Mock Board Exam

Mathematics- Basic

Class- X, Session: 2021-22

TERM II

Q.No.	HINTS/SOLUTION	Marks
	SECTION A	
1	$$3x^2 - 2\sqrt{6}x + 2 = 0$$ $\Rightarrow 3x^2 - 2\sqrt{6}x + 2 = 0$ $\Rightarrow 3x^2 - \sqrt{6}x - \sqrt{6}x + 2 = 0$ $\Rightarrow \sqrt{3}x(\sqrt{3}x - \sqrt{2}) - \sqrt{2}(\sqrt{3}x - \sqrt{2}) = 0$ $\Rightarrow (\sqrt{3}x - \sqrt{2})(\sqrt{3}x - \sqrt{2}) = 0$ $\Rightarrow \sqrt{3}x - \sqrt{2} = 0 \ or \ \sqrt{3}x - \sqrt{2} = 0$ $\Rightarrow \sqrt{3}x = \sqrt{2} \ or \ \sqrt{3}x = \sqrt{2}$ $\Rightarrow x = \sqrt{\frac{2}{3}}$ or $x = \sqrt{\frac{2}{3}}$ $\therefore$The two equal roots of $3x^2 - 2\sqrt{6}x + 2 = 0$ are $\sqrt{\frac{2}{3}}$, $\sqrt{\frac{2}{3}}$. **OR** $$kx(x-2) + 6 = 0$$ $\Rightarrow kx^2 - 2kx + 6 = 0$ $(a = k, b = -2k, c = 6)$ Since the roots are real and equal, $\therefore D = b^2 - 4ac = 0$ $$\Rightarrow (-2k)^2 - 4 \times k \times 6 = 0$$ $$\Rightarrow 4k^2 = 24k$$ $$\Rightarrow k = 6$$	$\frac{1}{2}$ $\frac{1}{2}$ 1 $\frac{1}{2}$ $\frac{1}{2}$ 1
2	We have, Radius of the cone, $r_1 = 1\ cm$ Height of the cone, $h_1 = 1\ cm$ Radius of the hemisphere, $r_2 = 1\ cm$ Volume of the solid = volume of the cone + volume of the hemisphere $\Rightarrow$ Volume of the solid = $\frac{1}{3}\pi r_1^2 h_1 + \frac{2}{3}\pi r_2^3$	$\frac{1}{2}$

⇒ Volume of the solid = $\frac{1}{3} \times \pi \times 1^2 \times 1 + \frac{2}{3} \times \pi \times 1^3$ $\frac{1}{2}$

⇒ Volume of the solid = $\pi\ cm^3$ 1

3

Class Interval	Frequency	Cumulative Frequency
0 - 10	7	7
10 - 20	15	22
20 - 30	16	38
30 - 40	12	50

$\frac{1}{2}$

Total frequency, N = 50
So 20 - 30 is the median class.
$l = 20,\ cf = 22,\ f = 16$

Median = $l + \frac{\left(\frac{N}{2}\right) - cf}{f} \times h$ $\frac{1}{2}$

⇒ Median = $20 + \frac{\left(\frac{50}{2}\right) - 22}{16} \times 10$

⇒ Median = $20 + 1.875 = 21.875$

1

4

We know that n^{th} term of an AP,

$$t_n = a + (n - 1)d$$

Where, a and d be the first term and common difference of an AP. $\frac{1}{2}$
$t_3 = a + 2d = 5$ - - - (1)
$t_7 = a + 6d = 9$ - - - (2)
Subtract equation (1) from (2),

