Strictly Confidential: (For Internal and Restricted use only)
Secondary School Examination
March 2019
Marking Scheme – MATHEMATICS (SUBJECT CODE -041)

PAPER CODE: 30/5/1, 30/5/2, 30/5/3

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 30/5/1

EXPECTED ANSWER/VALUE POINTS

SECTION A

1.	a.b = 1000	1
2.	$k(2)^2 + 2(2) - 3 = 0$	$\frac{1}{2}$
	$k = -\frac{1}{4}$	$\frac{1}{2}$
	OR	
	For real and equal roots	
	$k^2 - 4 \times 3 \times 3 = 0$	$\frac{1}{2}$
	$k = \pm 6$	$\frac{1}{2}$
3.	$15 + (n - 1)(-3) = 0$	$\frac{1}{2}$
	$n = 6$	$\frac{1}{2}$
4.	$\sin 30° + \cos y = 1$	
	$\cos y = \frac{1}{2}$	$\frac{1}{2}$
	$\Rightarrow \; y = 60°$	$\frac{1}{2}$
	OR	
	$\cos 48° - \sin 42°$	
	$= \cos 48° - \cos (90° - 42°)$	$\frac{1}{2}$
	$= 0$	$\frac{1}{2}$
5.	5 : 11	1
6.	$6 - 3a = 5$	$\frac{1}{2}$
	$a = \frac{1}{3}$	$\frac{1}{2}$

SECTION B

7. $a_1 = S_1 = 2(1)^2 + 1 = 3$ $\frac{1}{2}$

$a_2 = S_2 - S_1 = 10 - 3 = 7$ $\frac{1}{2}$

AP 3, 7 ..., $\Rightarrow d = 4$

$a_n = 3 + (n - 1)4 = (4n - 1)$ 1

OR

$a_{17} = a_{10} + 7$ $\frac{1}{2}$

$a + 16d = a + 9d + 7$ $\frac{1}{2}$

$d = 1$ 1

8. $\frac{2a-2}{2} = 1$

$\Rightarrow a = 2$ 1

$\frac{4+3b}{2} = 2a + 1$

$\Rightarrow b = 2$ 1

9. (i) P (getting A) = $\frac{3}{6}$ or $\frac{1}{2}$ 1

(ii) P (getting B) = $\frac{2}{6}$ or $\frac{1}{3}$ 1

10. $612 = 2^2 \times 3^2 \times 17$ $\frac{1}{2}$

$1314 = 2 \times 3^2 \times 73$ $\frac{1}{2}$

HCF (612, 1314) = $2 \times 3^2 = 18$ 1

OR

Let a be any +ve integer

and $b = 6$

$\Rightarrow$ a = 6m + r $\quad$ $0 \le r < 6$, for any +ve integer m $\quad$ 1

Possible forms of 'a' are

6m, 6m + 1, 6m + 2, 6m + 3, 6m + 4, 6m + 5 $\quad \frac{1}{2}$

Out of which 6m, 6m + 2 and 6m + 4 are even.

Hence, any +ve odd integer can be 6m + 1, 6m + 3 or 6m + 5 $\quad \frac{1}{2}$

11. Total cards = 46 $\quad \frac{1}{2}$

(i) P [Prime number less than 10(5, 7)] = $\frac{2}{46}$ or $\frac{1}{23}$ $\quad \frac{1}{2}$

(ii) P [A number which is perfect square (9, 16, 25, 36, 49)] = $\frac{5}{46}$ $\quad$ 1

12. For infinitely many solutions

$$\frac{2}{k-1} = \frac{3}{k+2} = \frac{7}{3k} \qquad 1$$

2k + 4 = 3k − 3; $\qquad$ 9k = 7k + 14

$\qquad$ k = 7 $\qquad\qquad$ k = 7

Hence k = 7 $\quad$ 1

SECTION C

13. Let $\sqrt{5}$ be rational.

$\therefore \sqrt{5} = \frac{a}{b}$, b ≠ 0. a, b are positive integers, HCF (a, b) = 1 $\quad \frac{1}{2}$

On squaring,

$$5 = \frac{a^2}{b^2}$$

$$b^2 = \frac{a^2}{5}$$

$\Rightarrow$ 5 divides a^2

$\Rightarrow$ 5 divides a also.

$a = 5m$, for some +ve integer m. 1

$$b^2 = \frac{25m^2}{5}$$

$$b^2 = 5m^2$$

$\Rightarrow$ 5 divides b^2

$\Rightarrow$ 5 divides b also

$\Rightarrow$ 5 divides a and b both. 1

Which is the contradiction to the fact that HCF (a, b) = 1

Hence our assumption is wrong. $\frac{1}{2}$

$\sqrt{5}$ is irrational.

14. Given $\sqrt{2}$ and $-\sqrt{2}$ are zeroes of given polynomial.

$\therefore$ $(x-\sqrt{2})$ and $(x+\sqrt{2})$ are two factors i.e. $x^2 - 2$ is a factor $\frac{1}{2}$

$$
\begin{array}{r|l|l}
x^2-2 & \cancel{x^4} + x^3 - 14x^2 - 2x + 24 & x^2 + x - 12 \\
 & \cancel{x^4} \qquad\;\; -2x^2 & \\
 & - \qquad\quad\;\; + & \\ \hline
 & \cancel{x^3} - 12x^2 - \cancel{2x} + 24 & \\
 & \cancel{x^3} \qquad\quad\; \cancel{-2x} & \\
 & - \qquad\qquad\;\; + & \\ \hline
 & -12\cancel{x^2} + \cancel{24} & \\
 & -1\cancel{2}x^2 + \cancel{2}4 & \\
 & + \qquad\;\; - & \\ \hline
 & 0 & \\ \hline
\end{array}
$$

$1\frac{1}{2}$

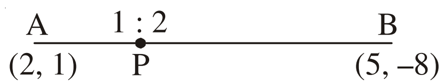
$x^2 + x - 12 = x^2 + 4x - 3x - 12$

$= (x + 4)\,(x - 3)$ $\frac{1}{2}$

$\therefore$ –4, 3 are the zeroes.

