Strictly Confidential: (For Internal and Restricted use only)
Secondary School Examination
March 2019
MARKING SCHEME – MATHEMATICS (SUBJECT CODE -041)
PAPER CODE: 30/4/1, 30/4/2, 30/4/3

General Instructions: -

1. You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully. **Evaluation is a 10-12 days mission for all of us. Hence, it is necessary that you put in your best efforts in this process.**
2. Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one's own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. **However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and marks be awarded to them.**
3. The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.
4. If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totaled up and written in the left-hand margin and encircled.
5. If a question does not have any parts, marks must be awarded in the left hand margin and encircled.
6. If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out.
7. No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
8. A full scale of marks 1-80 has to be used. Please do not hesitate to award full marks if the answer deserves it.
9. Every examiner has to necessarily do evaluation work for full working hours i.e. 8 hours every day and evaluate 25 answer books per day.
10. Ensure that you do not make the following common types of errors committed by the Examiner in the past:-
    - Leaving answer or part thereof unassessed in an answer book.
    - Giving more marks for an answer than assigned to it.
    - Wrong transfer of marks from the inside pages of the answer book to the title page.
    - Wrong question wise totaling on the title page.
    - Wrong totaling of marks of the two columns on the title page.
    - Wrong grand total.
    - Marks in words and figures not tallying.
    - Wrong transfer of marks from the answer book to online award list.
    - Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.)
    - Half or a part of answer marked correct and the rest as wrong, but no marks awarded.

11. While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as (X) and awarded zero (0) Marks.

12. Any unassessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.

13. The Examiners should acquaint themselves with the guidelines given in the Guidelines for spot Evaluation before starting the actual evaluation.

14. Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totaled and written in figures and words.

15. The Board permits candidates to obtain photocopy of the Answer Book on request in an RTI application and also separately as a part of the re-evaluation process on payment of the processing charges.

QUESTION PAPER CODE 30/4/1
EXPECTED ANSWER/VALUE POINTS
SECTION A

1. For equal roots, $4k^2 - 4k \times 6 = 0$ $\frac{1}{2}$

Hence $k = 6$ $\frac{1}{2}$

2. Here $-47 = 18 + (n-1)\left(-\frac{5}{2}\right)$ $\frac{1}{2}$

$\Rightarrow n = 27$ $\frac{1}{2}$

3. $\frac{\tan 65°}{\cot 25°} = \frac{\tan(90° - 25°)}{\cot 25°}$ $\frac{1}{2}$

$= \frac{\cot 25°}{\cot 25°} = 1$ $\frac{1}{2}$

OR

$\sin 67° + \cos 75° = \sin (90° - 23°) + \cos (90° - 15°)$ $\frac{1}{2}$

$= \cos 23° + \sin 15°$ $\frac{1}{2}$

4. Here $\frac{BC}{EF} = \frac{8}{11}$ $\frac{1}{2}$

$\therefore$ BC $= \frac{8}{11} \times 15.4 = 11.2$ cm $\frac{1}{2}$

5. Required distance = $\sqrt{(-a-a)^2 + (-b-b)^2}$ $\frac{1}{2}$

$= \sqrt{4(a^2 + b^2)}$ or $2\sqrt{a^2 + b^2}$ $\frac{1}{2}$

6. Here $1.41 < x < 2.6$

Any rational number lying between 1.4 ... & 2.6 ... 1

(variable answer)

OR

$2^2 \times 5^2 \times 5 \times 3^2 \times 17 = (10)^2 \times 5 \times 3^2 \times 17$

$\therefore$ No. of zeroes in the end of the number = Two 1

SECTION B

7. 12, 16, 20, ..., 204 $\frac{1}{2}$

Let the number of multiples be n.

$\therefore\ t_n = 12 + (n - 1) \times 4 = 204$ 1

$\Rightarrow n = 49$ $\frac{1}{2}$

OR

Here $t_3 = 16$ and $t_7 = t_5 + 12$ $\frac{1}{2}$

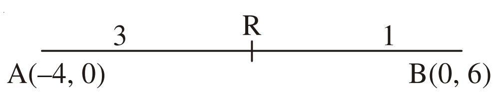
$\Rightarrow\ a + 2d = 16$ (i) and $a + 6d = a + 4d + 12$ (ii) $\frac{1}{2}$

From (ii), d = 6

From (i), a = 4 1

$\therefore$ A.P. is 4, 10, 16, ...

8.



$\frac{AR}{AB} = \frac{3}{4} \Rightarrow \frac{AR}{RB} = \frac{3}{1}$ 1

$\therefore\ R = \left(\frac{3\times0+1(-4)}{4}, \frac{3\times6+1\times0}{4}\right)$, i.e., $\left(-1, \frac{9}{2}\right)$ 1

9. $\left.\begin{array}{l} 867 = 3\times255+102 \\ 255 = 2\times102+51 \\ 102 = 2\times51+0 \end{array}\right\}$ $1\frac{1}{2}$

$\therefore$ HCF = 51 $\frac{1}{2}$

10. The possible number of outcomes are 8 {HHH, HHT, HTH, THH, HTT, THT, TTH, TTT} 1

P (exactly one head) = $\frac{3}{8}$ 1

11. No. of spade cards + 3 other kings = 13 + 3 = 16 $\frac{1}{2}$

$\therefore$ Cards which are neither spade nor kings = 52 – 16 = 36 $\frac{1}{2}$

Hence P (neither spade nor king) = $\frac{36}{52}$ or $\frac{9}{13}$ 1

12. $\frac{3}{x}+\frac{8}{y}=-1$ ...(i)

$\frac{1}{x}-\frac{2}{y}=2$ ...(ii)

Multiply (ii) by 3 and subtract from (i), we get

$\frac{14}{y}=-7 \Rightarrow y = -2$ 1

Substitute this value of y = –2 in (i), we get x = 1

Hence, x = 1, y = –2 1

OR

For unique solution $\frac{a_1}{a_2} \neq \frac{b_1}{b_2} \Rightarrow \frac{k}{3} \neq \frac{2}{6}$ 1

$\Rightarrow k \neq 1$ 1

The pair of equations have unique solution for all real values of k except 1.

SECTION C

13. Let $3+2\sqrt{5}=a$ where a is a rational number. $\frac{1}{2}$

Then $\sqrt{5}=\frac{a-3}{2}$ 1

which is contradiction as LHS in irrational and RHS is rational. 1

$\therefore$ $3+2\sqrt{5}$ can not be rational

Hence $3+2\sqrt{5}$ is irrational. $\frac{1}{2}$

14. Let the normal speed of the train be x km/hr

As per question, $\frac{480}{x-8} - \frac{480}{x} = 3$ 1

$\Rightarrow 480x - 480\,(x - 8) = 3(x - 8)x$

$\Rightarrow x^2 - 8x - 1280 = 0$ 1

$\Rightarrow (x - 40)(x + 32) = 0$

$\Rightarrow x = 40$

$\therefore$ Speed of the train = 40 km/hr. 1

15. Here $\alpha + \beta = 4,\ \alpha\beta = 3$ 1

$\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta = 16 - 6 = 10$ 1

$\therefore\ \alpha^4\beta^2 + \alpha^2\beta^4 = \alpha^2\beta^2\ (\alpha^2 + \beta^2) = 9 \times 10 = 90$ 1

16. LHS $= (\sin\theta + \cos\theta + 1)(\sin\theta + \cos\theta - 1)\sec\theta\ \text{cosec}\,\theta$

$= [(\sin\theta + \cos\theta)^2 - 1]\sec\theta\ \text{cosec}\,\theta$ 1

$= 2\sin\theta\cos\theta\sec\theta\ \text{cosec}\,\theta$ 1

$= 2 =$ RHS 1

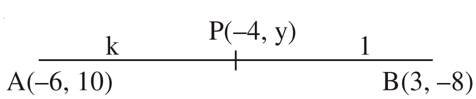
OR

LHS $= \sqrt{\frac{\sec\theta-1}{\sec\theta+1}} + \sqrt{\frac{\sec\theta+1}{\sec\theta-1}} = \frac{(\sec\theta-1)+(\sec\theta+1)}{\sqrt{\sec^2\theta-1}}$ 1

$= \frac{2\sec\theta}{\tan\theta}$ 1

$= \frac{2}{\sin\theta} = 2\,\text{cosec}\,\theta = \text{RHS}$ 1

17.