$$\Rightarrow 4d = 4$$
$$\Rightarrow d = 1$$

Substitute the value of d in equation (1), $\frac{1}{2}$

$$\Rightarrow a + 2 = 5$$
$$\Rightarrow a = 3$$

AP = 3, 4, 5, 6, 7, 8, 9,…

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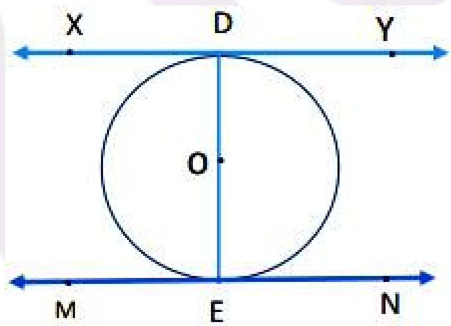
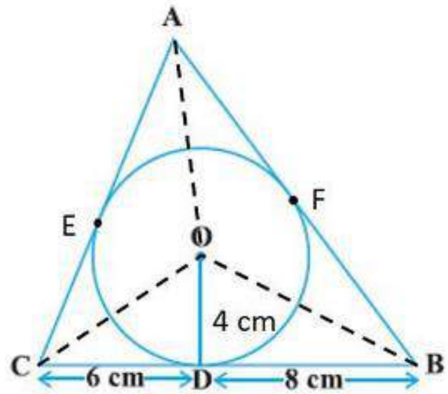
5	Here, modal class = 3 - 5 $\Rightarrow l = 3, f_o = 7, f_1 = 8, f_2 = 2$ and $h = 2$ Mode = $l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h$ $\Rightarrow$Mode = $3 + \frac{8-7}{2\times 8-7-2} \times 2 = 3 + 0.286 = 3.286$ $\Rightarrow$Mode = 3.286	$\frac{1}{2}$ $\frac{1}{2}$ 1
6	**<u>To prove</u>:** XY ∥ MN **Given:** A circle with centre O and diameter DE. Let XY be the tangent at point D & MN be the tangent at point E.  **Proof:** Since XY is a tangent at point D. OD ⊥ XY (Tangent at any point of a circle is perpendicular to the radius through the point of contact). ∠ODY = 90° - - - (1) OE ⊥ MN ∠OEM = 90° - - - (2) From (1) and (2), ∠ODY = ∠OEM i.e., ∠EDY = ∠DEM For lines XY & MN and transversal DE ∠EDY = ∠DEM i.e., both alternate angles are equal. So, the given lines are parallel. Therefore, XY ∥ MN. OR	$\frac{1}{2}$ $\frac{1}{2}$ 1

Given:
A circle with centre 'O' with radius OD = $4\ cm$.



Let $\triangle$ABC circumscribes the circle.
ar($\triangle$ABC) = $84\ cm^2$
Also,
BD = $8\ cm$ and CD = $6\ cm$

To find: AB and AC

Construction:
Join point 'O' with A, B and C.

Here, D, E and F are the points of contact of the circle with the sides BC, AC and ABrespectively.

OD = OE = OF = $4\ cm$ (Radii of the circle)

We know that the lengths of tangents drawn from an external point to a circle are equal.

$\therefore$ BD = BF = $8\ cm$

CD = CE = $6\ cm$

AE = AF = $x\ cm$ (say)

So, BC = BD + CD = $8\ cm + 6\ cm = 14\ cm$

AB = AF+ BF = $(x + 8)\ cm$

AC = AE + CE = $(x + 6)\ cm$

Also, the tangent at any point of a circle is perpendicular to the radius through the point of contact.

$\frac{1}{2}$

$\therefore$ OD $\perp$ BC, OE $\perp$ AC, OF $\perp$ AB

Now,

ar($\triangle$OBC) + ar($\triangle$OAB) + ar($\triangle$OAC) = ar($\triangle$ABC)

$\therefore \frac{1}{2} \times BC \times OD + \frac{1}{2} \times AB \times OF + \frac{1}{2} \times AC \times OE = 84\ cm^2$

$$\Rightarrow \frac{1}{2} \times 14 \times 4 + \frac{1}{2} \times (x + 8) \times 4 + \frac{1}{2} \times (x + 6) \times 4 = 84$$

$\frac{1}{2}$

$$\Rightarrow 28 + 2x + 16 + 2x + 12 = 84$$
$$\Rightarrow 4x = 28$$
$$\Rightarrow x = 7$$