Hence, all zeroes are –4, 3, $\sqrt{2}, -\sqrt{2}$ $\frac{1}{2}$

15. $\frac{AP}{AB} = \frac{1}{3} \Rightarrow \frac{AP}{PB} = \frac{1}{2}$ 1



Coordinates of P are $\left(\frac{5+4}{3}, \frac{-8+2}{3}\right) = (3, -2)$ 1

Now, P lies on $2x - y + k = 0$

$\therefore \quad 2(3) - (-2) + k = 0$

$\Rightarrow \quad k = -8$ 1

OR

Three points are collinear $\Rightarrow$ area of Δ formed by these points is zero. 1

$\therefore \quad \frac{1}{2}\left[2(-1-3) + p(3-1) - (1+1)\right] = 0$ 1

$-8 + 2p - 2 = 0$

$p = 5$ 1

16. LHS $= \frac{\tan\theta}{1-\tan\theta} - \frac{\cot\theta}{1-\cot\theta}$

$$= \frac{\frac{\sin\theta}{\cos\theta}}{1 - \frac{\sin\theta}{\cos\theta}} - \frac{\frac{\cos\theta}{\sin\theta}}{1 - \frac{\cos\theta}{\sin\theta}}$$ 1

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

$$= \frac{\sin\theta + \cos\theta}{\cos\theta - \sin\theta} = \text{RHS}$$ $\frac{1}{2}$

OR

$\sin\theta = (\sqrt{2}-1)\cos\theta$ 1

$(\sqrt{2}+1)\sin\theta = (\sqrt{2}-1)(\sqrt{2}+1)\cos\theta$ 1

$(\sqrt{2}+1)\sin\theta = \cos\theta$

$\Rightarrow \sqrt{2}\sin\theta = \cos\theta - \sin\theta$ 1

Alternate method

$\cos\theta + \sin\theta = \sqrt{2}\cos\theta$

On squaring

$\cos^2\theta + \sin^2\theta + 2\cos\theta\sin\theta = 2\cos^2\theta$ 1

$\sin^2\theta + 2\cos\theta\sin\theta = \cos^2\theta$

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

$2\cos\theta\sin\theta = (\cos\theta - \sin\theta)(\cos\theta + \sin\theta)$

$2\cos\theta\sin\theta = (\cos\theta - \sin\theta)(\sqrt{2}\cos\theta)$

$\sqrt{2}\sin\theta = \cos\theta - \sin\theta$ 1

17. Let the fixed charges per student = ₹ x

Cost of food per day per student = ₹ y

$x + 25y = 4500$ 1

$x + 30y = 5200$ 1

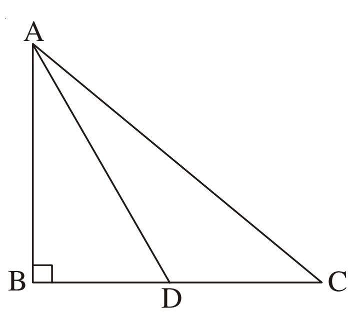
On solving $5y = 700$

$\therefore\ y = 140$

$x = 1000$ 1

$\therefore$ Fixed charges = ₹ 1000 & cost of food per day ₹ 140

18. Correct Figure $\frac{1}{2}$



ΔABC is right angled at B

$\therefore\ AC^2 = AB^2 + BC^2$

$AC^2 = AB^2 + (2CD)^2$

$AC^2 - 4CD^2 = AB^2$ ...(1) 1

ΔABD is right angled at B,

$\therefore\ AD^2 - BD^2 = AB^2$ ...(2) $\frac{1}{2}$

By (1) & (2) $AC^2 - 4CD^2 = AD^2 - BD^2$ $\frac{1}{2}$

$AC^2 = AD^2 - CD^2 + 4CD^2 = AD^2 + 3CD^2$ $(\because\ BD = CD)$ $\frac{1}{2}$

OR

$AB = AC \Rightarrow \angle C = \angle B$ ...(1) 1

In ΔABD & ΔECF,

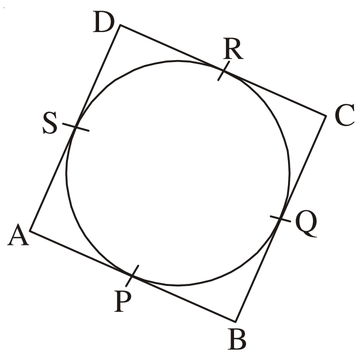
$\angle ADB = \angle EFC$ (each 90°)

$\angle ABD = \angle ECF$ (by (1)) 1

By AA similarity

$\Delta ABD \sim \Delta ECF$ 1

19. Correct Figure $\frac{1}{2}$



Let parallelogram ABCD circumscribes a circle

$$\left.\begin{array}{l} AP = AS \\ PB = BQ \\ DR = DS \\ CR = CQ \end{array}\right\} \text{tangents from an external point to a circle.}$$ 1

$AP + PB + DR + RC = AS + BQ + DS + CQ$

$AB + DC = AD + BC$ 1

$AB + AB = AD + AD$ (opp. sides equal)

$2AB = 2AD$

$\Rightarrow AB = AD$ $\frac{1}{2}$

$\Rightarrow$ ABCD is a rhombus.

20. Area of shaded region $= \dfrac{80°}{360°}\pi(7)^2 + \dfrac{40°}{360°}\pi(7)^2 + \dfrac{60°}{360°}\pi(7)^2$ $1\frac{1}{2}$

$= \dfrac{22}{7} \times 7 \times 7\left[\dfrac{180°}{360°}\right]$ 1

$= 77 \text{ cm}^2$ $\frac{1}{2}$

21. Modal class: 50 – 60 $\frac{1}{2}$

mode $= 50 + \left(\dfrac{90-58}{180-58-83}\right) \times 10$ $1\frac{1}{2}$

$= 50 + \frac{32}{39} \times 10$

$= 58.2$ 1

$\therefore$ Modal age = 58.2 years.

22. Apparent capacity $= \pi r^2 h$

$= 3.14 \times \frac{5}{2} \times \frac{5}{2} \times 10$ 1

$= 196.25 \text{ cm}^3$ $\frac{1}{2}$

Actual capacity $= 196.25 - \frac{2}{3} \times 3.14 \times \frac{5}{2} \times \frac{5}{2} \times \frac{5}{2}$ 1

$= 196.25 - 32.71$

$= 163.54 \text{ cm}^3$ $\frac{1}{2}$

OR

$\pi(18)^2 \times 32 = \frac{1}{3} \pi r^2 \times 24$ 1

$r^2 = (18)^2 \times 4$

$r = 36$ cm 1

$l^2 = (36)^2 + (24)^2$

$l^2 = 1872$

$l = 43.2$ cm 1

SECTION D

23. Let speed of train be x km/h

$\frac{360}{x} - \frac{360}{x+5} = 1$ 2

$360\left[\frac{x+5-x}{x(x+5)}\right] = 1$

$x^2 + 5x - 1800 = 0$ $\frac{1}{2}$

$(x + 45)(x - 40) = 0$ $\frac{1}{2}$

$x = -45, \quad x = 40$ 1

(Rejected)

Hence, speed of train = 40 km/h

OR

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

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

$-ab = x^2 + (a + b)x$

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

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

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

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

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

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

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

On solving (1) and (2) for a and d

$$d = \frac{-2(p+q)}{pq}$$ $\frac{1}{2}$

$$a = \frac{q^2+p^2-p+pq-q}{pq}$$ $\frac{1}{2}$

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

$$= \frac{p+q}{2}\left[2\left(\frac{q^2+p^2-p+pq-q}{pq}\right)+(p+q-1)\left(\frac{-2(p+q)}{pq}\right)\right]$$ 1

$$= (p+q)\left[\frac{\cancel{a^2} + \cancel{p^2} - \cancel{p} + pq - \cancel{q} - \cancel{p^2} - \cancel{q^2} - 2pq + \cancel{p} + \cancel{q}}{pq}\right]$$

$$= (p+q) \times \frac{-pq}{pq} = -(p+q)$$ $\frac{1}{2}$

Alternatively:

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

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

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

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

Solving (1) and (2) for d

$$d = \frac{-2(p+q)}{pq}$$ 1

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

$$= \frac{(p+q)}{2}[2a + (p-1)d + qd]$$

$$= \frac{(p+q)}{2}\left[\frac{2q}{p} + \frac{q \times (-2)(p+q)}{pq}\right]$$ 1

$$= \frac{(p+q)}{2} \times 2\left[\frac{q-p-q}{p}\right] = -(p+q)$$ $\frac{1}{2}$

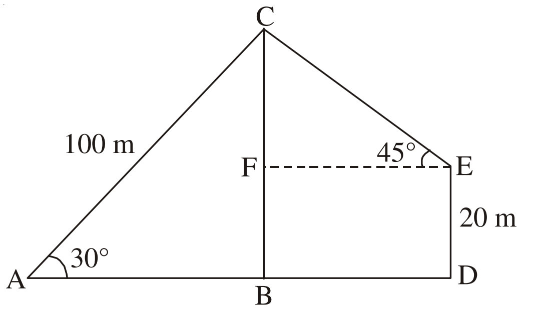
25. For Correct Given, To Prove, Construction, Figure $4 \times \frac{1}{2} = 2$

For Correct Proof 2

26. For Correct Construction of triangle 2

For construction of similar triangle 2

27.



Correct Figure 1

In ΔABC

$$\sin 30^\circ = \frac{BC}{100}$$

$\Rightarrow BC = 50 \text{ m}$ 1

$CF = 50 - 20 = 30 \text{ m}$ $\frac{1}{2}$

In ΔCFE

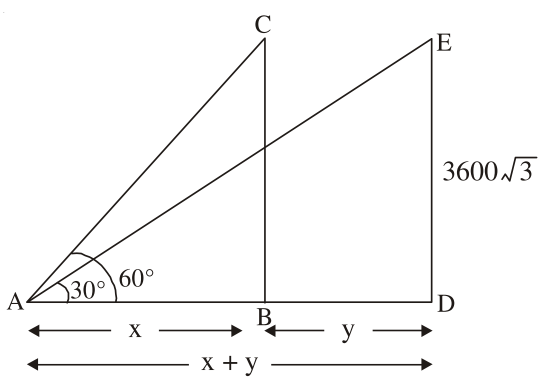
$$\sin 45^\circ = \frac{30}{CE}$$

$CE = 30\sqrt{2}$ 1

$= 30 \times 1.414$

$= 42.42 \text{ m}$ $\frac{1}{2}$

OR



Correct Figure 1

In ΔABC, $\tan 60^\circ = \dfrac{3600\sqrt{3}}{x}$

$x = 3600$ 1

In ΔADE, $\tan 30^\circ = \dfrac{3600\sqrt{3}}{x+y}$

$3600 + y = 3600 \times 3$

$y = 7200$ 1

Speed $= \dfrac{7200}{30} = 240$ m/s 1

28.

Marks	**fi**	**cf**
0–10	10	10
10–20	x	10 + x
20–30	25	35 + x
30–40	30	65 + x
40–50	y	65 + x + y
50–60	10	75 + x + y
Total	100	

Correct Table 1

Median class = 30 – 40 $\frac{1}{2}$

75 + x + y = 100

x + y = 25 $\frac{1}{2}$

$$32 = 30 + \left(\frac{50 - 35 - x}{30}\right) \times 10$$ 1

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

x = 9 $\frac{1}{2}$

y = 16 $\frac{1}{2}$

OR

Class	cf
More than or equal to 0	100
More than or equal to 10	95
More than or equal to 20	80
More than or equal to 30	60
More than or equal to 40	37
More than or equal to 50	20
More than or equal to 60	9

Correct Table $\frac{1}{2}$

Plotting of points (0, 100), (10, 95), (20, 80), (30, 60), (40, 37), (50, 20) and (60, 9) $1\frac{1}{2}$

Joining the points to get curve $\frac{1}{2}$

Median = 35 (approx.) $\frac{1}{2}$

29. LHS $= \dfrac{(1+\cot\theta+\tan\theta)(\sin\theta-\cos\theta)}{\sec^3\theta-\operatorname{cosec}^3\theta}$

$$= \frac{\left(1+\dfrac{\cos\theta}{\sin\theta}+\dfrac{\sin\theta}{\cos\theta}\right)(\sin\theta-\cos\theta)}{\dfrac{1}{\cos^3\theta}-\dfrac{1}{\sin^3\theta}} \qquad 1$$

$$= \frac{\dfrac{(\cos\theta\sin\theta+\cos^2\theta+\sin^2\theta)(\sin\theta-\cos\theta)}{\cos\theta\sin\theta}}{\dfrac{\sin^3\theta-\cos^3\theta}{\cos^3\theta\sin^3\theta}} \qquad 1$$

$$= \frac{\sin^3\theta-\cos^3\theta}{\sin\theta\cos\theta}\times\frac{\cos^3\theta\sin^3\theta}{\sin^3\theta-\cos^3\theta} \qquad 1$$

$= \cos^2\theta\ \sin^2\theta =$ RHS 1

30. $l^2 = (24)^2 + \left(\frac{45}{2} - \frac{25}{2}\right)^2$

$l^2 = 576 + 100 = 676$

$l = 26$ cm 1

$\text{TSA} = \frac{22}{7} \times 26\left(\frac{25}{2} + \frac{45}{2}\right) + \frac{22}{7} \times \frac{25}{2} \times \frac{25}{2}$

$= 2860 + 491.07$

$= 3351.07 \text{ cm}^2$ $1\frac{1}{2}$

$\text{Volume} = \frac{1}{3} \times \frac{22}{7} \times 24\left(\frac{625}{4} + \frac{2025}{4} + \frac{1125}{4}\right)$

$= \frac{1}{\cancel{3}} \times \frac{22}{7} \times \cancel{6}^{2}\ \cancel{24} \times \frac{3775}{\cancel{4}}$

$= \frac{166100}{7} \text{ cm}^3$

or 23728.57 cm^3 $1\frac{1}{2}$

QUESTION PAPER CODE 30/5/2
EXPECTED ANSWER/VALUE POINTS

SECTION A

1.	5 : 11	1
2.	$6 - 3a = 5$	$\frac{1}{2}$
	$a = \frac{1}{3}$	$\frac{1}{2}$
3.	a.b = 1000	1
4.	$k(2)^2 + 2(2) - 3 = 0$	$\frac{1}{2}$
	$k = -\frac{1}{4}$	$\frac{1}{2}$
	OR	
	For real and equal roots	
	$k^2 - 4 \times 3 \times 3 = 0$	$\frac{1}{2}$
	$k = \pm 6$	$\frac{1}{2}$
5.	$\sin 30° + \cos y = 1$	
	$\cos y = \frac{1}{2}$	$\frac{1}{2}$
	$\Rightarrow y = 60°$	$\frac{1}{2}$
	OR	
	$\cos 48° - \sin 42°$	
	$= \cos 48° - \cos (90° - 42°)$	$\frac{1}{2}$
	$= 0$	$\frac{1}{2}$
6.	$a_1 = \sqrt{3}$	
	$a_2 = \sqrt{12} = 2\sqrt{3}$	$\frac{1}{2}$
	$d = \sqrt{3}$	$\frac{1}{2}$

