Pre-board (Semester 2) 2022
Mathematics: Basic
Marking - Scheme

Section A

A1) $D = (-\sqrt{5})^2 - 4(2)(1) = 5 - 8 = -3 < 0$ ∴ Roots are imaginary
— (½) — (½) — (1)

OR

$Kx^2 - 2Kx + 6 = 0$. For equal & real roots: $D = 0$ — (½)

i.e., $(-2K)^2 - 4(K)(6) = 0 \Rightarrow 4K^2 - 24K = 0 \Rightarrow K(K-6) = 0$ — (1)

$K = 0$, $K = 6$. $K = 0$ not feasible. ∴ $\boxed{K = 6}$ — (½)

A2) Terms are in AP. ∴ $(2y+3) - (2y-1) = (4y+3) - (2y+3)$ — (1)

$2y + 3 - 2y + 1 = 4y + 3 - 2y - 3$ — (½)

$\boxed{y = 2}$ — (½)

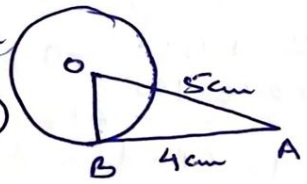
A3) $AN = AM = 3$ cm, $BN = BL = 4$ cm, $CM = CL$ (length of tangents from external point is equal) — (1)

$\Rightarrow AC = AM + MC \Rightarrow MC = 6$ cm — (½)

∴ $BC = BL + LC = 4 + 6 = 10$ cm — (½)

OR

$\angle OBA = 90°$ (Radius through the point of contact is ⊥ to tangent) — (1)



In rt $\triangle OBA$,

$OB = \sqrt{OA^2 - AB^2} = \sqrt{5^2 - 4^2} = \sqrt{25 - 16} = 3$ cm — (1)

A4)

CI	f	cf
0–5	9	9
5–10	16	25
10–15	15	40
15–20	8	48
20–25	12	60

— (½)

Modal class: 5–10 — (½)

Median class: 10–15 $\left(\because \frac{n}{2} = 30\right)$ — (½)

∴ UL of median class + LL of modal class $= 15 + 5 = 20$ — (½)

A5)

CI	f_i	cf_i
0–10	5	5
10–20	7	x_1
20–30	x_2	18
30–40	5	x_3
40–50	x_4	30

$x_1 = 5 + 7 = 12$ — (½)

$x_2 = 18 - 12 = 6$ — (½)

$x_3 = 18 + 5 = 23$ — (½)

$x_4 = 7$ — (½)

A6) Let no. of solid sphere be 'n'

$n \times$ ⊖ ($d = 6 \Rightarrow r = 3$ cm) → (H = 45 cm, R = $\frac{4}{2}$ cm = 2 cm) — (½)

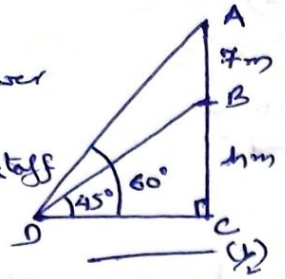
$n \times \frac{4}{3}\pi r^3 = \pi R^2 H$ — ½

$n = \frac{3 \times 2 \times 2 \times 45}{4 \times 3 \times 3} = 5 \Rightarrow \boxed{n = 5}$

— (1)

Section B

A7) BC = height of tower
= h m (say)
AB = height of flagstaff
= 7 m



In $\triangle BCD$,
$\tan 45° = \frac{h}{CD}$

$CD = h$ — (1)

In $\triangle ACD$,
$\tan 60 = \frac{7+h}{CD}$

$\sqrt{3}CD = 7+h$ — (1)

$\Rightarrow \sqrt{3}h = 7+h$

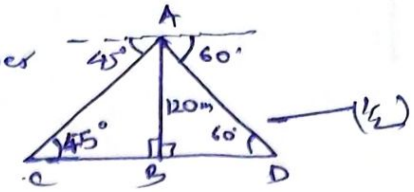
$h = \frac{7}{\sqrt{3}-1}$

$= \frac{7(\sqrt{3}+1)}{2}$

$h = 9.6$ m — (½)

OR

AB = height of tower
= 120 m



(½)

In $\triangle ABC$
$\tan 45° = \frac{120}{CB}$ — (1)

$CB = 120$ m

In $\triangle ABD$,
$\tan 60° = \frac{120}{BD}$

$BD = \frac{120}{\sqrt{3}}$

$BD = 40\sqrt{3}$ m — (1)

$\therefore CD = 120 + 40\sqrt{3}$
$= 189.2$ m — (½)

A8) AP: $-6, -\frac{11}{2}, -5, -\frac{9}{2}$ ... $a = -6$, $d = 0.5$ — (½)

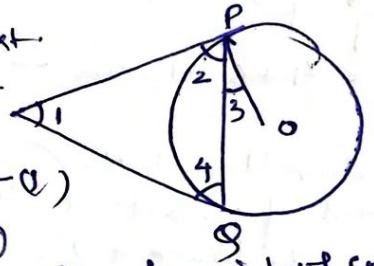
(given) $S_n = 0 \Rightarrow \frac{n}{2}[-12 + (n-1)(0.5)] = 0$ — (½)

$n(-24 + n - 1) = 0$ — (½)

$n(n-25) = 0$ — (½)

