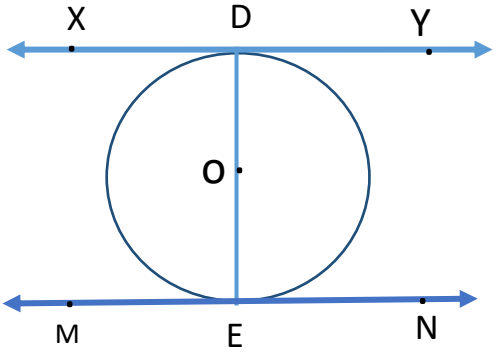
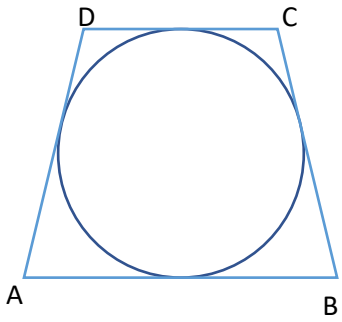
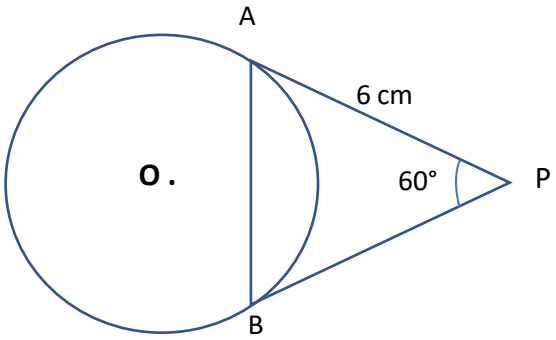
Sample Question Paper
Mathematics- Basic (241)
Class- X, Session: 2021-22
TERM II

Time Allowed: 2 hours **Maximum Marks: 40**

General Instructions:

1. The question paper consists of 14 questions divided into 3 sections A, B, C.
2. Section A comprises of 6 questions of 2 marks each. Internal choice has been provided in two questions.
3. Section B comprises of 4questions of 3 marks each. Internal choice has been provided in one question.
4. Section C comprises of 4 questions of 4 marks each. An internal choice has been provided in one question. It contains two case study based questions.

<table>
<tr><td></td><td>SECTION A</td><td></td></tr>
<tr><td>Q.No.</td><td></td><td>MARKS</td></tr>
<tr><td>1</td><td>Find the roots of the quadratic equation $3x^2 - 7x - 6 = 0$.
OR
Find the values of k for which the quadratic equation $3x^2 + kx + 3 = 0$ has real and equal roots.</td><td>2</td></tr>
<tr><td>2</td><td>Three cubes each of volume 64cm^3 are joined end to end to form a cuboid. Find the total surface area of the cuboid so formed?</td><td>2</td></tr>
<tr><td>3</td><td>An inter house cricket match was organized by a school. Distribution of runs made by the students is given below. Find the median runs scored.
<table>
<tr><td>Runs scored</td><td>0-20</td><td>20-40</td><td>40-60</td><td>60-80</td><td>80-100</td></tr>
<tr><td>Number of students</td><td>4</td><td>6</td><td>5</td><td>3</td><td>4</td></tr>
</table></td><td>2</td></tr>
<tr><td>4</td><td>Find the common difference of the AP 4,9,14,… If the first term changes to 6 and the common difference remains the same then write the new AP.</td><td>2</td></tr>
<tr><td>5</td><td>The mode of the following frequency distribution is 38. Find the value of x.
<table>
<tr><td>Class Interval</td><td>0-10</td><td>10-20</td><td>20-30</td><td>30-40</td><td>40-50</td><td>50-60</td><td>60-70</td></tr>
<tr><td>Frequency</td><td>7</td><td>9</td><td>12</td><td>16</td><td>x</td><td>6</td><td>11</td></tr>
</table></td><td>2</td></tr>
<tr><td>6</td><td>XY and MN are the tangents drawn at the end points of the diameter DE of the circle with centre O. Prove that XY || MN.
 
