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Secondary School Examination

Term–II, 2022

Marking Scheme : MATHEMATICS (Standard) (Subject Code : 041)

[Paper Code : 30/4/2]

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.
2. **“Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, evaluation done and several other aspects. Its leakage to public in any manner could lead to derailment of the examination system and affect the life and future of millions of candidates. Sharing this policy/document to anyone, publishing in any magazine and printing in Newspaper/ Website, etc., may invite action under IPC.”**
3. Evaluation is to be done as per instruction 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. In Class-X, while evaluating two competency based questions, please try to understand given answer and even if reply is not from marking scheme but correct competency is enumerated by the candidate, marks should be awarded.**
4. 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.
5. Evaluators will mark (3) wherever answer is correct. For wrong answer ‘7’ be marked. Evaluators will not put right kind of mark while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing.**
6. 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 totalled up and written in the left-hand margin and encircled. This may be followed strictly.
7. If a question does not have any parts, marks must be awarded in the left-hand margin and encircled. This may also be followed strictly.

8. If a student has attempted both option given in question, answer of the question deserving more marks should be retained and the other answer scored out.
9. No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
10. A full scale of marks _____ (example 0–100 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.
11. Every examiner has to necessarily do evaluation work for full working hours, i.e., 8 hours everyday and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines).
12. 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 totalling of marks awarded on a reply
 - Wrong transfer of marks from the inside pages of the answer book to the title page
 - Wrong questionwise totalling on the title page
 - Wrong totalling 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 7 for incorrect answer).
 - Half or a part of answer marked correct and the rest as wrong, but no marks awarded.
13. While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as (7) and awarded zero (0) Mark.
14. Any unassessed portion, non-carrying over of marks to the title page, or totalling error detected by the candidates 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.
15. The examiners should acquaint themselves with the guidelines given in the guidelines for spot evaluation before starting the actual evaluation.
16. Every examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totalled and written in figures and words.
17. 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.

MARKING SCHEME

Secondary School Examination TERM–II, 2022

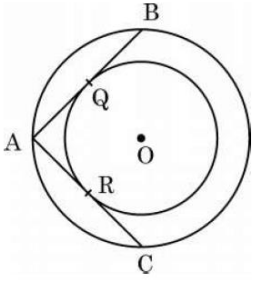
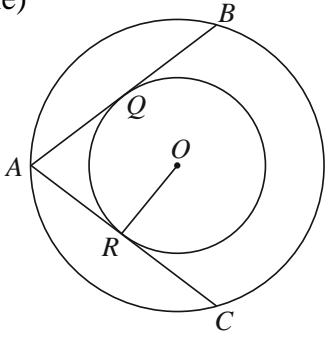
MATHEMATICS (Standard) (Subject Code–041)

[Paper Code : 30/4/2]

Instructions :

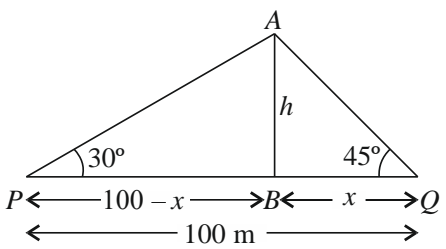
1. The Marking Scheme provides general guidelines to reduce subjectivity in the marking. The answers given in the Marking Scheme are suggested answers. The content is thus indicative. If a student has given any other answer which is different from the one given in the Marking Scheme, but conveys the meaning, such answers should be given full weightage.
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.
3. Alternative methods are accepted. Proportional marks are to be awarded.
4. If a candidate has attempted a question twice, answer of the question deserving more marks should be retained and the other answer scored out.
5. A full scale of marks - 0 to 40 has to be used. Please do not hesitate to award full marks if the answer deserves it.
6. Separate Marking Scheme for all the three sets has been given.
7. As per orders of the Hon'ble Supreme Court. The candidates would now be permitted to obtain photocopy of the Answer book on request on payment of the prescribed fee. All examiners/Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme.