Let point P divides the line segment AB in the ratio k : 1

$\therefore\ \frac{3k-6}{k+1} = -4$ 1

$\Rightarrow\ 3k - 6 = -4k - 4$

$\Rightarrow\ 7k = 2$ i.e., $k = \frac{2}{7}$ $\therefore$ Ratio is 2 : 7 1

Again $\frac{2\times(-8)+7\times10}{2+7} = y \Rightarrow y = 6$ 1

Hence y = 6

OR

The points are collinear if the area of triangle formed is zero.

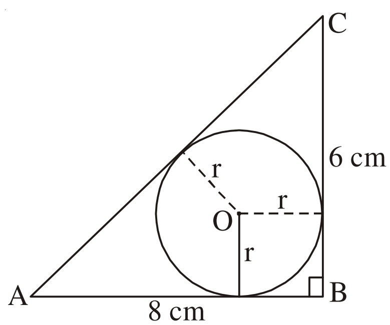
i.e., $-5(p + 2) + 1(-2 - 1) + 4(1 - p) = 0$ $1\frac{1}{2}$

$-5p - 10 - 3 + 4 - 4p = 0$

$-9p = 9$

$p = -1$ $1\frac{1}{2}$

18.



$AC = \sqrt{AB^2 + BC^2} = \sqrt{64+36} = 10\text{ cm}$ $\frac{1}{2}$

Area of $\Delta ABC = \frac{1}{2} \times 8 \times 6 = 24\text{ cm}^2$ $\frac{1}{2}$

Let r be the radius of inscribed circle.

$ar(\Delta ABC) = ar(AOB) + ar(\Delta BOC) + ar(\Delta AOC)$

$= \frac{1}{2} \times 8r + \frac{1}{2} \times 6r + \frac{1}{2} \times 10r$ 1

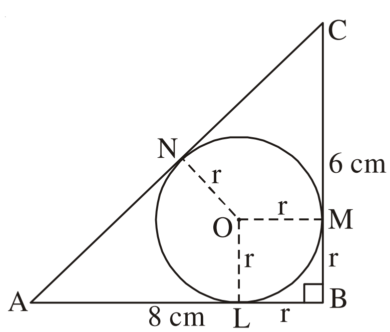
$= \frac{1}{2} r(8+6+10) = 12r$

$12r = 24 \Rightarrow r = 2\text{ cm}$ $\frac{1}{2}$

$\therefore$ Diameter = 4 cm $\frac{1}{2}$

Alternate method:

Here BL = BM = r (sides of squares)



$AC = \sqrt{AB^2 + BC^2} = 10\text{ cm}$ 1

$AL = AN = 8 - r$ and $CM = CN = 6 - r$ $\frac{1}{2}$

$AC = AN + NC$

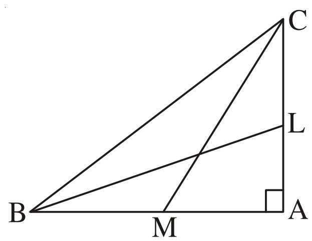
$\Rightarrow$ $10 = 8 - r + 6 - r$

$\Rightarrow$ $2r = 4$

$\Rightarrow$ $r = 2$ $\frac{1}{2}$

$\therefore$ Diameter = 4 cm 1

19. In right angled triangle CAM,



$$CM^2 = CA^2 + AM^2 \quad \text{...(i)}$$

Similarly, $BC^2 = AC^2 + AB^2$ ...(ii) 1

and $BL^2 = AL^2 + AB^2$ ...(iii)

Now $4(BL^2 + CM^2) = 4(AL^2 + AB^2 + AC^2 + AM^2)$ 1

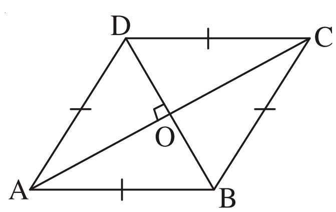
But $AL = LC = \frac{1}{2}AC$ and $AM = MB = \frac{1}{2}AB$

$\therefore\ 4(BL^2 + CM^2) = 4\left(\frac{AC^2}{4} + AB^2 + AC^2 + \frac{AB^2}{4}\right)$

$= 4\left(\frac{5}{4}AB^2 + \frac{5}{4}AC^2\right)$

$= 5(AB^2 + AC^2) = 5BC^2$ 1

OR



Let ABCD be rhombus and its diagonals intersect at O.

In ΔAOB, $AB^2 = AO^2 + OB^2$ 1

$= \left(\frac{AC}{2}\right)^2 + \left(\frac{BD}{2}\right)^2$

$= \frac{1}{4}(AC^2 + BD^2)$ 1

$\Rightarrow 4AB^2 = AC^2 + BD^2$

$\Rightarrow AB^2 + BC^2 + CD^2 + AD^2 = AC^2 + BD^2$ (ABCD being rhombus) 1

20. Area of shaded region

$= \left[\pi(42)^2 - \pi(21)^2\right]\frac{300°}{360°}$ 1

$= \frac{22}{7} \times 63 \times 21 \times \frac{5}{6}.$ 1

$= 3465\ cm^2$ 1

21. Volume of cone = $\frac{1}{3}\pi r^2 h = \frac{1}{3}\pi (6)^2 \times 24 \text{ cm}^3$ 1

Let the radius of the sphere be R cm

$\therefore \frac{4}{3}\pi R^3 = \frac{1}{3}\pi \times 36 \times 24$ 1

$\Rightarrow R^3 = 6 \times 6 \times 6$

$\Rightarrow R = 6$ cm $\frac{1}{2}$

Surface area = $4\pi R^2 = 144\pi \text{ cm}^2$ $\frac{1}{2}$

OR

Water required to fill the tank = $\pi(5)^2 \times 2 = 50\pi \text{ m}^3$ 1

Water flown in 1 hour = $\pi\left(\frac{1}{10}\right)^2 \times 3000 \text{ m}^3$

$= 30\pi \text{ m}^3$ 1

Time taken to fill $30\pi \text{ m}^3$ = 60 minutes

Time taken to fill $50\pi \text{ m}^3$ = $\frac{60}{30} \times 50 = 100$ minutes 1

22. Here the modal class is 20 – 25 $\frac{1}{2}$

Mode = $20 + \frac{20-7}{40-7-8} \times 5$ 2

$= 20 + \frac{13}{25} \times 5 = 22.6$ Hence mode = 22.6 $\frac{1}{2}$

SECTION D

23. $\frac{1}{2a+b+2x} - \frac{1}{2x} = \frac{1}{2a} + \frac{1}{b}$

or $\frac{2x-2a-b-2x}{2x(2a+b+2x)} = \frac{b+2a}{2ab}$ 1

or $\frac{-(2a+b)}{2x(2a+b+2x)} = \frac{2a+b}{2ab}$ 1 or $2x^2 + x(2a + b) + ab = 0$

$(x + a)\ (2x + b) = 0$ 1

$\Rightarrow\ x = -a \text{ or } -\frac{b}{2}$ 1

OR

Let x and y be lengths of the sides of two squares.