</td><td>2</td></tr>
</table>

	OR In the given figure, a circle is inscribed in the quadrilateral ABCD. Given AB=6cm, BC=7cm and CD=4cm. Find AD.  	
	Section-B	
7	An AP 5, 8, 11…has 40 terms. Find the last term. Also find the sum of the last 10 terms.	**3**
8	A tree is broken due to the storm in such a way that the top of the tree touches the ground and makes an angle of 30^0 with the ground. Length of the broken upper part of the tree is 8 meters. Find the height of the tree before it was broken. **OR** Two poles of equal height are standing opposite each other on either side of the road 80m wide. From a point between them on the road the angles of elevation of the top of the two poles are respectively 60^0 and 30^0. Find the distance of the point from the two poles.	**3**
9	PA and PB are the tangents drawn to a circle with centre O. If PA= 6 cm and $\angle$ APB=60^0, then find the length of the chord AB.  	**3**
10	The sum of the squares of three positive numbers that are consecutive multiples of 5 is 725. Find the three numbers.	**3**
	Section-C	
11	Construct two concentric circles of radii 3cm and 7cm. Draw two tangents to the smaller circle from a point P which lies on the bigger circle. **OR** Draw a pair of tangents to a circle of radius 6cm which are inclined to each other at an angle of 60^0. Also find the length of the tangent.	**4**

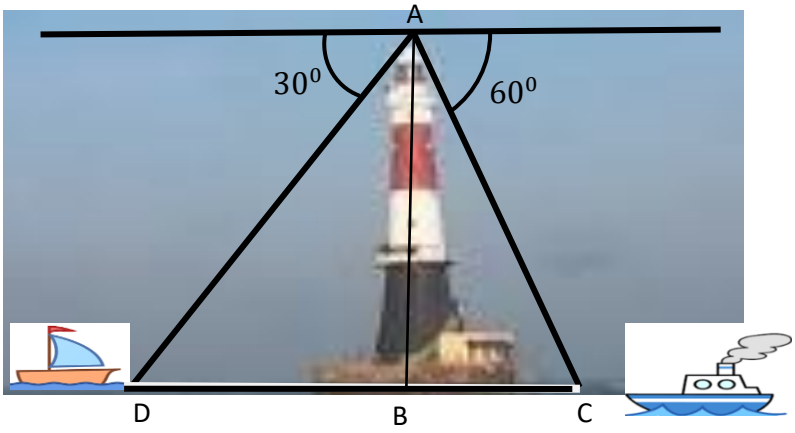
12	The following age wise chart of 300 passengers flying from Delhi to Pune is prepared by the Airlines staff.	**4**

Age	Less than 10	Less than 20	Less than 30	Less than 40	Less than 50	Less than 60	Less than 70	Less than 80
Number of passengers	14	44	82	134	184	245	287	300

Find the mean age of the passengers.

13 A lighthouse is a tall tower with light near the top. These are often built on islands, coasts or on cliffs. Lighthouses on water surface act as a navigational aid to the mariners and send warning to boats and ships for dangers. Initially wood, coal would be used as illuminators. Gradually it was replaced by candles, lanterns, electric lights. Nowadays they are run by machines and remote monitoring.

Prongs Reef lighthouse of Mumbai was constructed in 1874-75. It is approximately 40 meters high and its beam can be seen at a distance of 30 kilometres. A ship and a boat are coming towards the lighthouse from opposite directions. Angles of depression of flash light from the lighthouse to the boat and the ship are 30^0 and 60^0 respectively.



i) Which of the two, boat or the ship is nearer to the light house. Find its distance from the lighthouse? **2**

ii) Find the time taken by the boat to reach the light house if it is moving at the rate of 20 km per hour. **2**

14 Krishnanagar is a small town in Nadia District of West Bengal. Krishnanagar clay dolls are unique in their realism and quality of their finish. They are created by modelling coils of clay over a metal frame. The figures are painted in natural colours and their hair is made either by sheep's wool or jute. Artisans make models starting from fruits, animals, God, goddess, farmer, fisherman, weavers to Donald Duck and present comic characters. These creations are displayed in different national and international museums.

Here are a few images (not to scale) of some clay dolls of Krishnanagar.

Doll-1

Doll-2

Doll-3

Doll-4

The ratio of diameters of red spherical apples in Doll-1 to that of spherical oranges in Doll-2 is 2:3. In Doll-3, male doll of blue colour has cylindrical body and a spherical head. The spherical head touches the cylindrical body. The radius of both the spherical head and the cylindrical body is 3cm and the height of the cylindrical body is 8cm. Based on the above information answer the following questions:

i) What is the ratio of the surface areas of red spherical apples in Doll-1 to that of spherical oranges in Doll-2.? **2**

ii) The blue doll of Doll-3 is melted and its clay is used to make the cylindrical drum of Doll-4. If the radius of the drum is also 3cm, find the height of the drum. **2**