SECTION B

7. Total cards = 46 $\frac{1}{2}$

(i) P [Prime number less than 10(5, 7)] = $\frac{2}{46}$ or $\frac{1}{23}$ $\frac{1}{2}$

(ii) P [A number which is perfect square (9, 16, 25, 36, 49)] = $\frac{5}{46}$ 1

8. For infinitely many solutions

$\frac{2}{k-1} = \frac{3}{k+2} = \frac{7}{3k}$ 1

$2k + 4 = 3k - 3;$ $\quad 9k = 7k + 14$

$k = 7$ $\quad k = 7$

Hence $k = 7$ 1

9. $a_1 = S_1 = 2(1)^2 + 1 = 3$ $\frac{1}{2}$

$a_2 = S_2 - S_1 = 10 - 3 = 7$ $\frac{1}{2}$

AP 3, 7 ..., $\Rightarrow d = 4$

$a_n = 3 + (n - 1)4 = (4n - 1)$ 1

OR

$a_{17} = a_{10} + 7$ $\frac{1}{2}$

$a + 16d = a + 9d + 7$ $\frac{1}{2}$

$d = 1$ 1

10. (i) P (getting A) = $\frac{3}{6}$ or $\frac{1}{2}$ 1

(ii) P (getting B) = $\frac{2}{6}$ or $\frac{1}{3}$ 1

11. $612 = 2^2 \times 3^2 \times 17$ $\frac{1}{2}$

$1314 = 2 \times 3^2 \times 73$ $\frac{1}{2}$

HCF (612, 1314) = $2 \times 3^2 = 18$ 1

OR

Let a be any +ve integer

and b = 6

$\Rightarrow$ a = 6m + r $\quad 0 \le r < 6$, for any +ve integer m 1

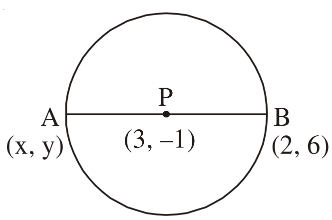
Possible forms of 'a' are

6m, 6m + 1, 6m + 2, 6m + 3, 6m + 4, 6m + 5 $\frac{1}{2}$

Out of which 6m, 6m + 2 and 6m + 4 are even.

Hence, any +ve odd integer can be 6m + 1, 6m + 3 or 6m + 5 $\frac{1}{2}$

12.



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

$\frac{y+6}{2} = -1 \Rightarrow y = -8$ $\frac{1}{2}$

$\Rightarrow$ A(4, –8) $\frac{1}{2}$

SECTION C

13. LHS $= \frac{\tan\theta}{1-\tan\theta} - \frac{\cot\theta}{1-\cot\theta}$

$= \frac{\frac{\sin\theta}{\cos\theta}}{1 - \frac{\sin\theta}{\cos\theta}} - \frac{\frac{\cos\theta}{\sin\theta}}{1-\frac{\cos\theta}{\sin\theta}}$ 1

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

$= \frac{\sin\theta+\cos\theta}{\cos\theta-\sin\theta}$ = RHS $\frac{1}{2}$

OR

$\sin\theta = (\sqrt{2}-1)\cos\theta$ 1

$(\sqrt{2}+1)\sin\theta = (\sqrt{2}-1)(\sqrt{2}+1)\cos\theta$ 1

$(\sqrt{2}+1)\sin\theta = \cos\theta$

$\Rightarrow \sqrt{2}\sin\theta = \cos\theta - \sin\theta$ 1

Alternate method

$\cos\theta + \sin\theta = \sqrt{2}\cos\theta$

On squaring

$\cos^2\theta + \sin^2\theta + 2\cos\theta\sin\theta = 2\cos^2\theta$ 1

$\sin^2\theta + 2\cos\theta\sin\theta = \cos^2\theta$

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

$2\cos\theta\sin\theta = (\cos\theta - \sin\theta)(\cos\theta + \sin\theta)$

$2\cos\theta\sin\theta = (\cos\theta - \sin\theta)(\sqrt{2}\cos\theta)$

$\sqrt{2}\sin\theta = \cos\theta - \sin\theta$ 1

14. Let the fixed charges per student = ₹ x

Cost of food per day per student = ₹ y

$x + 25y = 4500$ 1

$x + 30y = 5200$ 1

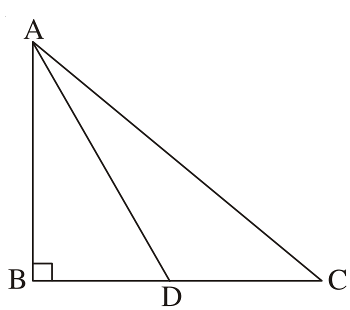
On solving $5y = 700$

$\therefore\ y = 140$

$x = 1000$ 1

$\therefore$ Fixed charges = ₹ 1000 & cost of food per day ₹ 140

15. Correct Figure $\frac{1}{2}$



ΔABC is right angled at B

$\therefore\ AC^2 = AB^2 + BC^2$

$AC^2 = AB^2 + (2CD)^2$

$AC^2 - 4CD^2 = AB^2$ ...(1) 1

ΔABD is right angled at B,

$\therefore\ AD^2 - BD^2 = AB^2$ ...(2) $\frac{1}{2}$

By (1) & (2) $AC^2 - 4CD^2 = AD^2 - BD^2$ $\frac{1}{2}$

$AC^2 = AD^2 - CD^2 + 4CD^2 = AD^2 + 3CD^2$ $(\because\ BD = CD)$ $\frac{1}{2}$

OR

$AB = AC \Rightarrow \angle C = \angle B$ ...(1) 1

In ΔABD & ΔECF,

$\angle ADB = \angle EFC$ (each 90°)

$\angle ABD = \angle ECF$ (by (1)) 1

By AA similarity

$\Delta ABD \sim \Delta ECF$ 1

16. Area of shaded region $= \frac{80°}{360°}\pi(7)^2 + \frac{40°}{360°}\pi(7)^2 + \frac{60°}{360°}\pi(7)^2$ $1\frac{1}{2}$

$= \frac{22}{7} \times 7 \times 7 \left[\frac{180°}{360°}\right]$ 1

$= 77 \text{ cm}^2$ $\frac{1}{2}$

17. Apparent capacity $= \pi r^2 h$

$= 3.14 \times \frac{5}{2} \times \frac{5}{2} \times 10$ 1

$= 196.25 \text{ cm}^3$ $\frac{1}{2}$

Actual capacity $= 196.25 - \frac{2}{3} \times 3.14 \times \frac{5}{2} \times \frac{5}{2} \times \frac{5}{2}$ 1