$\therefore\ x^2 + y^2 = 640$ and $4(x - y) = 64$ i.e., $x - y = 16$ 1

$x^2 + (x - 16)^2 = 640$ 1

or $x^2 + x^2 - 32x + 256 - 640 = 0$

or $2x^2 - 32x - 384 = 0$

or $x^2 - 16x - 192 = 0$

or $(x + 8)\ (x - 24) = 0 \Rightarrow x = 24$ 1

$\therefore\ y = x - 16 = 24 - 16 = 8$

Hence lengths of sides of the squares are 24 cm and 8 cm. 1

24. Here $\frac{p}{2}\{2a + (p-1)d\} = \frac{q}{2}\{2a + (q-1)d\}$ 1

$\Rightarrow\ pa + \frac{p(p-1)d}{2} - qa - \frac{q(q-1)d}{2} = 0$

$\Rightarrow\ (p-q)a + \frac{d}{2}(p^2 - p - q^2 + q) = 0$ 1

$\Rightarrow\ (p-q)a + \frac{d}{2}(p-q)(p+q-1) = 0$

$\Rightarrow\ a + \frac{d}{2}(p+q-1) = 0$

$\Rightarrow\ 2a + (p + q - 1)d = 0 \qquad ...(i)$ 1

Now $S_{p+q} = \frac{p+q}{2}\{2a + (p+q-1)d\}$

$= 0$ (using (i)) 1

25. In ΔABD, $AB^2 = AD^2 + BD^2 \Rightarrow AD^2 = AB^2 - BD^2$ 1

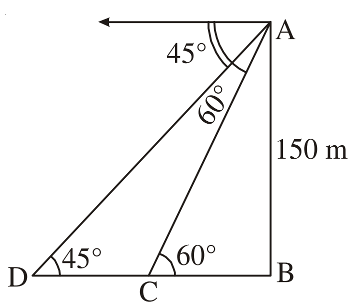
In ΔADC, $AC^2 = AD^2 + CD^2$

$= AB^2 - BD^2 + (BC - BD)^2$ 1

$= AB^2 - BD^2 + BC^2 + BD^2 - 2BC \times BD$ 1

$= AB^2 + BC^2 - 2BC \times BD$ 1

26. Correct Figure 1



$\frac{150}{BC} = \tan 60° = \sqrt{3}$

$\Rightarrow$ $BC = \frac{150}{\sqrt{3}} = 50\sqrt{3}$ m $\frac{1}{2}$

Also $\frac{AB}{BD} = \tan 45° = 1 \Rightarrow AB = BD = 150$ m $\frac{1}{2}$

Now $CD = BD - BC = (150 - 50\sqrt{3})$ m $\frac{1}{2}$

Distance travelled in 2 minutes $= (150 - 50\sqrt{3})$ m

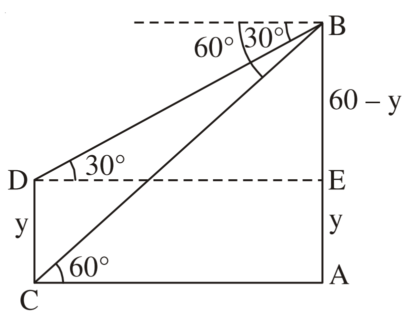
$\therefore$ Distance travelled in 1 minute $= (75 - 25\sqrt{3})$ m 1

or $75 - 25(1.732) = 75 - 43.3 = 31.7$ m/minute

Hence speed of boat is $(75 - 25\sqrt{3})$ m/minutes or 31.7 m/minutes $\frac{1}{2}$

OR

Correct Figure 1



In ΔABC, $\frac{AB}{AC} = \tan 60°$

$\frac{60}{AC} = \sqrt{3}$

$AC = 20\sqrt{3}$ m 1

In ΔBED, $\frac{60 - y}{DE} = \tan 30° = \frac{1}{\sqrt{3}}$ 1

i.e., $\frac{60 - y}{20\sqrt{3}} = \frac{1}{\sqrt{3}} \Rightarrow 60 - y = 20$ i.e., $y = 40$ m $\frac{1}{2}$

$\left.\begin{array}{l}\text{Hence width of river} = 20\sqrt{3} \text{ m and} \\ \text{height of other pole} = 40 \text{ m}\end{array}\right\}$ $\frac{1}{2}$

27. Correct Construction of triangle 1

Correct Construction of similar triangle 3

28. LHS = $\sin^8\theta - \cos^8\theta = (\sin^4\theta)^2 - (\cos^4\theta)^2$

$= (\sin^4\theta + \cos^4\theta)(\sin^4\theta - \cos^4\theta)$ 1

$= (\sin^4\theta + \cos^4\theta + 2\sin^2\theta\cos^2\theta - 2\sin^2\theta\cos^2\theta)(\sin^2\theta + \cos^2\theta)(\sin^2\theta - \cos^2\theta)$ 1

$= [(\sin^2 + \cos^2\theta)^2 - 2\sin^2\theta\cos^2\theta](\sin^2\theta - \cos^2\theta)$ 1

$= (1 - 2\sin^2\theta\cos^2\theta)(\sin^2\theta - \cos^2\theta)$

$= (1 - 2\sin^2\theta\cos^2\theta)(1 - 2\cos^2\theta)$ = RHS 1

29. Volume of the container $= \dfrac{\pi}{3}h(r_1^2 + r_2^2 + r_1r_2)$

$= \dfrac{3.14}{3} \times 16\,(20^2 + 8^2 + 20 \times 8)$ $\frac{1}{2}$

$= 3.14 \times 16 \times 208 = 10450 \text{ cm}^3$ 1

= 10.45 litres

Cost of milk = 10.45×50 = ₹ 522.50 $\frac{1}{2}$

Slant height of frustum $= \sqrt{16^2 + 12^2} = 20\,\text{cm}$ $\frac{1}{2}$

Surface area $= \pi[(r_1 + r_2)l + r_2^2]$

$= 3.14[(8 + 20)\,20 + 8^2]$

$= 3.14 \times 624 = 1959.36 \text{ cm}^2$ 1

$\therefore$ Cost of metal used $= \dfrac{10}{100} \times 1959.36 =$ ₹195.93 $\frac{1}{2}$

30.

Classes	**Class mark (X)**	**Frequency (f_i)**	**f_i x_i**
10-30	20	5	100
30-50	40	8	320
50-70	60	12	720
70-90	80	20	1600
90-110	100	3	300
110-130	120	2	240

Correct Table 2

$$\left.\begin{aligned} \text{Mean} &= \frac{\Sigma f_i x_i}{\Sigma f_i} \\ &= \frac{3280}{50} \\ &= 65.6 \end{aligned}\right\} \qquad 2$$

Alternate methods by assuming mean are acceptable.

OR

	cf	
More than or equal to 65	24	
More than or equal to 60	54	
More than or equal to 55	74	Table $1\frac{1}{2}$
More than or equal to 50	90	
More than or equal to 45	96	
More than or equal to 40	100	

Plotting graph of (40, 100), (45, 96), (50, 90), (55, 74), (60, 54)

and (65, 24) and joining the points $1\frac{1}{2}+1$

QUESTION PAPER CODE 30/4/2
EXPECTED ANSWER/VALUE POINTS
SECTION A

1. Disc. = 144 – 4 × 4 × (–k) < 0 $\frac{1}{2}$

16k < –144

k < –9 $\frac{1}{2}$

2. Required distance = $\sqrt{(-a-a)^2+(-b-b)^2}$ $\frac{1}{2}$

$= \sqrt{4(a^2+b^2)}$ or $2\sqrt{a^2+b^2}$ $\frac{1}{2}$

3. Here 1.41 < x < 2.6

Any rational number lying between 1.4 ... & 2.6 ... 1

(variable answer)

OR

$2^2 \times 5^2 \times 5 \times 3^2 \times 17 = (10)^2 \times 5 \times 3^2 \times 17$

∴ No. of zeroes in the end of the number = Two 1

4. Here $\frac{BC}{EF} = \frac{8}{11}$ $\frac{1}{2}$

∴ $BC = \frac{8}{11} \times 15.4 = 11.2$ cm $\frac{1}{2}$

5. $\frac{\tan 65°}{\cot 25°} = \frac{\tan(90° - 25°)}{\cot 25°}$ $\frac{1}{2}$

$= \frac{\cot 25°}{\cot 25°} = 1$ $\frac{1}{2}$

OR

sin 67° + cos 75° = sin (90° – 23°) + cos (90° – 15°) $\frac{1}{2}$

= cos 23° + sin 15° $\frac{1}{2}$

6. Here $-47 = 18 + (n-1)\left(-\frac{5}{2}\right)$ $\frac{1}{2}$

$\Rightarrow$ n = 27 $\frac{1}{2}$

SECTION B

7. Let the number of white balls = x

$\therefore$ The number of black balls = 15 – x

P(Black) = $\frac{2}{3}$

$\Rightarrow \frac{15-x}{15} = \frac{2}{3}$ 1

$\Rightarrow$ 45 – 3x = 30

$\Rightarrow$ x = 5 1

Hence number of white balls = 5.