Marking Scheme
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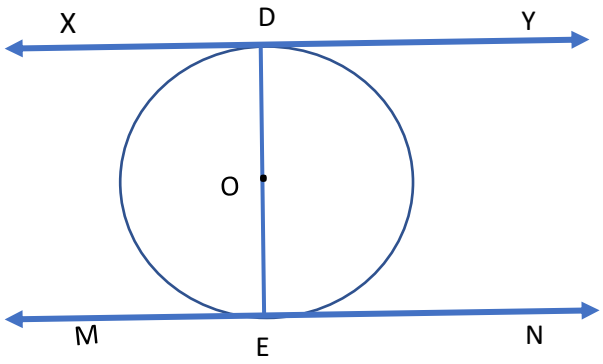
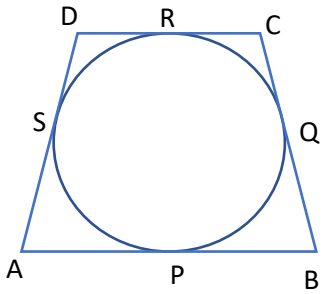
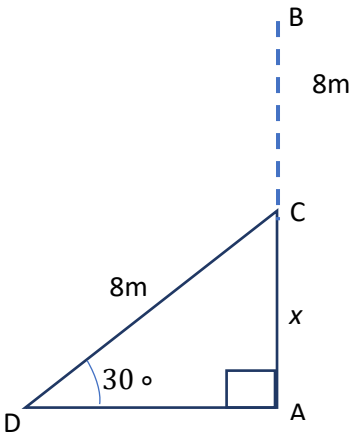
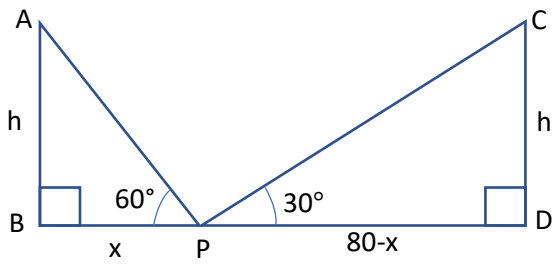
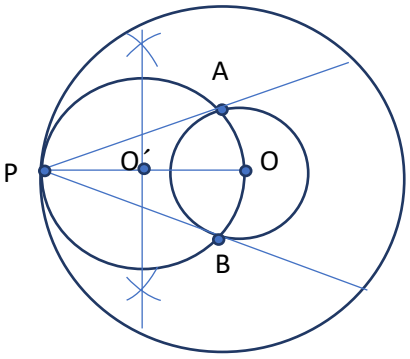
<table>
<tr><th>Q.N.</th><th>HINTS/SOLUTION</th><th>Marks</th></tr>
<tr><td>1</td><td>$3x^2 - 7x - 6 = 0$
$\Rightarrow 3x^2 - 9x + 2x - 6 = 0$
$\Rightarrow 3x(x-3) + 2(x-3) = 0$
$\Rightarrow (x-3)(3x+2) = 0$
$\because x = 3, -\frac{2}{3}$
OR
Since the roots are real and equal, $\therefore D = b^2 - 4ac = 0$
$\Rightarrow k^2 - 4\times3\times3 = 0$ ($\because a = 3, b = k, c = 3$)
$\Rightarrow k^2 = 36$
$\Rightarrow k = 6\ or\ -6$</td><td>1/2
1/2
1
1
1/2 +1/2</td></tr>
<tr><td>2</td><td>Let l be the side of the cube and L, B, H be the dimensions of the cuboid
Since $l^3 = 64\ cm^3\ \therefore l = 4\ cm$
Total surface area of cuboid is $2[LB + BH + HL]$, Where L=12, B=4 and H=4
$=2(12\times4 + 4\times4 + 4\times12)\ cm^2 = 224 cm^2$</td><td>1/2
1/2
1</td></tr>
<tr><td>3</td><td>
<table>
<tr><th>Runs scored</th><th>Frequency</th><th>Cumulative Frequency</th></tr>
<tr><td>0-20</td><td>4</td><td>4</td></tr>
<tr><td>20-40</td><td>6</td><td>10</td></tr>
<tr><td>40-60</td><td>5</td><td>15</td></tr>
<tr><td>60-80</td><td>3</td><td>18</td></tr>
<tr><td>80-100</td><td>4</td><td>22</td></tr>
</table>
Total frequency (N) = 22
$\frac{N}{2}$ = 11; So 40-60 is the median class.
Median = $l + \frac{\left(\frac{N}{2}\right) - cf}{f} \times h$
= 40 + $\frac{11-10}{5}$ x 20
= 44 runs</td><td>1/2
1/2
1/2
1/2</td></tr>
<tr><td>4</td><td>The common difference is 9 - 4=5
If the first term is 6 and common difference is 5, then new AP is,
6, 6+5, 6+10…
=6,11,16….</td><td>1
1</td></tr>
<tr><td>5</td><td>$\because$ Mode = 38.
$\therefore$ The modal class is 30-40.
Mode = $l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h$</td><td>1/2
1/2</td></tr>
</table>