$\therefore$ AB = $(x + 8)\ cm = (7 + 8)\ cm = 15\ cm$

$\therefore$ AC = $(x + 6)\ cm = (7 + 6)\ cm = 13\ cm$

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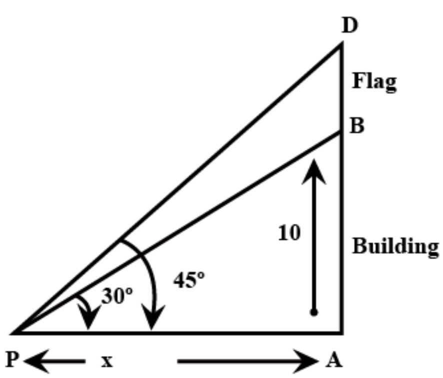
	SECTION B	
7	Given: $a = 21, d = ?, n = ?$ Sum of n terms in an AP, $S_n = \frac{n}{2}(2a + (n-1)d)$ From the given data, $\Rightarrow 93 = \frac{3}{2}(2 \times 21 + (3-1)d)$ $\Rightarrow 93 \times 2 = 3(2 \times 21 + 2d)$ $\Rightarrow 186 = 126 + 6d$ $\Rightarrow d = 10$ n^{th} terms in an AP, $t_n = a + (n-1)d$ It is given that the sum of the last two terms is 272. $t_{n-1} + t_n = 272$ $\Rightarrow a + ((n-1)-1)d + a + (n-1)d = 272$ $\Rightarrow 2a + (2n-3)d = 272$ $\Rightarrow 2 \times 21 + (2n-3) \times 10 = 272$ $\Rightarrow n = 13$	1 1 1
8	In △BAP, $tan(30)^o = \frac{AB}{AP}$ $\Rightarrow \frac{1}{\sqrt{3}} = \frac{10}{x}$ $\Rightarrow x = 10\sqrt{3}\ m$ Distance of building from point P is $10\sqrt{3}\ m$.  Now, In △PAD	1

$$tan(45)^o = \frac{AD}{AP}$$

$$\Rightarrow 1 = \frac{AD}{10\sqrt{3}}$$

$$\Rightarrow AD = 10\sqrt{3}\ m$$ 1

$$\Rightarrow AB + BD = 10\sqrt{3}\ m$$

$$\Rightarrow 10 + BD = 10\sqrt{3}\ m$$

$$\Rightarrow BD = 10(\sqrt{3}\ - 1)\ m$$

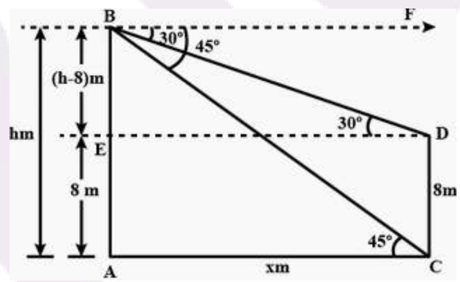
$$\Rightarrow BD = 10(1.732\ - 1)\ m$$

$$\Rightarrow BD = 7.32\ m$$ 1

Hence, the length of the flag is $7.32\ m$.

OR

Let AB and CD be the multi-storied building and the building respectively.
Let the height of the multi-storied building be 'h' m and the distance between the two buildings be 'x' m.



AE = CD = $8\ m$ [Given]
BE = AB - AE = $(h - 8)\ m$ and 1
AC = DE = $x\ m$ [Given]
Now,
In △ACB,

$$tan(45)^o = \frac{AB}{AC}$$

$$\Rightarrow 1 = \frac{h}{x}$$

$\Rightarrow x = h$ - - - (1)
In △BDE,

$$tan(30)^o = \frac{BE}{AD}$$ 1

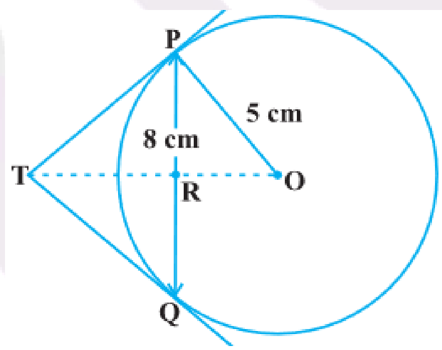
$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h-8}{x}$$