8. No. of spade cards + 3 other kings = 13 + 3 = 16 $\frac{1}{2}$

$\therefore$ Cards which are neither spade nor kings = 52 – 16 = 36 $\frac{1}{2}$

Hence P (neither spade nor king) = $\frac{36}{52}$ or $\frac{9}{13}$ 1

9. $\frac{3}{x} + \frac{8}{y} = -1$ ...(i)

$\frac{1}{x} - \frac{2}{y} = 2$ ...(ii)

Multiply (ii) by 3 and subtract from (i), we get

$\frac{14}{y} = -7 \Rightarrow y = -2$ 1

Substitute this value of y = –2 in (i), we get x = 1

Hence, x = 1, y = –2 1

OR

For unique solution $\frac{a_1}{a_2} \neq \frac{b_1}{b_2} \Rightarrow \frac{k}{3} \neq \frac{2}{6}$ 1

$\Rightarrow k \neq 1$ 1

The pair of equations have unique solution for all real values of k except 1.

10. 12, 16, 20, ..., 204 $\frac{1}{2}$

Let the number of multiples be n.

$\therefore\ t_n = 12 + (n - 1) \times 4 = 204$ 1

$\Rightarrow n = 49$ $\frac{1}{2}$

OR

Here $t_3 = 16$ and $t_7 = t_5 + 12$ $\frac{1}{2}$

$\Rightarrow\ a + 2d = 16$ (i) and $a + 6d = a + 4d + 12$ (ii) $\frac{1}{2}$

From (ii), d = 6

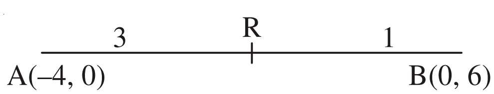
From (i), a = 4 1

$\therefore$ A.P. is 4, 10, 16, ...

11. $\left.\begin{array}{l} 867 = 3 \times 255 + 102 \\ 255 = 2 \times 102 + 51 \\ 102 = 2 \times 51 + 0 \end{array}\right\}$ $1\frac{1}{2}$

$\therefore$ HCF = 51 $\frac{1}{2}$

12. $\frac{AR}{AB} = \frac{3}{4} \Rightarrow \frac{AR}{RB} = \frac{3}{1}$ 1



$\therefore\ R = \left(\frac{3 \times 0 + 1(-4)}{4}, \frac{3 \times 6 + 1 \times 0}{4}\right)$, i.e., $\left(-1, \frac{9}{2}\right)$ 1

SECTION C

13. LHS $= (\sin\theta + \cos\theta + 1)(\sin\theta + \cos\theta - 1)\sec\theta\,\mathrm{cosec}\,\theta$

$= [(\sin\theta + \cos\theta)^2 - 1]\sec\theta\,\mathrm{cosec}\,\theta$ 1

$= 2\sin\theta\cos\theta\sec\theta\,\mathrm{cosec}\,\theta$ 1

$= 2 =$ RHS 1

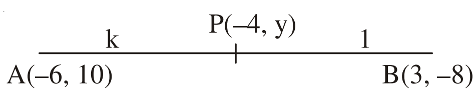
OR

LHS $= \sqrt{\dfrac{\sec\theta-1}{\sec\theta+1}} + \sqrt{\dfrac{\sec\theta+1}{\sec\theta-1}} = \dfrac{(\sec\theta-1)+(\sec\theta+1)}{\sqrt{\sec^2\theta-1}}$ 1

$= \dfrac{2\sec\theta}{\tan\theta}$ 1

$= \dfrac{2}{\sin\theta} = 2\,\mathrm{cosec}\,\theta = \text{RHS}$ 1

14.



Let point P divides the line segment AB in the ratio k : 1

$\therefore\ \dfrac{3k-6}{k+1} = -4$ 1

$\Rightarrow\ 3k - 6 = -4k - 4$

$\Rightarrow\ 7k = 2$ i.e., $k = \dfrac{2}{7}$ $\therefore$ Ratio is 2 : 7 1

Again $\dfrac{2\times(-8)+7\times10}{2+7} = y \Rightarrow y = 6$ 1

Hence $y = 6$

OR

The points are collinear if the area of triangle formed is zero.

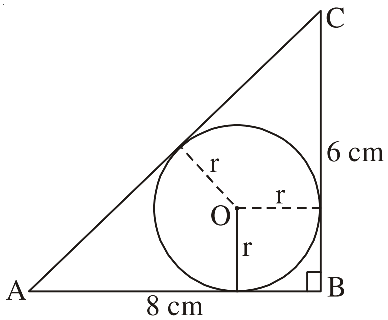
i.e., $-5(p + 2) + 1(-2 - 1) + 4(1 - p) = 0$ $1\frac{1}{2}$

$-5p - 10 - 3 + 4 - 4p = 0$

$-9p = 9$

$p = -1$ $1\frac{1}{2}$

15.



$AC = \sqrt{AB^2 + BC^2} = \sqrt{64 + 36} = 10\text{ cm}$ $\frac{1}{2}$

Area of $\Delta ABC = \frac{1}{2} \times 8 \times 6 = 24\text{ cm}^2$ $\frac{1}{2}$

Let r be the radius of inscribed circle.

ar(ΔABC) = ar(AOB) + ar(ΔBOC) + ar(ΔAOC)

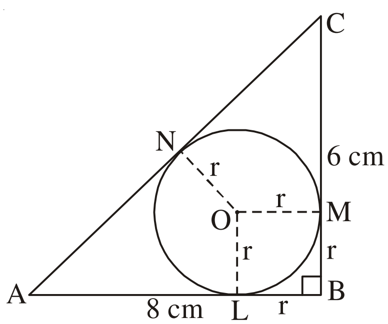
$= \frac{1}{2} \times 8r + \frac{1}{2} \times 6r + \frac{1}{2} \times 10r$ 1

$= \frac{1}{2} r(8 + 6 + 10) = 12r$

$12r = 24 \Rightarrow r = 2$ cm $\frac{1}{2}$

$\therefore$ Diameter = 4 cm $\frac{1}{2}$

Alternate method:



Here BL = BM = r (sides of squares)

$AC = \sqrt{AB^2 + BC^2} = 10$ cm 1

AL = AN = 8 – r and CM = CN = 6 – r $\frac{1}{2}$

AC = AN + NC

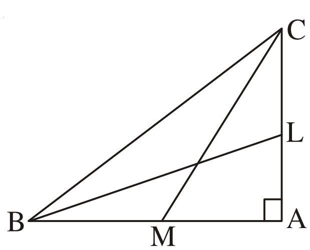
$\Rightarrow$ 10 = 8 – r + 6 – r

$\Rightarrow$ 2r = 4

$\Rightarrow$ r = 2 $\frac{1}{2}$

$\therefore$ Diameter = 4 cm 1

16.