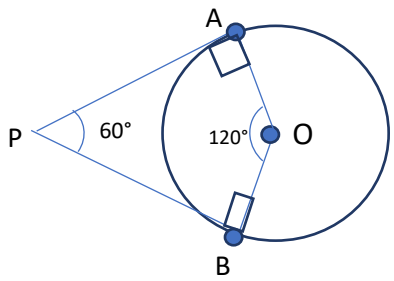
	$=30+\frac{16-12}{32-12-x}$ x 10 = 38 $\frac{4}{20-x}$ x 10 =8 8(20-x) = 40 20-x= 5 X= 15	1/2 1/2
6	 ∵XY is the tangent to the circle at the point D $\therefore$ OD $\perp$ XY $\Rightarrow \angle$ ODX $= 90^0 \Rightarrow \angle$ EDX $= 90^0$ Also, MN is the tangent to the circle at E $\therefore$ OE $\perp$ MN$\Rightarrow \angle$ OEN $= 90^0 \Rightarrow \angle$ DEN $= 90^0$ $\Rightarrow \angle$ EDX $= \angle$ DEN $(each\ 90^0)$. which are alternate interior angles. $\therefore$ XY $\|$ MN **OR** ∵Tangent segments drawn from an external point to a circle are equal $\therefore$ BP=BQ CR=CQ DR=DS AP=AS  ⇒BP+CR+DR+AP = BQ+CQ+DS+AS ⇒ AB+DC = BC+AD $\therefore$ AD= 10-7= 3 cm	1/2 1/2 1 1 1
	Section-B	

7	First Term of the AP(a) = 5 Common difference (d) = 8-5=3 Last term = a_{40} = a+(40-1) d = 5 + 39 × 3 = 122 Also $a_{31} = a + 30d = 5 + 30 \times 3 = 95$ Sum of last 10 terms = $\frac{n}{2}(a_{31} + a_{40})$ $= \frac{10}{2}(95 + 122)$ $= 5 \times 217 = 1085$	1 1 1
8	Let, AB be the tree broken at C, Also let $AC = x$ In Δ CAD, sin30^0 = $\frac{AC}{DC}$ $\Rightarrow \frac{1}{2} = \frac{x}{8}$ $\Rightarrow x = 4\ m$ ⇒the length of the tree is = 8+4 =12m  **OR** Let AB and CD be two poles of height h meters also let P be a point between them on the road which is *x* meters away from foot of first pole AB, PD= (80-x) meters. In ΔABP, $tan60^o = \frac{h}{x} \Rightarrow h = x\sqrt{3}$ ….(1) In ΔCDP, $tan\,30^o = \frac{h}{80-x} \Rightarrow h = \frac{80-x}{\sqrt{3}}$ ….(2) $x\sqrt{3} = \frac{80-x}{\sqrt{3}}$ $[\because LHS(1) = LHS(2), so\ equating\ RHS]$ $\Rightarrow 3x = 80 - x \Rightarrow 4x = 80 \Rightarrow x = 20m$ So, $80 - x = 80 - 20 = 60m$ Hence the point is 20m from one pole and 60 meters from the other pole.  	1 1/2 1/2 1(correct Fig.) 1 1/2 1/2 1(correct Fig.)