$= 196.25 - 32.71$

$= 163.54 \text{ cm}^3$ $\frac{1}{2}$

OR

$\pi(18)^2 \times 32 = \frac{1}{3}\pi r^2 \times 24$ 1

$r^2 = (18)^2 \times 4$

$r = 36$ cm 1

$l^2 = (36)^2 + (24)^2$

$l^2 = 1872$

$l = 43.2$ cm 1

18. Let $\sqrt{5}$ be rational.

$\therefore \sqrt{5} = \dfrac{a}{b}$, $b \neq 0$. a, b are positive integers, HCF (a, b) = 1 $\qquad \frac{1}{2}$

On squaring,

$$5 = \frac{a^2}{b^2}$$

$$b^2 = \frac{a^2}{5}$$

$\Rightarrow$ 5 divides a^2

$\Rightarrow$ 5 divides a also.

a = 5m, for some +ve integer m. $\qquad 1$

$$b^2 = \frac{25m^2}{5}$$

$$b^2 = 5m^2$$

$\Rightarrow$ 5 divides b^2

$\Rightarrow$ 5 divides b also

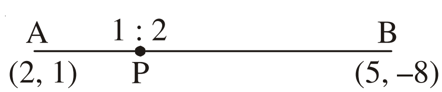
$\Rightarrow$ 5 divides a and b both. $\qquad 1$

Which is the contradiction to the fact that HCF (a, b) = 1

Hence our assumption is wrong. $\qquad \frac{1}{2}$

$\sqrt{5}$ is irrational.

19. $\dfrac{AP}{AB} = \dfrac{1}{3} \Rightarrow \dfrac{AP}{PB} = \dfrac{1}{2}$ $\qquad 1$



Coordinates of P are $\left(\dfrac{5+4}{3}, \dfrac{-8+2}{3}\right) = (3, -2)$ $\qquad 1$

Now, P lies on $2x - y + k = 0$

$\therefore \quad 2(3) - (-2) + k = 0$

$\Rightarrow \quad k = -8$ $\qquad 1$

OR

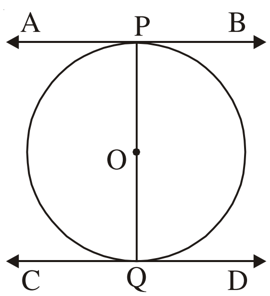
Three points are collinear ⇒ area of Δ formed by these points is zero. 1

$\therefore\ \frac{1}{2}[2(-1-3)+p(3-1)-(1+1)]=0$ 1

$-8 + 2p - 2 = 0$

$p = 5$ 1

20.



Correct Figure $\frac{1}{2}$

$\angle OPB = 90°$

{radius ⊥ tangent} 1

$\angle OQC = 90°$

But they are forming alternate interior angles. 1

⇒ AB ∥ CD $\frac{1}{2}$

21.

$$
\begin{array}{r|l|l}
x^2-3x+2 & \cancel{x^4}-2x^3-x+2 & x^2+x+1 \\
 & \cancel{x^4}-3x^3\qquad+2x^2 & \\
 & -\quad+\qquad\quad- & \\
\hline
 & \cancel{x^3}-2x^2-x+2 & \\
 & \cancel{x^3}-3x^2+2x & \\
 & -\quad+\qquad- & \\
\hline
 & x^2-3x+2 & \\
 & x^2-3x+2 & \\
 & -\quad+\quad- & \\
\hline
 & 0 & \\
\end{array}
$$

2

Yes, g(x) is factor of f(x) 1

22.

Class	fi	xi	di	ui	fiui
0 – 20	17	10	–40	–2	–34
20 – 40	28	30	–20	–1	–28
40 – 60	32	50 A	0	0	0
60 – 80	24	70	20	1	24
80 – 100	19	90	40	2	38
Total	120				0

Correct Table 2

$$\text{Mean} = 50 + \frac{0}{120}$$

$$= 50$$ 1

SECTION D

23. $l^2 = (24)^2 + \left(\frac{45}{2} - \frac{25}{2}\right)^2$

$l^2 = 576 + 100 = 676$

$l = 26$ cm 1

$$\text{TSA} = \frac{22}{7} \times 26\left(\frac{25}{2} + \frac{45}{2}\right) + \frac{22}{7} \times \frac{25}{2} \times \frac{25}{2}$$

$$= 2860 + 491.07$$

$$= 3351.07 \text{ cm}^2$$ $1\frac{1}{2}$

$$\text{Volume} = \frac{1}{3} \times \frac{22}{7} \times 24\left(\frac{625}{4} + \frac{2025}{4} + \frac{1125}{4}\right)$$

$$= \frac{1}{\cancel{3}} \times \frac{22}{7} \times \overset{2}{\cancel{6}}\ \cancel{24} \times \frac{3775}{\cancel{4}}$$

$$= \frac{166100}{7} \text{ cm}^3$$

or 23728.57 cm^3 $1\frac{1}{2}$

24.

Marks	fi	cf
0–10	10	10
10–20	x	10 + x
20–30	25	35 + x
30–40	30	65 + x
40–50	y	65 + x + y
50–60	10	75 + x + y
Total	100	

Correct Table 1

Median class = 30 – 40 $\frac{1}{2}$

75 + x + y = 100

x + y = 25 $\frac{1}{2}$

$$32 = 30 + \left(\frac{50 - 35 - x}{30}\right) \times 10$$ 1

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

x = 9 $\frac{1}{2}$

y = 16 $\frac{1}{2}$

OR

Class	**cf**
More than or equal to 0	100
More than or equal to 10	95
More than or equal to 20	80
More than or equal to 30	60
More than or equal to 40	37
More than or equal to 50	20
More than or equal to 60	9

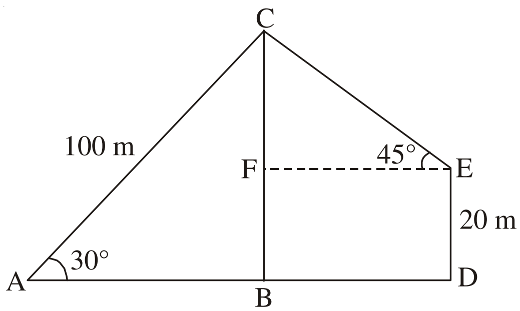
Correct Table $\frac{1}{2}$

Plotting of points (0, 100), (10, 95), (20, 80), (30, 60), (40, 37), (50, 20) and (60, 9) $1\frac{1}{2}$

Joining the points to get curve $\frac{1}{2}$

Median = 35 (approx.) $\frac{1}{2}$

25.