In right angled triangle CAM,

$CM^2 = CA^2 + AM^2$ ...(i)

Similarly, $BC^2 = AC^2 + AB^2$ ...(ii)

and $BL^2 = AL^2 + AB^2$ ...(iii) 1

Now $4(BL^2 + CM^2) = 4(AL^2 + AB^2 + AC^2 + AM^2)$ 1

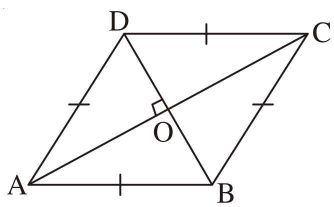
But $AL = LC = \frac{1}{2}AC$ and $AM = MB = \frac{1}{2}AB$

$$\therefore\ 4(BL^2 + CM^2) = 4\left(\frac{AC^2}{4} + AB^2 + AC^2 + \frac{AB^2}{4}\right)$$

$$= 4\left(\frac{5}{4}AB^2 + \frac{5}{4}AC^2\right)$$

$= 5(AB^2 + AC^2) = 5BC^2$ 1

OR



Let ABCD be rhombus and its diagonals intersect at O.

In ΔAOB, $AB^2 = AO^2 + OB^2$ 1

$$= \left(\frac{AC}{2}\right)^2 + \left(\frac{BD}{2}\right)^2$$

$= \frac{1}{4}(AC^2 + BD^2)$ 1

$\Rightarrow 4AB^2 = AC^2 + BD^2$

$\Rightarrow AB^2 + BC^2 + CD^2 + AD^2 = AC^2 + BD^2$ (ABCD being rhombus) 1

17. Area of shaded region

$= \left[\pi(42)^2 - \pi(21)^2\right]\frac{300°}{360°}$ 1

$= \frac{22}{7} \times 63 \times 21 \times \frac{5}{6}.$ 1

$= 3465\ cm^2$ 1

18. Here the modal class is 20 – 25 $\frac{1}{2}$

Mode $= 20 + \frac{20-7}{40-7-8} \times 5$ 2

$= 20 + \frac{13}{25} \times 5 = 22.6$ Hence mode = 22.6 $\frac{1}{2}$

19. Volume of cone $= \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi(6)^2 \times 24\ cm^3$ 1

Let the radius of the sphere be R cm

$\therefore\ \frac{4}{3}\pi R^3 = \frac{1}{3}\pi \times 36 \times 24$ 1

$\Rightarrow R^3 = 6 \times 6 \times 6$

$\Rightarrow R = 6$ cm $\frac{1}{2}$

Surface area $= 4\pi R^2 = 144\pi$ cm^2 $\frac{1}{2}$

OR

Water required to fill the tank $= \pi(5)^2 \times 2 = 50\pi$ m^3 1

Water flown in 1 hour $= \pi\left(\frac{1}{10}\right)^2 \times 3000$ m^3

$= 30\pi$ m^3 1

Time taken to fill 30π m^3 = 60 minutes

Time taken to fill 50π m^3 $= \frac{60}{30} \times 50 = 100$ minutes 1

20. Let $2+3\sqrt{3}=a$ where a is a rational number $\frac{1}{2}$

Then $\sqrt{3}=\frac{a-2}{3}$ 1

Which is contradiction as LHS in irrational and

RHS is rational 1

$\therefore\ 2+3\sqrt{3}$ is irrational $\frac{1}{2}$

21. Let x and y be length of the sides of two squares.

$\therefore\ x^2 + y^2 = 157$ and $4(x + y) = 68 \Rightarrow x + y = 17$ 1

$\therefore\ x^2 + (17 - x)^2 = 157$ 1

$x^2 + 289 + x^2 - 34x - 157 = 0$

or $x^2 - 17x + 66 = 0$

$(x - 6)(x - 11) = 0$

$\therefore\ x = 6$ or 11

$\therefore\ y = 11$ or 6

Hence length of sides of squares are 6 m and 11 m. 1

22. If α, β are zeroes of the polynomial, then

$\alpha + \beta = -1,\ \alpha\beta = -20$

$\therefore$ Polynomial is $(x^2 + x - 20)$ $1\frac{1}{2}$

$(x + 5)(x - 4)$

$\therefore$ Zeroes of the polynomial are 4 and –5 $1\frac{1}{2}$

SECTION D

23. Let x km/hr be the usual speed of the plane

$\therefore \quad \frac{1500}{x} - \frac{1500}{x+250} = \frac{1}{2}$ $1\frac{1}{2}$

$\Rightarrow x^2 + 250x - 750000 = 0$ 1

$\Rightarrow x = -1000$ or 750 1

$\therefore$ Speed of the plane = 750 km/h $\frac{1}{2}$

OR

Let l be the length and b be the breadth of the park

$\therefore \quad 2(l + b) = 60 \Rightarrow l + b = 30$ and $l \times b = 200$ 1

$l(30 - l) = 200$ 1

$\Rightarrow l^2 - 30l + 200 = 0$

$\Rightarrow (l - 20)(l - 10) = 10$ 1

$\Rightarrow l = 20$ or 10

Hence length = 20 m, breadth = 10 m 1

24. Let x be the nth term

$\therefore \quad t_n = x = 2 + (n - 1)4$ i.e. $x = 4n - 2$ 1

Also $S_n = 1800 = \frac{n}{2}\{4 + (n-1)4\}$ 1

i.e. $\frac{4n^2}{2} = 1800$

$n^2 = 900 \Rightarrow n = 30$ 1

$\therefore \quad x = 30 \times 4 - 2 = 118$ 1

25. $\sec\theta + \tan\theta = m$ ...(i)

We know that $\sec^2\theta - \tan^2\theta = 1$ 1

$\sec\theta - \tan\theta = \dfrac{1}{m}$ ...(ii) 1

From (i) and (ii), $2\sec\theta = m + \dfrac{1}{m}$ and $2\tan\theta = m - \dfrac{1}{m}$ 1

Now $\sin\theta = \dfrac{2\tan\theta}{2\sec\theta} = \dfrac{m - \frac{1}{m}}{m + \frac{1}{m}} = \dfrac{m^2 - 1}{m^2 + 1}$ 1

26. In ΔABD, $AB^2 = AD^2 + BD^2 \Rightarrow AD^2 = AB^2 - BD^2$ 1

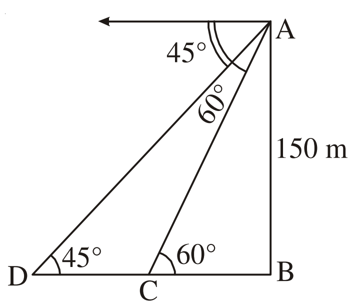
In ΔADC, $AC^2 = AD^2 + CD^2$

$= AB^2 - BD^2 + (BC - BD)^2$ 1

$= AB^2 - BD^2 + BC^2 + BD^2 - 2BC \times BD$ 1

$= AB^2 + BC^2 - 2BC \times BD$ 1

27. Correct Figure 1



$\dfrac{150}{BC} = \tan 60° = \sqrt{3}$

$\Rightarrow \quad BC = \dfrac{150}{\sqrt{3}} = 50\sqrt{3}$ m $\frac{1}{2}$

Also $\dfrac{AB}{BD} = \tan 45° = 1 \Rightarrow AB = BD = 150$ m $\frac{1}{2}$

Now $CD = BD - BC = (150 - 50\sqrt{3})$ m $\frac{1}{2}$

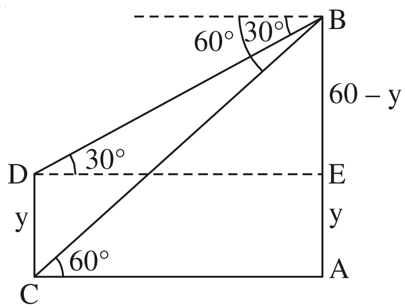
Distance travelled in 2 minutes = $(150 - 50\sqrt{3})$ m

$\therefore$ Distance travelled in 1 minute = $(75 - 25\sqrt{3})$ m 1

or $75 - 25(1.732) = 75 - 43.3 = 31.7$ m/minute

Hence speed of boat is $(75 - 25\sqrt{3})$ m/minutes or 31.7 m/minutes $\frac{1}{2}$

OR



Correct Figure 1

In ΔABC, $\frac{AB}{AC} = \tan 60°$

$\frac{60}{AC} = \sqrt{3}$

$AC = 20\sqrt{3}$ m 1

In ΔBED, $\frac{60-y}{DE} = \tan 30° = \frac{1}{\sqrt{3}}$ 1

i.e., $\frac{60-y}{20\sqrt{3}} = \frac{1}{\sqrt{3}} \Rightarrow 60 - y = 20$ i.e., $y = 40$ m $\frac{1}{2}$

$\left.\begin{array}{l}\text{Hence width of river} = 20\sqrt{3} \text{ m and} \\ \text{height of other pole} = 40 \text{ m}\end{array}\right\}$ $\frac{1}{2}$

28. Correct Construction of triangle 1

Correct Construction of similar triangle 3

29.