9	PA = PB (Tangent segments drawn to a circle from an external point are equal) ∴ In ΔAPB, $\angle$ PAB = $\angle$ PBA Also, $\angle$ APB = 60^0 In ΔAPB, sum of three angles is 180^0. Therefore, $\angle$ PAB + $\angle$ PBA = 180^0 - $\angle$ APB= $180^0 - 60^0 = 120^0$. ∴$\angle$ PAB = $\angle$ PBA = 60^0 (∵$\angle$ PAB = $\angle$ PBA) ∵ ΔAPB is an equilateral triangle. So, $AB = 6cm$	1 1 1
10	Let the three consecutive multiples of 5 be 5x, 5x+5, 5x+10. Their squares are $(5x)^2, (5x+5)^2$and$(5x+10)^2$. $(5x)^2 + (5x+5)^2 + (5x+10)^2 = 725$ ⇒25x^2 + 25x^2+ 50x + 25 + 25x^2 + 100x + 100 = 725 ⇒ $75x^2 + 150x - 600 = 0$ ⇒ $x^2 + 2x - 8 = 0$ ⇒ $(x+4)(x-2) = 0$ ⇒ $x = -4, 2$ ⇒ $x = 2$ (ignoring –ve value) So the numbers are 10, 15 and 20	1 1 1
	Section-C	

11	 Draw two concentric circles with center O and radii 3cm and 7cm respectively. Join OP and bisect it at O', so $PO' = O'O$ Construct circle with center O' and radius $O'O$ Join PA and PB	1 1 1 1

OR



Draw a circle of radius 6cm — 1

Draw OA and Construct $\angle AOB = 120^0$ — 1

Draw $\angle OAP = \angle OBP = 90^0$ — 1

PA and PB are required tangents

Join OP and apply $\tan\angle APO = \tan 30° = \frac{6}{PA}$ — 1

$\Rightarrow$ Length of tangent = $6\sqrt{3}$ cm

12

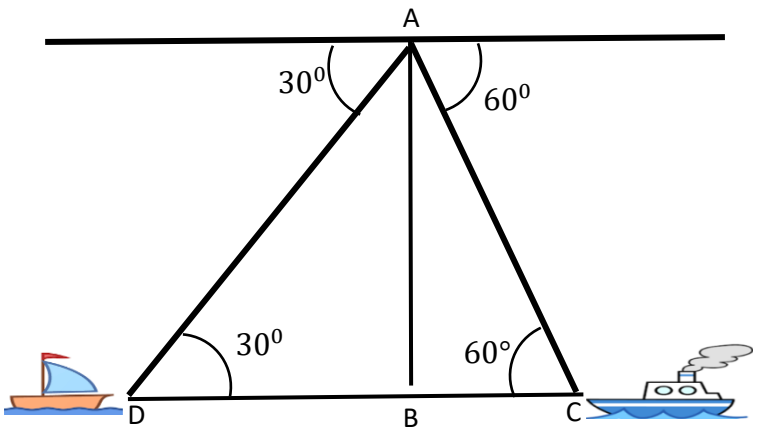
Converting the cumulative frequency table into exclusive classes, we get:

Age	No of passengers(f_i)	x_i	$f_i x_i$
0-10	14	5	70
10-20	30	15	450
20-30	38	25	950
30-40	52	35	1820
40-50	50	45	2250
50-60	61	55	3355
60-70	42	65	2730
70-80	13	75	975
	$\sum f_i = 300$		$\sum f_i x_i$ =12600

2

Mean age = $\bar{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{12600}{300}$ — 1

$\bar{x} = 42$ — 1

13 (i)	The ship is nearer to the lighthouse as its angle of depression is greater. In Δ ACB, $\tan 60^0 = \frac{AB}{BC}$ $\Rightarrow \sqrt{3} = \frac{40}{BC}$ $\therefore BC = \frac{40}{\sqrt{3}} = \frac{40\sqrt{3}}{3} m$  	1 1
(ii)	In Δ ADB, $\tan 30^0 = \frac{AB}{BD}$ $\Rightarrow \frac{1}{\sqrt{3}} = \frac{40}{DB}$ $\therefore DB = 40\sqrt{3} m$ Time taken to cover this distance = $(\frac{60}{2000} \times 40\sqrt{3})$ minutes $= \frac{60\sqrt{3}}{100} = 2.076$ minutes	1 1
14 (i)	Let $r_1 and\ r_2$ be respectively the radii of apples and oranges $\because 2r_1 : 2r_2 = 2:3 \Rightarrow r_1 : r_2 = 2:3$ $4\pi r_1^2 : 4\pi r_2^2 = \left(\frac{r_1}{r_2}\right)^2 = \left(\frac{2}{3}\right)^2 = 4:9$	1/2 $1\frac{1}{2}$
(ii)	Let the height of the drum be h. Volume of the drum = volume of the cylinder + volume of the sphere $\pi 3^2 h = (\pi 3^2 \times 8 + \frac{4}{3}\pi 3^3)\ cm^3$ $\Rightarrow h = (8+4) cm$ $\Rightarrow h = 12 cm$	1 1