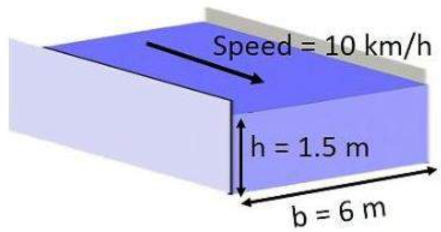
$\Rightarrow x = \sqrt{3}(h - 8)$ - - - (2)

$$\Rightarrow h = \sqrt{3}(h - 8)$$

$$\Rightarrow (\sqrt{3} - 1)h = 8\sqrt{3}$$

$$\Rightarrow h = \frac{8\sqrt{3}}{\sqrt{3} - 1}$$

	$$\Rightarrow h = \frac{8\sqrt{3}}{\sqrt{3}-1} \times \frac{\sqrt{3}+1}{\sqrt{3}+1}$$ $$\Rightarrow h = \frac{8\sqrt{3}(\sqrt{3}+1)}{2}$$ $$\Rightarrow h = \frac{8(3+\sqrt{3})}{2}$$ $$\Rightarrow h = 4(3+\sqrt{3})$$ $$\Rightarrow h = x = (12+4\sqrt{3})\ m$$ ∴ The height of the multi-storied building and the distance between the two buildings is $(12+4\sqrt{3})\ m$.	1
9	△TPQ is isosceles and TO is the angle bisector of ∠PTO. [∵ TP = TQ = Tangents from T upon the circle]  ∴OT ⊥ PQ ∴OT bisects PQ (The perpendicular from the centre of a circle to a chord bisects the chord.) PR = RQ = $4\ cm$ Now, OR = $\sqrt{OP^2 - PR^2} = \sqrt{5^2 - 4^2} = 3\ cm$ Now, ∠TPR + ∠RPO = 90^0 [∵ ∠TPO = 90^0] ∠TPR + ∠PTR = 90^0 [∵ ∠TRP = 90^0] ∴ ∠RPO = ∠PTR ∴ △TRP ~ △PRO [by AA symmetry]	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ 1

	$\therefore \frac{TP}{PO} = \frac{RP}{RO} \Rightarrow \frac{TP}{5} = \frac{4}{3} \Rightarrow TP = \frac{20}{3}\ cm$	
10	Canal is in the shape of cuboid, where, Breadth = 6 m Height = 1.5 m Speed of canal = 10 km/hr Length of canal in 1 $hour$ = 10 km Length of canal in 60 $minutes$ = 10 km  Length of canal in 1 $minute$ = $\frac{1}{60} \times 10\ km$ Length of canal in 30 $minute$ = $\frac{30}{60} \times 10 = 5\ km = 5000\ m$ Now, Volume of canal = length × breadth × height = $5000 \times 6 \times 1.5\ m^3$ Now, Volume of water in canal = Volume of area irrigated Volume of water in canal = Area irrigated × Height $5000 \times 6 \times 1.5 = Area\ irrigated \times \frac{8}{100}$ $\Rightarrow Area\ irrigated = \frac{5000 \times 6 \times 1.5 \times 100}{8} = 562500\ m^2$ $\Rightarrow Area\ irrigated = \frac{562500}{10000} = 56.25\ hectares$	1 1 1
	SECTION C	

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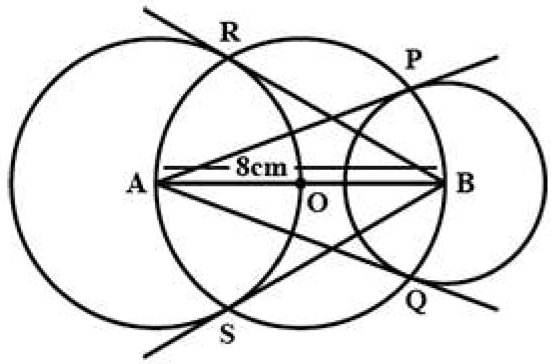
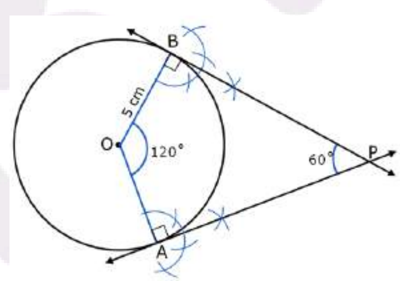


Steps of Construction:
Step I: A line segment AB of 8 cm is drawn.
Step II: With A as centre and radius equal to 4 cm, a circle is drawn which cuts the line at point O.
Step III: With B as centre and radius equal to 3 cm, a circle is drawn.
Step IV: With O as centre and OA as radius, a circle is drawn which intersects the previous two circles at P, Q, R, and S.
Step V: AP, AQ, BR and BS are joined. Thus, AP, AQ, BR and BS are the required tangents.
OR