$\Rightarrow n = 0$ or $n = 25$
Not feasible — (½)

A9) In $\triangle TPQ$
$TP = TQ$ (tangents from ext. point)
$\Rightarrow \angle 2 = \angle 4$ (because $\triangle$le)
Also, $\angle 1 + \angle 2 + \angle 4 = 180°$
$\angle 1 + 2\angle 2 = 180°$ — (A) — (1)

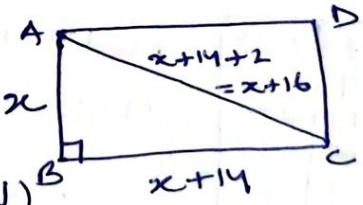


$\angle 2 + \angle 3 = 90°$ (Radius through point of contact is ⊥ to tangent)
$\angle 2 = 90 - \angle 3$ — (B) — (1)

from (A) & (B)
$\Rightarrow \angle 1 + 2(90 - \angle 3) = 180 \Rightarrow \angle 1 + 180° - 2\angle 3 = 180 \Rightarrow \angle 1 = 2\angle 3$ — (1)

i.e. $\angle PTQ = 2\angle OPQ$

A10) let one side rectangle be x m
longer side = (x+14) m
Diagonal = x+14+2
= x+16 m — (1)



(given) $x^2 + (x+14)^2 = (x+16)^2$ (Pythagoras theorem) — (½)

$2x^2 + 28x + 196 = x^2 + 32x + 256$ — (1½)

$x^2 - 4x - 60 = 0$
$x^2 - 10x + 6x - 60 = 0$

$\Rightarrow (x-10)(x+6) = 0$ — (1)

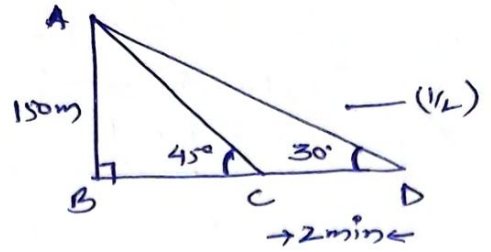
$x = 10, -6$ — (½)

∴ sides are 10, 24 cm

Section C

A11) Construction — (3) steps of construction — (1)

A12) AB = height of lighthouse
$= 150$ m



(1½)

In rt ΔABC,

$\tan 45° = \frac{150}{BC}$ — (1)

$\boxed{BC = 150 \text{ m}}$

In rt ΔABD,

$\tan 30° = \frac{150}{BD}$

$BD = 150\sqrt{3}$

$\boxed{BD = 259.5 \text{ m}}$ — (1)

$CD = 259.5 - 150$ (1)
$= 109.5$ m

time$_{CD}$ = 2 min

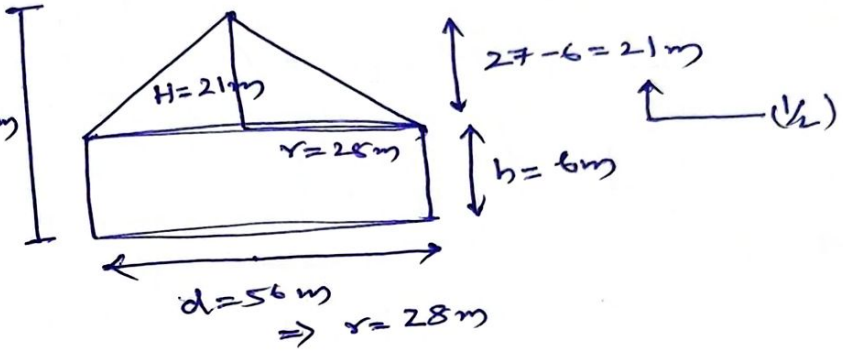
$\therefore$ Speed $= \frac{109.5}{2} = 54.75$ m/min — (1½)

Note: other units of speed is also accepted.

A13) a) $l = \sqrt{r^2 + H^2}$ — (½)

$= \sqrt{28^2 + 21^2}$ } — (1)

Slant height $= 35$ m



(1½)

$\Rightarrow r = 28$ m

b) Surface area of Canvas

$= \pi r l + 2\pi r h$ — (½)

$= \pi r (l + 2h)$ — (½)

$= \frac{22}{7} \times 4 (35 + 12)$ — (½)

$= 22 \times 4 \times 47$

$= 4136 \text{ m}^2$ — (½)

A14)

Marks	x_i	f_i	$d_i = x_i - A$	$f_i d_i$
0 – 20	10	10	−40	−400
20 – 40	30	8	−20	−160
40 – 60	(50)	12	0	0
60 – 80	70	16	20	320
80 – 100	90	4	40	160
		50		−80

— (1)

$A = 50$

a) $\bar{x} = A + \frac{\Sigma f_i d_i}{\Sigma f_i} = 50 + \frac{(-80)}{50} = 50 - 1.6 = 48.4$ — (1)

b) Modal class : 60 – 80

$l = 60$, $f_0 = 12$, $f_1 = 16$, $f_2 = 4$, $h = 20$ — (1)

$\text{Mode} = l + \frac{(f_1 - f_0)\, h}{(2f_1 - f_0 - f_2)} = 60 + \left(\frac{16 - 12}{32 - 12 - 4}\right) 20$

$= 60 + \frac{4}{16} \times 20 = 65$ — (1)

$\therefore$ Modal marks is 65