Classes	Class mark (X)	Frequency (f_i)	$f_i x_i$	
10-30	20	5	100	
30-50	40	8	320	
50-70	60	12	720	
70-90	80	20	1600	Correct Table 2
90-110	100	3	300	
110-130	120	2	240	

$$\left.\begin{aligned}\text{Mean} &= \frac{\Sigma f_i x_i}{\Sigma f_i} \\ &= \frac{3280}{50} \\ &= 65.6\end{aligned}\right\}$$ 2

Alternate methods by assuming mean are acceptable.

OR

	cf	
More than or equal to 65	24	
More than or equal to 60	54	
More than or equal to 55	74	Table $1\frac{1}{2}$
More than or equal to 50	90	
More than or equal to 45	96	
More than or equal to 40	100	

Plotting graph of (40, 100), (45, 96), (50, 90), (55, 74), (60, 54)

and (65, 24) and joining the points $1\frac{1}{2}+1$

30. Volume of the container $= \frac{\pi}{3}h(r_1^2 + r_2^2 + r_1r_2)$

$= \frac{3.14}{3} \times 16\,(20^2 + 8^2 + 20 \times 8)$ $\frac{1}{2}$

$= 3.14 \times 16 \times 208 = 10450 \text{ cm}^3$ 1

$= 10.45$ litres

Cost of milk $= 10.45 \times 50 =$ ₹ 522.50 $\frac{1}{2}$

Slant height of frustum $= \sqrt{16^2 + 12^2} = 20$ cm $\frac{1}{2}$

Surface area $= \pi[(r_1 + r_2)l + r_2^2]$

$= 3.14[(8 + 20)\ 20 + 8^2]$

$= 3.14 \times 624 = 1959.36 \text{ cm}^2$ 1

$\therefore$ Cost of metal used $= \frac{10}{100} \times 1959.36 =$ ₹195.93 $\frac{1}{2}$

QUESTION PAPER CODE 30/4/3
EXPECTED ANSWER/VALUE POINTS
SECTION A

1. Let nth term of the A.P. be 101.

$\therefore\ t_n = -4 + (n - 1)3 = 101$ $\frac{1}{2}$

$3n - 7 = 101$

$n = \frac{108}{3} = 36$ $\frac{1}{2}$

2. $\frac{\tan 65°}{\cot 25°} = \frac{\tan(90° - 25°)}{\cot 25°}$ $\frac{1}{2}$

$= \frac{\cot 25°}{\cot 25°} = 1$ $\frac{1}{2}$

OR

$\sin 67° + \cos 75° = \sin(90° - 23°) + \cos(90° - 15°)$ $\frac{1}{2}$

$= \cos 23° + \sin 15°$ $\frac{1}{2}$

3. For equal roots, $4k^2 - 4k \times 6 = 0$ $\frac{1}{2}$

Hence $k = 6$ $\frac{1}{2}$

4. Here $1.41 < x < 2.6$

Any rational number lying between 1.4 ... & 2.6 ... 1

(variable answer)

OR

$2^2 \times 5^2 \times 5 \times 3^2 \times 17 = (10)^2 \times 5 \times 3^2 \times 17$

$\therefore$ No. of zeroes in the end of the number = Two 1

5. Required distance $= \sqrt{(-a-a)^2 + (-b-b)^2}$ $\frac{1}{2}$

$= \sqrt{4(a^2+b^2)}$ or $2\sqrt{a^2+b^2}$ $\frac{1}{2}$

6. Here $\frac{BC}{EF} = \frac{8}{11}$ $\frac{1}{2}$

$\therefore$ BC = $\frac{8}{11} \times 15.4 = 11.2$ cm $\frac{1}{2}$

SECTION B

7. $\frac{3}{x} + \frac{8}{y} = -1$ ...(i)

$\frac{1}{x} - \frac{2}{y} = 2$ ...(ii)

Multiply (ii) by 3 and subtract from (i), we get

$\frac{14}{y} = -7 \Rightarrow y = -2$ 1

Substitute this value of y = –2 in (i), we get x = 1

Hence, x = 1, y = –2 1

OR

For unique solution $\frac{a_1}{a_2} \neq \frac{b_1}{b_2} \Rightarrow \frac{k}{3} \neq \frac{2}{6}$ 1

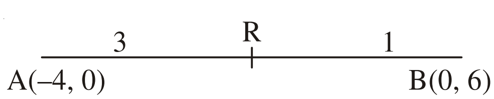
$\Rightarrow k \neq 1$ 1

The pair of equations have unique solution for all real values of k except 1.

8. $\left.\begin{array}{l} 867 = 3 \times 255 + 102 \\ 255 = 2 \times 102 + 51 \\ 102 = 2 \times 51 + 0 \end{array}\right\}$ $1\frac{1}{2}$

$\therefore$ HCF = 51 $\frac{1}{2}$

9.



$\frac{AR}{AB} = \frac{3}{4} \Rightarrow \frac{AR}{RB} = \frac{3}{1}$ 1

$\therefore$ R = $\left(\frac{3 \times 0 + 1(-4)}{4}, \frac{3 \times 6 + 1 \times 0}{4}\right)$, i.e., $\left(-1, \frac{9}{2}\right)$ 1

10. 12, 16, 20, ..., 204 $\frac{1}{2}$

Let the number of multiples be n.

$\therefore\ t_n = 12 + (n - 1) \times 4 = 204$ 1

$\Rightarrow n = 49$ $\frac{1}{2}$

OR

Here $t_3 = 16$ and $t_7 = t_5 + 12$ $\frac{1}{2}$

$\Rightarrow\ a + 2d = 16$ (i) and $a + 6d = a + 4d + 12$ (ii) $\frac{1}{2}$

From (ii), d = 6

From (i), a = 4 1

$\therefore$ A.P. is 4, 10, 16, ...

11. The possible number of outcomes are 8 {HHH, HHT, HTH, THH, HTT, THT, TTH, TTT} 1

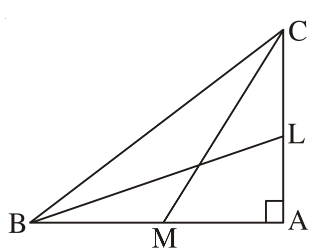
P (exactly one head) = $\frac{3}{8}$ 1

12. (a) P(a prime no.) = $\frac{3}{6}$ or $\frac{1}{2}$ 1

(b) P(odd no.) = $\frac{3}{6}$ or $\frac{1}{2}$ 1

SECTION C

13. In right angled triangle CAM,



$CM^2 = CA^2 + AM^2$ ...(i)

Similarly, $BC^2 = AC^2 + AB^2$ ...(ii)

and $BL^2 = AL^2 + AB^2$ ...(iii) 1

Now $4(BL^2 + CM^2) = 4(AL^2 + AB^2 + AC^2 + AM^2)$ 1

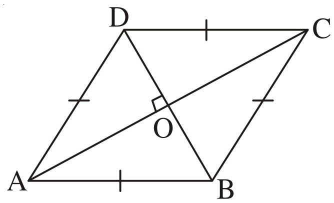
But $AL = LC = \frac{1}{2}AC$ and $AM = MB = \frac{1}{2}AB$

$\therefore\ 4(BL^2 + CM^2) = 4\left(\frac{AC^2}{4} + AB^2 + AC^2 + \frac{AB^2}{4}\right)$

$= 4\left(\frac{5}{4}AB^2 + \frac{5}{4}AC^2\right)$

$= 5(AB^2 + AC^2) = 5BC^2$ 1

OR



Let ABCD be rhombus and its diagonals intersect at O.