Correct Figure 1

In ΔABC

$\sin 30° = \dfrac{BC}{100}$

$\Rightarrow BC = 50$ m 1

$CF = 50 - 20 = 30$ m $\frac{1}{2}$

In ΔCFE

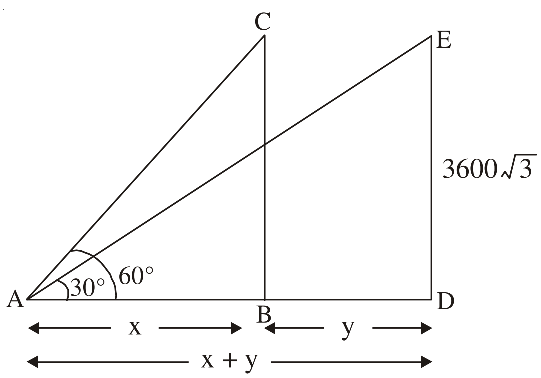
$\sin 45° = \dfrac{30}{CE}$

$CE = 30\sqrt{2}$ 1

$= 30 \times 1.414$

$= 42.42$ m $\frac{1}{2}$

OR



Correct Figure 1

In ΔABC, $\tan 60° = \dfrac{3600\sqrt{3}}{x}$

$x = 3600$ 1

In ΔADE, $\tan 30° = \dfrac{3600\sqrt{3}}{x+y}$

$3600 + y = 3600 \times 3$

$y = 7200$ 1

Speed $= \dfrac{7200}{30} = 240$ m/s 1

26. For Correct Given, To Prove, Construction, Figure $4\times\frac{1}{2} = 2$

For Correct Proof 2

27. Let speed of train be x km/h

$\dfrac{360}{x} - \dfrac{360}{x+5} = 1$ 2

$$360\left[\frac{x+5-x}{x(x+5)}\right]=1$$

$x^2 + 5x - 1800 = 0$ $\frac{1}{2}$

$(x + 45)(x - 40) = 0$ $\frac{1}{2}$

$x = -45,$ $x = 40$ 1
(Rejected)

Hence, speed of train = 40 km/h

OR

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

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

$-ab = x^2 + (a + b)x$

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

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

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

28. $$\frac{\operatorname{cosec}^2(90°-\theta)-\tan^2\theta}{2(\cos^2 37°+\cos^2(90°-37°))}-\frac{2\tan^2 30°\sec^2 37°\sin^2(90°-37°)}{\operatorname{cosec}^2(90°-27°)-\tan^2 27°}$$ 1

$$=\frac{\sec^2\theta-\tan^2\theta}{2(\cos^2 37°+\sin^2 37°)}-\frac{2\left(\frac{1}{\sqrt{3}}\right)^2\times\frac{1}{\cos^2 37°}\times\cos^2 37°}{\sec^2 27°-\tan^2 27°}$$ $1\frac{1}{2}$

$$=\frac{1}{2\times1}-\frac{\frac{2}{3}\times1}{1}$$ 1

$$=\frac{1}{2}-\frac{2}{3}=\frac{-1}{6}$$ $\frac{1}{2}$

29. For Correct Construction of Triangle 2

For Correct Construction of Similar triangle 2

30. Numbers are 12, 17, 22, ..., 97 1

$97 = 12 + (n - 1)5$

$85 = (n - 1)5$

$n = 18$ $1\frac{1}{2}$

$S_n = \frac{18}{2}(12+97)$

$= 981$ $1\frac{1}{2}$

QUESTION PAPER CODE 30/5/3
EXPECTED ANSWER/VALUE POINTS

SECTION A

1. $15 + (n - 1)(-3) = 0$ $\frac{1}{2}$

$n = 6$ $\frac{1}{2}$

2. $\sin 30° + \cos y = 1$

$\cos y = \frac{1}{2}$ $\frac{1}{2}$

$\Rightarrow y = 60°$ $\frac{1}{2}$

OR

$\cos 48° - \sin 42°$

$= \cos 48° - \cos (90° - 42°)$ $\frac{1}{2}$

$= 0$ $\frac{1}{2}$

3. 5 : 11 1

4. a.b = 1000 1

5. $k(2)^2 + 2(2) - 3 = 0$ $\frac{1}{2}$

$k = -\frac{1}{4}$ $\frac{1}{2}$

OR

For real and equal roots

$k^2 - 4 \times 3 \times 3 = 0$ $\frac{1}{2}$

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

6. $(x - 9)^2 + (2 - 8)^2 = 100$ $\frac{1}{2}$

$(x - 9)^2 = 64$

$x - 9 = \pm 8$

$x = 17, \quad x = 1$ $\frac{1}{2}$

SECTION B

7. (i) P (getting A) = $\frac{3}{6}$ or $\frac{1}{2}$ 1

(ii) P (getting B) = $\frac{2}{6}$ or $\frac{1}{3}$ 1

8. $612 = 2^2 \times 3^2 \times 17$ $\frac{1}{2}$

$1314 = 2 \times 3^2 \times 73$ $\frac{1}{2}$

HCF (612, 1314) $= 2 \times 3^2 = 18$ 1

OR

Let a be any +ve integer

and b = 6

$\Rightarrow a = 6m + r \quad 0 \le r < 6$, for any +ve integer m 1

Possible forms of 'a' are

6m, 6m + 1, 6m + 2, 6m + 3, 6m + 4, 6m + 5 $\frac{1}{2}$

Out of which 6m, 6m + 2 and 6m + 4 are even.

Hence, any +ve odd integer can be 6m + 1, 6m + 3 or 6m + 5 $\frac{1}{2}$

9. For infinitely many solutions

$$\frac{2}{k-1} = \frac{3}{k+2} = \frac{7}{3k}$$ 1

$2k + 4 = 3k - 3; \qquad 9k = 7k + 14$

$k = 7 \qquad\qquad k = 7$

Hence k = 7 1

10. $a_1 = S_1 = 2(1)^2 + 1 = 3$ $\frac{1}{2}$

$a_2 = S_2 - S_1 = 10 - 3 = 7$ $\frac{1}{2}$

AP 3, 7 ..., $\Rightarrow d = 4$

$a_n = 3 + (n - 1)4 = (4n - 1)$ 1

OR

$a_{17} = a_{10} + 7$ $\frac{1}{2}$

$a + 16d = a + 9d + 7$ $\frac{1}{2}$

$d = 1$ 1

11. $\frac{2a-2}{2} = 1$

$\Rightarrow a = 2$ 1

$\frac{4+3b}{2} = 2a + 1$

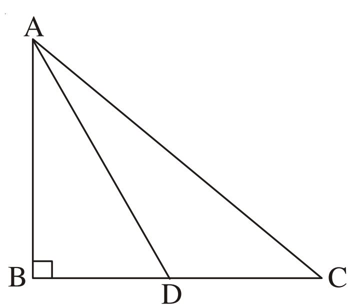
$\Rightarrow b = 2$ 1

12. Mean $= \frac{50}{10} = 5$ 1

$P(5) = \frac{2}{10} = \frac{1}{5}$ 1

SECTION C

13.