Steps of Construction:
Step I: Draw a circle of radius 5 cm and mark the center as O.
Step II: As we have angle between the tangents as 60°
By quadrilateral property we have angle between the radii of circle is 120°
Step III: Draw two radius OA and OB such that they have angle of 120°
Step IV: At points A and B, draw 90°angles and mark the point P where the arms of these angles intersect.
Step V: we get PA and PB as our required tangents.
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Class Interval	x_i	f_i	$f_i x_i$
0 - 10	5	3	15
10 - 20	15	8	120
20 - 30	25	10	250
30 - 40	35	15	525
40 - 50	45	7	315
50 - 60	55	4	220
60 - 70	65	3	195
		$\sum f_i = 50$	$\sum f_i x_i = 1640$

1

Mean = $\frac{\sum f_i x_i}{\sum f_i} = \frac{1640}{50} = 32.8$ 1

For mode, Modal class = $30 - 40$ 1

and $l = 30, f_1 = 15, f_2 = 7, f_0 = 10$ and $h = 10$

$$Mode = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h = 30 + \frac{15 - 10}{30 - 10 - 7} \times 10$$

$$= 30 + \frac{5}{13} \times 10$$

$$= 30 + \frac{50}{13}$$

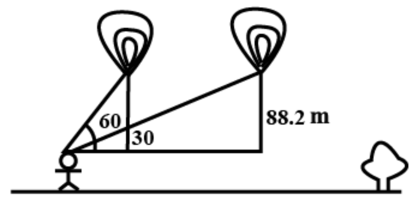
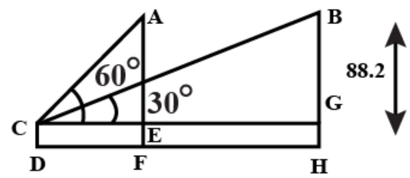
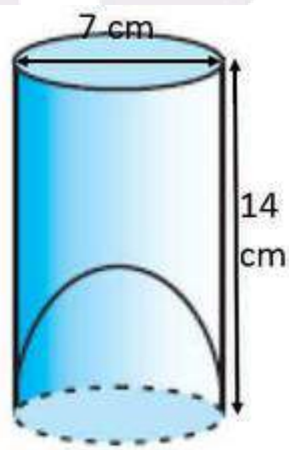
$$= 30 + 3.85 = 33.85$$

1

13

1

1

	In △ACE, $tan(60)^o = \frac{AE}{CE}$ $\Rightarrow \sqrt{3} = \frac{88.2 - 1.2}{CE}$ $\Rightarrow CE = \frac{88.2 - 1.2}{\sqrt{3}} = \frac{87}{\sqrt{3}} = 29\sqrt{3}$  In △BCG, $tan(30)^o = \frac{BG}{CG}$ $\Rightarrow \frac{1}{\sqrt{3}} = \frac{88.2 - 1.2}{CG}$ $\Rightarrow CG = 87\sqrt{3}$  Distance traveled by Balloon = EG = CG - CE ⇒ Distance traveled by Balloon = $87\sqrt{3} - 29\sqrt{3} = 58\sqrt{3} = 100.46\ m$	1 1
14	 Let us first find the actual quantity of milk in a mug. Actual capacity of the mug = Volume of cylinder - volume of hemisphere Volume of cylinder = $\pi r^2 h = \frac{22}{7} \times \left(\frac{7}{2}\right)^2 \times 14 = 539\ cm^3$ Volume of hemisphere = $\frac{2}{3}\pi r^3 = \frac{2}{3} \times \frac{22}{7} \times \left(\frac{7}{2}\right)^3 = \frac{539}{6}\ cm^3$ Actual capacity of the mug = $539 - \frac{539}{6} = \frac{2695}{6}\ cm^3$ The owner charges ₹80 per litre.	1 1

	∴ Amount for 1 litre = ₹80 ∴ Amount for 1000 cm^3 = ₹80 ∴ Amount for $\frac{2695}{6}$ cm^3 = $\frac{80\times2695}{6\times1000}$ = ₹35.93 Thus, one mug costs ₹35.93. Since, owner Q is honest, he will sell one mug at ₹35.93.	1 1