In ΔAOB, $AB^2 = AO^2 + OB^2$ 1

$= \left(\frac{AC}{2}\right)^2 + \left(\frac{BD}{2}\right)^2$

$= \frac{1}{4}(AC^2 + BD^2)$ 1

$\Rightarrow 4AB^2 = AC^2 + BD^2$

$\Rightarrow AB^2 + BC^2 + CD^2 + AD^2 = AC^2 + BD^2$ (ABCD being rhombus) 1

14. Area of shaded region

$= \left[\pi(42)^2 - \pi(21)^2\right]\frac{300°}{360°}$ 1

$= \frac{22}{7} \times 63 \times 21 \times \frac{5}{6}.$ 1

$= 3465 \text{ cm}^2$ 1

15. Volume of cone $= \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi(6)^2 \times 24 \text{ cm}^3$ 1

Let the radius of the sphere be R cm

$\therefore \frac{4}{3}\pi R^3 = \frac{1}{3}\pi \times 36 \times 24$ 1

$\Rightarrow R^3 = 6 \times 6 \times 6$

$\Rightarrow R = 6$ cm $\frac{1}{2}$

Surface area $= 4\pi R^2 = 144\pi \text{ cm}^2$ $\frac{1}{2}$

OR

Water required to fill the tank $= \pi(5)^2 \times 2 = 50\pi \text{ m}^3$ 1

Water flown in 1 hour = $\pi\left(\frac{1}{10}\right)^2 \times 3000\ m^3$

$= 30\pi\ m^3$ 1

Time taken to fill $30\pi\ m^3$ = 60 minutes

Time taken to fill $50\pi\ m^3$ = $\frac{60}{30} \times 50 = 100$ minutes 1

16. Here the modal class is 20 – 25 $\frac{1}{2}$

Mode $= 20 + \frac{20-7}{40-7-8} \times 5$ 2

$= 20 + \frac{13}{25} \times 5 = 22.6$ Hence mode = 22.6 $\frac{1}{2}$

17. Let $\frac{2+3\sqrt{2}}{7}$ be a rational number say 'a'

$\therefore \quad \frac{2+3\sqrt{2}}{7} = a$ 1

$\Rightarrow \quad 3\sqrt{2} = 7a - 2$

$\Rightarrow \quad \sqrt{2} = \frac{7a-2}{3}$ 1

This is a contradiction because $\sqrt{2}$ is an irriational number and $\frac{7a-2}{3}$ is a rational number. 1

Hence $\frac{2+3\sqrt{2}}{7}$ is an irrational number.

18. The polynomial whose zeroes are 2 and –2 is

$(x - 2)(x + 2)$ i.e. $x^2 - 4$ 1

$\therefore \quad 2x^4 - 5x^3 - 11x^2 + 20x + 12 = (x^2 - 4)(2x^2 - 5x - 3)$ 1

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

$\therefore$ Zeroes are 2, –2, 3 and $-\frac{1}{2}$ 1

19. Let the speed of stream = x km/hr.

$\therefore \quad \dfrac{24}{18-x} - \dfrac{24}{18+x} = 1$ $\qquad 1\frac{1}{2}$

$\Rightarrow \; x^2 + 48x - 324 = 0$ $\qquad 1$

$\Rightarrow \; (x - 6)(x + 54) = 0$

$\Rightarrow \; x = 6$

i.e. speed of stream = 6 km/hr $\qquad \frac{1}{2}$

20. LHS $= (\sin\theta + \cos\theta + 1)(\sin\theta + \cos\theta - 1) \sec\theta \operatorname{cosec}\theta$

$= [(\sin\theta + \cos\theta)^2 - 1] \sec\theta \operatorname{cosec}\theta$ $\qquad 1$

$= 2 \sin\theta \cos\theta \sec\theta \operatorname{cosec}\theta$ $\qquad 1$

$= 2 =$ RHS $\qquad 1$

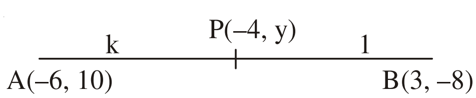
OR

LHS $= \sqrt{\dfrac{\sec\theta - 1}{\sec\theta + 1}} + \sqrt{\dfrac{\sec\theta + 1}{\sec\theta - 1}} = \dfrac{(\sec\theta - 1) + (\sec\theta + 1)}{\sqrt{\sec^2\theta - 1}}$ $\qquad 1$

$= \dfrac{2\sec\theta}{\tan\theta}$ $\qquad 1$

$= \dfrac{2}{\sin\theta} = 2\operatorname{cosec}\theta = \text{RHS}$ $\qquad 1$

21.



Let point P divides the line segment AB in the ratio k : 1

$\therefore \quad \dfrac{3k-6}{k+1} = -4$ $\qquad 1$

$\Rightarrow \; 3k - 6 = -4k - 4$

$\Rightarrow \; 7k = 2$ i.e., $k = \dfrac{2}{7}$ $\therefore$ Ratio is 2 : 7 $\qquad 1$

Again $\dfrac{2 \times (-8) + 7 \times 10}{2+7} = y \Rightarrow y = 6$ $\qquad 1$

Hence $y = 6$

OR

The points are collinear if the area of triangle formed is zero.

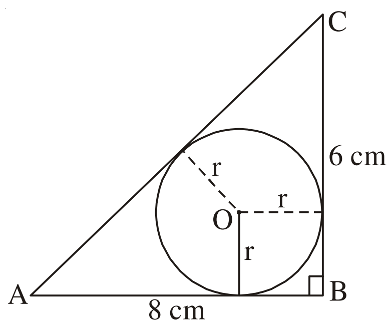
i.e., $-5(p + 2) + 1(-2 - 1) + 4(1 - p) = 0$ $1\frac{1}{2}$

$-5p - 10 - 3 + 4 - 4p = 0$

$-9p = 9$

$p = -1$ $1\frac{1}{2}$

22.



$AC = \sqrt{AB^2 + BC^2} = \sqrt{64 + 36} = 10\text{ cm}$ $\frac{1}{2}$

Area of $\Delta ABC = \frac{1}{2} \times 8 \times 6 = 24\text{ cm}^2$ $\frac{1}{2}$

Let r be the radius of inscribed circle.

$ar(\Delta ABC) = ar(AOB) + ar(\Delta BOC) + ar(\Delta AOC)$

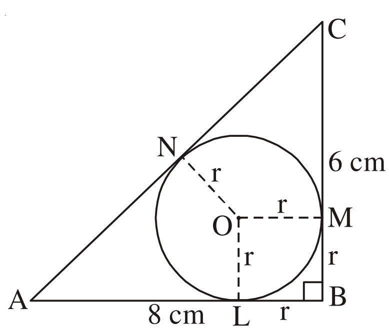
$= \frac{1}{2} \times 8r + \frac{1}{2} \times 6r + \frac{1}{2} \times 10r$ 1

$= \frac{1}{2} r(8 + 6 + 10) = 12r$

$12r = 24 \Rightarrow r = 2$ cm $\frac{1}{2}$

$\therefore$ Diameter = 4 cm $\frac{1}{2}$

Alternate method:



Here BL = BM = r (sides of squares)