Correct Figure $\frac{1}{2}$

ΔABC is right angled at B

$\therefore AC^2 = AB^2 + BC^2$

$AC^2 = AB^2 + (2CD)^2$

$AC^2 - 4CD^2 = AB^2$ ...(1) 1

ΔABD is right angled at B,

$\therefore AD^2 - BD^2 = AB^2$ ...(2) $\frac{1}{2}$

By (1) & (2) $AC^2 - 4CD^2 = AD^2 - BD^2$ $\frac{1}{2}$

$AC^2 = AD^2 - CD^2 + 4CD^2 = AD^2 + 3CD^2$ ($\because$ BD = CD) $\frac{1}{2}$

OR

$AB = AC \Rightarrow \angle C = \angle B$ ...(1) 1

In ΔABD & ΔECF,

$\angle ADB = \angle EFC$ (each 90°)

$\angle ABD = \angle ECF$ (by (1)) 1

By AA similarity

$\Delta ABD \sim \Delta ECF$ 1

14. Area of shaded region $= \frac{80°}{360°}\pi(7)^2 + \frac{40°}{360°}\pi(7)^2 + \frac{60°}{360°}\pi(7)^2$ $1\frac{1}{2}$

$= \frac{22}{7} \times 7 \times 7 \left[\frac{180°}{360°}\right]$ 1

$= 77 \text{ cm}^2$ $\frac{1}{2}$

15. Apparent capacity $= \pi r^2 h$

$= 3.14 \times \frac{5}{2} \times \frac{5}{2} \times 10$ 1

$= 196.25 \text{ cm}^3$ $\frac{1}{2}$

Actual capacity $= 196.25 - \frac{2}{3} \times 3.14 \times \frac{5}{2} \times \frac{5}{2} \times \frac{5}{2}$ 1

$= 196.25 - 32.71$

$= 163.54 \text{ cm}^3$ $\frac{1}{2}$

OR

$\pi(18)^2 \times 32 = \frac{1}{3}\pi r^2 \times 24$ 1

$r^2 = (18)^2 \times 4$

$r = 36$ cm 1

$l^2 = (36)^2 + (24)^2$

$l^2 = 1872$

$l = 43.2$ cm 1

16. Given $\sqrt{2}$ and $-\sqrt{2}$ are zeroes of given polynomial.

$\therefore$ $(x-\sqrt{2})$ and $(x+\sqrt{2})$ are two factors i.e. x^2-2 is a factor $\frac{1}{2}$

$$
\begin{array}{r|l}
x^2-2 & \cancel{x^4} + x^3 - 14x^2 - 2x + 24 \;(\, x^2 + x - 12 \\
 & \cancel{x^4} \qquad\quad -2x^2 \\
 & - \qquad\qquad + \\
\hline
 & \cancel{x^3} - 12x^2 - \cancel{2x} + 24 \\
 & \cancel{x^3} \qquad\quad \cancel{-2x} \\
 & - \qquad\qquad + \\
\hline
 & -12\cancel{x^2} + \cancel{24} \\
 & -\cancel{12}x^2 + \cancel{24} \\
 & + \qquad - \\
\hline
 & 0 \\
\hline
\end{array}
$$

$1\frac{1}{2}$

$x^2 + x - 12 = x^2 + 4x - 3x - 12$

$= (x + 4)\,(x - 3)$ $\frac{1}{2}$

$\therefore$ -4, 3 are the zeroes.

Hence, all zeroes are $-4, 3, \sqrt{2}, -\sqrt{2}$ $\frac{1}{2}$

17. $\frac{AP}{AB}=\frac{1}{3} \Rightarrow \frac{AP}{PB}=\frac{1}{2}$ 1

Coordinates of P are $\left(\frac{5+4}{3}, \frac{-8+2}{3}\right) = (3, -2)$ 1

Now, P lies on $2x - y + k = 0$

$\therefore$ $2(3) - (-2) + k = 0$

$\Rightarrow$ $k = -8$ 1

OR

Three points are collinear $\Rightarrow$ area of Δ formed by these points is zero. 1

$\therefore$ $\frac{1}{2}\left[2(-1-3)+p(3-1)-(1+1)\right]=0$ 1

$-8 + 2p - 2 = 0$

$p = 5$ 1

18. LHS $= \dfrac{\tan\theta}{1-\tan\theta} - \dfrac{\cot\theta}{1-\cot\theta}$

$$= \frac{\frac{\sin\theta}{\cos\theta}}{1-\frac{\sin\theta}{\cos\theta}} - \frac{\frac{\cos\theta}{\sin\theta}}{1-\frac{\cos\theta}{\sin\theta}} \qquad 1$$

$$= \frac{\sin\theta}{\cos\theta-\sin\theta} + \frac{\cos\theta}{\cos\theta-\sin\theta} \qquad 1\frac{1}{2}$$

$$= \frac{\sin\theta+\cos\theta}{\cos\theta-\sin\theta} = \text{RHS} \qquad \frac{1}{2}$$

OR

$\sin\theta = (\sqrt{2}-1)\cos\theta$ 1

$(\sqrt{2}+1)\sin\theta = (\sqrt{2}-1)(\sqrt{2}+1)\cos\theta$ 1

$(\sqrt{2}+1)\sin\theta = \cos\theta$

$\Rightarrow \sqrt{2}\sin\theta = \cos\theta - \sin\theta$ 1

Alternate method

$\cos\theta + \sin\theta = \sqrt{2}\cos\theta$

On squaring

$\cos^2\theta + \sin^2\theta + 2\cos\theta\sin\theta = 2\cos^2\theta$ 1

$\sin^2\theta + 2\cos\theta\sin\theta = \cos^2\theta$

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

$2\cos\theta\sin\theta = (\cos\theta - \sin\theta)(\cos\theta + \sin\theta)$

$2\cos\theta\sin\theta = (\cos\theta-\sin\theta)(\sqrt{2}\cos\theta)$

$\sqrt{2}\sin\theta = \cos\theta - \sin\theta$ 1

19. Let the fixed charges per student = ₹ x

Cost of food per day per student = ₹ y

$x + 25y = 4500$ 1

$x + 30y = 5200$ 1

On solving $5y = 700$

$\therefore\ y = 140$

$x = 1000$ 1

$\therefore$ Fixed charges = ₹ 1000 & cost of food per day ₹ 140

20. Modal class: 26 – 30 $\frac{1}{2}$

$f_1 = 25,\ f_0 = 20,\ f_2 = 22,\ l = 26,\ h = 4$

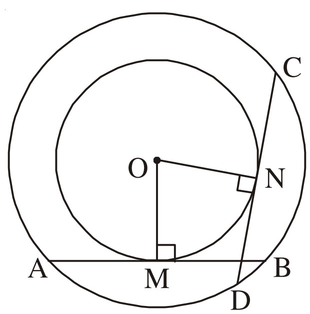
Mode $= 26 + \left(\frac{25-20}{50-20-22}\right) \times 4$ $1\frac{1}{2}$

$= 26 + \frac{5}{\cancel{8}_2} \times \cancel{4}$

$= 26 + 2.5$

$= 28.5$ 1

21.



