad \frac{h}{\frac{k}{2}} = \tan\theta$

$\Rightarrow \quad \tan\theta = \frac{2h}{k}$ ...(ii) **1**

Multiplying (i) and (ii),

$$\frac{4h}{k} \times \frac{2h}{k} = 1$$

$\therefore \quad h^2 = \frac{k^2}{8}$

$\Rightarrow \quad h = \frac{k}{2\sqrt{2}} = \frac{k\sqrt{2}}{4}$ m **1**

[CBSE Marking Scheme, 2015]

39. Given, Depth of well = 14 m, radius = 2 m.

Volume of earth taken out $= \pi r^2 h$

$= \frac{22}{7} \times 2 \times 2 \times 14$

$= 176 \text{ m}^3$ **1**

Let r be the width of embankment

The radius of outer circle of embankment

$= 2 + r$

Area of upper surface of embankment

$= \pi[(2+r)^2 - (2)^2]$

Volume of embankment = Volume of earth taken out **1½**

or, $\pi[(2+r)^2 - (2)^2] \times 0.4 = 176$

or, $\pi[4 + r^2 + 4r - 4] \times 0.4 = 176$

or, $r^2 + 4r = \frac{176 \times 7}{0.4 \times 22}$

or, $r^2 + 4r = 140$

or, $r^2 + 4r - 140 = 0$

or, $(r + 14)(r - 10) = 0$

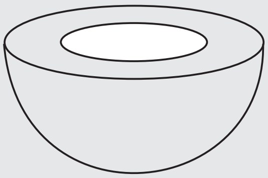
or, $r = 10$ m **1½**

Hence, width of embankment = 10 m.

[CBSE Marking Scheme, 2015]

OR

$R = 8$ cm, $r = 6$ cm



Total Surface area $= 2\pi R^2 + 2\pi r^2 + \pi(R^2 - r^2)$ **1**

$= \pi[8^2 \times 2 + 6^2 \times 2 + (8^2 - 6^2)]$

$= \pi[64 \times 2 + 36 \times 2 + (64 - 36)]$

$= \pi[128 + 72 + 28]$

$= 228 \times 3.14$ **2**

$= 715.92 \text{ cm}^2$

Total cost $= 715.92 \times ₹\, 5.50 = ₹\, 3{,}937.56$ **1**

[CBSE MarkingScheme, 2012]

Commonly Made Error

- In problems related to surface area and volume, student write incorrect formula and do wrong calculation.

Answering Tip

- Students should learn formulae of basic figures and do adequate practice and do correct calculation.

40.

Class	Class mark (x)	Frequency (f)	fx
11 – 13	12	3	36
13 – 15	14	6	84
15 – 17	16	9	144
17 – 19	18	13	234
19 – 21	20	f	$20f$
21 – 23	22	5	110
23 – 25	24	4	96
		$\Sigma f = 40 + f$	$\Sigma fx = 704 + 20f$

For x **½**

$\Sigma f = 40 + f$ **½**

$\Sigma fx = 704 + 20f$ **1**

Mean $= 18 = \frac{704 + 20f}{40 + f}$ **1**

$\Rightarrow \quad 720 + 18f = 704 + 20f$ **1**

$\Rightarrow \quad f = 8$

[CBSE Marking Scheme, 2018]

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