$AC = \sqrt{AB^2 + BC^2} = 10$ cm 1

$AL = AN = 8 - r$ and $CM = CN = 6 - r$ $\frac{1}{2}$

$AC = AN + NC$

$\Rightarrow$ $10 = 8 - r + 6 - r$

$\Rightarrow$ $2r = 4$

$\Rightarrow$ $r = 2$ $\frac{1}{2}$

$\therefore$ Diameter = 4 cm 1

SECTION D

23. Here $a_1 = -4$, $a_n = 29$ and $S_n = 150$

Now $29 = -4 + (n-1)d = (n-1)d = 33$ ...(i) $1\frac{1}{2}$

Also $S_n = 150 = \frac{n}{2}(-4+29) \Rightarrow n = 12$ $1\frac{1}{2}$

From (i), d = 3

Hence common difference = 3 1

24. Drawing circle of radius 4 cm and taking a point 6 cm away from the centre $1\frac{1}{2}$

Drawing two tangents 2

Length of tangents = 4.5 cm (approx.) $\frac{1}{2}$

25. LHS = $2(\sin^6\theta + \cos^6\theta) - 3(\sin^4\theta + \cos^4\theta) + 1$

$= 2[(\sin^2\theta)^3 + (\cos^2\theta)^3] - 3[(\sin^2\theta)^2 + (\cos^2\theta)^2 + 2\cos^2\theta \sin^2\theta - 2\cos^2\theta \sin^2\theta] + 1$ 1

$= 2[(\sin^2\theta + \cos^2\theta)(\sin^4\theta + \cos^4\theta - \sin^2\theta\cos^2\theta)] - 3[(\sin^2\theta + \cos^2\theta)^2 - 2\cos^2\theta\sin^2\theta] + 1$

$= 2(\sin^4\theta + \cos^4\theta - \sin^2\theta\cos^2\theta) - 3(1 - 2\cos^2\theta\sin^2\theta) + 1$ 1

$= 2[(\sin^2\theta + \cos^2\theta)^2 - 3\sin^2\theta\cos^2\theta] - 3(1 - 2\cos^2\theta\sin^2\theta) + 1$

$= 2(1 - 3\sin^2\theta\cos^2\theta) - 3(1 - 2\cos^2\theta\sin^2\theta) + 1$ 1

$= 2 - 6\sin^2\theta\cos^2\theta - 3 + 6\sin^2\theta\cos^2\theta + 1$

$= 0 = \text{RHS}$ 1

26. $\frac{1}{2a+b+2x} - \frac{1}{2x} = \frac{1}{2a} + \frac{1}{b}$

or $\frac{2x-2a-b-2x}{2x(2a+b+2x)} = \frac{b+2a}{2ab}$ 1

or $\frac{-(2a+b)}{2x(2a+b+2x)} = \frac{2a+b}{2ab}$ 1

or $2x^2 + x(2a+b) + ab = 0$

$(x+a)(2x+b) = 0$ 1

$\Rightarrow x = -a$ or $-\frac{b}{2}$ 1

OR

Let x and y be lengths of the sides of two squares.

$\therefore\ x^2 + y^2 = 640$ and $4(x - y) = 64$ i.e., $x - y = 16$ 1

$x^2 + (x - 16)^2 = 640$ 1

or $x^2 + x^2 - 32x + 256 - 640 = 0$

or $2x^2 - 32x - 384 = 0$

or $x^2 - 16x - 192 = 0$

or $(x + 8)(x - 24) = 0 \Rightarrow x = 24$ 1

$\therefore\ y = x - 16 = 24 - 16 = 8$

Hence lengths of sides of the squares are 24 cm and 8 cm. 1

27. In ΔABD, $AB^2 = AD^2 + BD^2 \Rightarrow AD^2 = AB^2 - BD^2$ 1

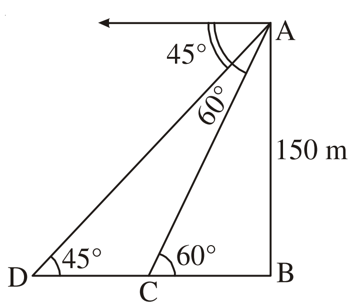
In ΔADC, $AC^2 = AD^2 + CD^2$

$= AB^2 - BD^2 + (BC - BD)^2$ 1

$= AB^2 - BD^2 + BC^2 + BD^2 - 2BC \times BD$ 1

$= AB^2 + BC^2 - 2BC \times BD$ 1

28. Correct Figure 1



$$\frac{150}{BC} = \tan 60° = \sqrt{3}$$

$$\Rightarrow\ BC = \frac{150}{\sqrt{3}} = 50\sqrt{3}\text{ m}$$ $\frac{1}{2}$

Also $\frac{AB}{BD} = \tan 45° = 1 \Rightarrow AB = BD = 150$ m $\frac{1}{2}$

Now $CD = BD - BC = (150 - 50\sqrt{3})$ m $\frac{1}{2}$

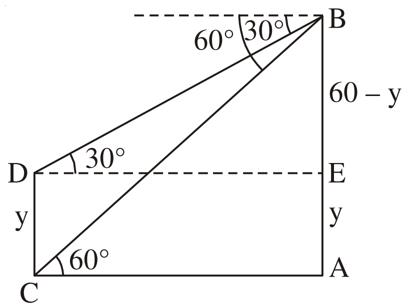
Distance travelled in 2 minutes = $(150 - 50\sqrt{3})$ m

$\therefore$ Distance travelled in 1 minute = $(75 - 25\sqrt{3})$ m 1

or $75 - 25(1.732) = 75 - 43.3 = 31.7$ m/minute

Hence speed of boat is $(75 - 25\sqrt{3})$ m/minutes or 31.7 m/minutes $\frac{1}{2}$

OR



Correct Figure 1

In ΔABC, $\dfrac{AB}{AC} = \tan 60°$

$\dfrac{60}{AC} = \sqrt{3}$

$AC = 20\sqrt{3}$ m 1

In ΔBED, $\dfrac{60-y}{DE} = \tan 30° = \dfrac{1}{\sqrt{3}}$ 1

i.e., $\dfrac{60-y}{20\sqrt{3}} = \dfrac{1}{\sqrt{3}} \Rightarrow 60 - y = 20$ i.e., $y = 40$ m $\frac{1}{2}$

$\left.\begin{array}{l}\text{Hence width of river} = 20\sqrt{3} \text{ m and} \\ \text{height of other pole} = 40 \text{ m}\end{array}\right\}$ $\frac{1}{2}$

29.

Classes	**Class mark (X)**	**Frequency (f_i)**	**$f_i\ x_i$**	
10-30	20	5	100	
30-50	40	8	320	
50-70	60	12	720	
70-90	80	20	1600	Correct Table 2
90-110	100	3	300	
110-130	120	2	240	

$$\left.\begin{aligned}\text{Mean} &= \frac{\Sigma f_i x_i}{\Sigma f_i} \\ &= \frac{3280}{50} \\ &= 65.6\end{aligned}\right\}$$ 2

Alternate methods by assuming mean are acceptable.

OR

	cf	
More than or equal to 65	24	
More than or equal to 60	54	
More than or equal to 55	74	Table $1\frac{1}{2}$
More than or equal to 50	90	
More than or equal to 45	96	
More than or equal to 40	100	

Plotting graph of (40, 100), (45, 96), (50, 90), (55, 74), (60, 54)

and (65, 24) and joining the points $1\frac{1}{2}+1$

30. Volume of the container $= \frac{\pi}{3}h(r_1^2 + r_2^2 + r_1r_2)$

$= \frac{3.14}{3} \times 16\,(20^2 + 8^2 + 20 \times 8)$ $\frac{1}{2}$

$= 3.14 \times 16 \times 208 = 10450 \text{ cm}^3$ 1

$= 10.45$ litres

Cost of milk $= 10.45 \times 50 =$ ₹ 522.50 $\frac{1}{2}$

Slant height of frustum $= \sqrt{16^2 + 12^2} = 20\,\text{cm}$ $\frac{1}{2}$

Surface area $= \pi[(r_1 + r_2)l + r_2^2]$

$= 3.14[(8 + 20)\ 20 + 8^2]$

$= 3.14 \times 624 = 1959.36 \text{ cm}^2$ 1

$\therefore$ Cost of metal used $= \frac{10}{100} \times 1959.36 =$ ₹195.93 $\frac{1}{2}$