Correct Figure $\frac{1}{2}$

OM = ON (radii of same circle) $\frac{1}{2}$

& OM $\perp$ AB (tangent $\perp$ radius)
& ON $\perp$ CD 1

Chords equidistant from centre of circle are equal in length

$\Rightarrow$ AB = CD $\frac{1}{2}$

Hence, all chords are equal. $\frac{1}{2}$

22. Let $5-3\sqrt{2}$ be rational

$\therefore\ 5-3\sqrt{2} = \frac{p}{q}$, p & q are integers, $q \neq 0$, HCF (p, q) = 1 1

$5-\frac{p}{q} = 3\sqrt{2}$

$\frac{15q-p}{3q} = \sqrt{2}$

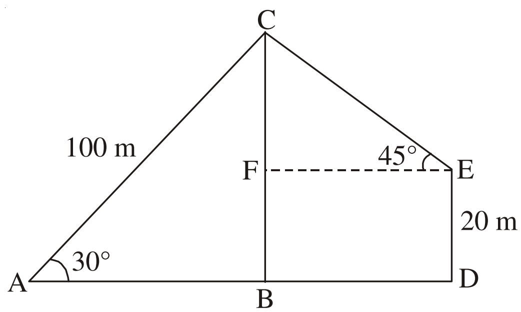
Rational = Irrational $1\frac{1}{2}$

which is a contradiction. $\frac{1}{2}$

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

SECTION D

23.



Correct Figure 1

In ΔABC

$\sin 30° = \frac{BC}{100}$

$\Rightarrow BC = 50$ m 1

$CF = 50 - 20 = 30$ m $\frac{1}{2}$

In ΔCFE

$\sin 45° = \frac{30}{CE}$

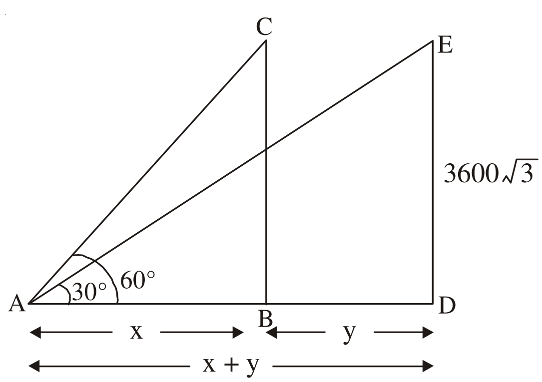
$CE = 30\sqrt{2}$ 1

$= 30 \times 1.414$

$= 42.42$ m $\frac{1}{2}$

OR

Correct Figure 1



In ΔABC, $\tan 60° = \frac{3600\sqrt{3}}{x}$

$x = 3600$ 1

In ΔADE, $\tan 30° = \frac{3600\sqrt{3}}{x+y}$

$3600 + y = 3600 \times 3$

$y = 7200$ 1

Speed $= \frac{7200}{30} = 240$ m/s 1

24.

Marks	**fi**	**cf**
0–10	10	10
10–20	x	10 + x
20–30	25	35 + x
30–40	30	65 + x
40–50	y	65 + x + y
50–60	10	75 + x + y
Total	100	

Correct Table 1

Median class = 30 – 40 $\frac{1}{2}$

$75 + x + y = 100$

$x + y = 25$ $\frac{1}{2}$

$32 = 30+\left(\frac{50-35-x}{30}\right)\times 10$ 1

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

$x = 9$ $\frac{1}{2}$

$y = 16$ $\frac{1}{2}$

OR

Class	cf
More than or equal to 0	100
More than or equal to 10	95
More than or equal to 20	80
More than or equal to 30	60
More than or equal to 40	37
More than or equal to 50	20
More than or equal to 60	9

Correct Table $\frac{1}{2}$

Plotting of points (0, 100), (10, 95), (20, 80), (30, 60), (40, 37), (50, 20) and (60, 9) $1\frac{1}{2}$

Joining the points to get curve $\frac{1}{2}$

Median = 35 (approx.) $\frac{1}{2}$

25. LHS $= \dfrac{(1+\cot\theta+\tan\theta)(\sin\theta-\cos\theta)}{\sec^3\theta-\text{cosec}^3\theta}$

$$= \frac{\left(1+\dfrac{\cos\theta}{\sin\theta}+\dfrac{\sin\theta}{\cos\theta}\right)(\sin\theta-\cos\theta)}{\dfrac{1}{\cos^3\theta}-\dfrac{1}{\sin^3\theta}} \quad 1$$

$$= \frac{\dfrac{(\cos\theta\sin\theta+\cos^2\theta+\sin^2\theta)(\sin\theta-\cos\theta)}{\cos\theta\sin\theta}}{\dfrac{\sin^3\theta-\cos^3\theta}{\cos^3\theta\sin^3\theta}} \quad 1$$

$$= \frac{\sin^3\theta-\cos^3\theta}{\sin\theta\cos\theta}\times\frac{\cos^3\theta\sin^3\theta}{\sin^3\theta-\cos^3\theta} \quad 1$$

$= \cos^2\theta\ \sin^2\theta =$ RHS 1

26. $l^2 = (24)^2 + \left(\frac{45}{2} - \frac{25}{2}\right)^2$

$l^2 = 576 + 100 = 676$

$l = 26$ cm 1

$\text{TSA} = \frac{22}{7} \times 26\left(\frac{25}{2} + \frac{45}{2}\right) + \frac{22}{7} \times \frac{25}{2} \times \frac{25}{2}$

$= 2860 + 491.07$

$= 3351.07 \text{ cm}^2$ $1\frac{1}{2}$

$\text{Volume} = \frac{1}{3} \times \frac{22}{7} \times 24\left(\frac{625}{4} + \frac{2025}{4} + \frac{1125}{4}\right)$

$= \frac{1}{\cancel{3}} \times \frac{22}{7} \times \cancel{6}^2\, \cancel{24} \times \frac{3775}{\cancel{4}}$

$= \frac{166100}{7} \text{ cm}^3$

or 23728.57 cm^3 $1\frac{1}{2}$

27. Let speed of train be x km/h

$\frac{360}{x} - \frac{360}{x+5} = 1$ 2

$360\left[\frac{x+5-x}{x(x+5)}\right] = 1$

$x^2 + 5x - 1800 = 0$ $\frac{1}{2}$

$(x + 45)(x - 40) = 0$ $\frac{1}{2}$

$x = -45$, $x = 40$ 1
(Rejected)

Hence, speed of train = 40 km/h

OR

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

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

$-ab = x^2 + (a + b)x$

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

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

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

28. $a_n = \frac{1}{m}$

$a + (n - 1)d = \frac{1}{m}$ $\frac{1}{2}$

$a_m = \frac{1}{n}$

$a + (m - 1)d = \frac{1}{n}$ $\frac{1}{2}$

On solving,

$a = \frac{1}{mn}$ $\frac{1}{2}$

$d = \frac{1}{mn}$ $\frac{1}{2}$

(i) $a_{mn} = \frac{1}{mn}+(mn-1)\times\frac{1}{mn}$

$= \frac{1+mn-1}{mn}=1$ 1

(ii) $S_{mn} = \frac{mn}{2}\left(\frac{1}{mn}+1\right)$

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

29.	For Correct Given, To prove, Construction, Figure	$4\times\frac{1}{2}=2$
	For Correct Proof	2
30.	For Construction of Correct Circle	1
	For Construction of Correct Pair of Tangents	3