Q. No.	EXPECTED ANSWER / VALUE POINTS	Marks
	SECTION—A	
1.(a)	If the sum of the roots of the quadratic equation $ky^2 - 11y + (k - 23) = 0$ is $\frac{13}{21}$ more than the product of the roots, then find the value of k.	
Sol.	$ky^2 - 11y + (k - 23) = 0$. Here $a = k$, $b = -11$, $c = k - 23$	
	Sum of roots = $\frac{11}{k}$	$\frac{1}{2}$
	Product of roots = $\frac{k-23}{k}$	$\frac{1}{2}$
	ATQ, $\frac{11}{k} = \frac{k-23}{k} + \frac{13}{21}$	$\frac{1}{2}$
	Solving, we get $k = 21$	$\frac{1}{2}$
	Or	
1.(b)	If $x = -2$ is the common solution of quadratic equations $ax^2 + x - 3a = 0$ and $x^2 + bx + b = 0$, then find the value of a^2b .	
Sol.	$x = -2$ is the common solution of $ax^2 + x - 3a = 0$ and $x^2 + bx + b = 0$.	
	$\therefore a(-2)^2 + (-2) - 3a = 0 \Rightarrow 4a - 2 - 3a = 0$	$\frac{1}{2}$
	$a = 2$	$\frac{1}{2}$

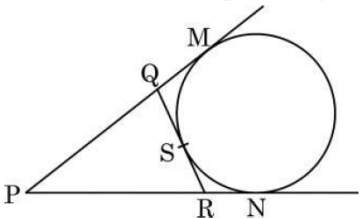
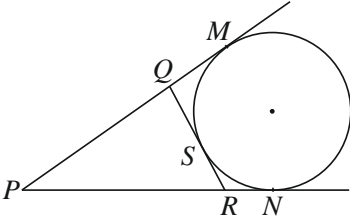
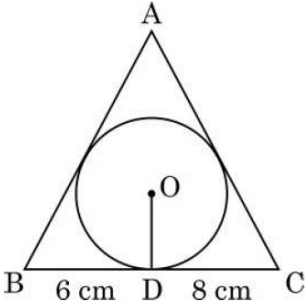
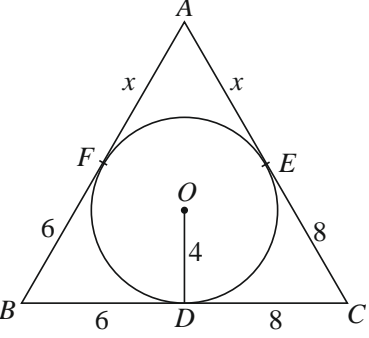
	<p>And $(-2)^2 + b(-2) + b = 0 \Rightarrow 4 - 2b + b = 0 \Rightarrow b = 4$</p> <p>$a^2b = 4 \times 4 = 16$</p>	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p>
2.	<p>In Fig. 1, there are two concentric circles with centre O. If ARC and AQB are tangents to the smaller circle from the point A lying on the larger circle, find the length of AC, if AQ = 5 cm.</p> 	
Sol.	<p>$AQ = AR$ (tangents drawn from external point to the circle)</p> <p>$\therefore AR = 5$ cm</p> <p>Join OR</p> <p>$\therefore OR \perp AC$ (radius tangent)</p> <p>Now AC is the chord of larger circle and we know that perpendicular from the centre bisects the chord</p> <p>$\therefore AR = RC = 5$ cm</p> <p>$\Rightarrow AC = 5 + 5 = 10$ cm</p> 	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p>
3.(a)	<p>The curved surface area of a right circular cylinder is 176 sq cm and its volume is 1232 cu cm. What is the height of the cylinder ?</p>	
Sol.	<p>Let h be the height of cylinder</p> <p>CSA of cylinder = 176 $\Rightarrow 2\pi rh = 176 \dots (i)$</p> <p>Volume of cylinder = 1232 $\Rightarrow \pi r^2 h = 1232$</p> <p>on dividing, $\frac{\pi r^2 h}{2\pi rh} = \frac{1232}{176}$</p> <p>we get, $r = 14$ cm</p> <p>$\therefore (i) \Rightarrow 2 \times \frac{22}{7} \times 14^2 \times h = 176$</p> <p>$\Rightarrow h = 2$ cm</p>	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p>
	Or	
3.(b)	<p>The largest sphere is carved out of a solid cube of side 21 cm. Find the volume of the sphere.</p>	
Sol.	<p>Diameter of sphere = side of cube = 21 cm</p> <p>\therefore radius $r = \frac{21}{2}$ cm</p>	<p>$\frac{1}{2}$</p>

	Volume of sphere $= \frac{4}{3}\pi r^3 = \frac{4}{3} \times \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2} \times \frac{21}{2}$ $= 4851 \text{ cm}^3$	1 $\frac{1}{2}$
4. Sol.	If the first term of an A.P. is 5, the last term is 15 and the sum of first n terms is 30, then find the value of n. $a = 5$, last term $l = 15$ $S_n = 30 \Rightarrow \frac{n}{2}(a + l) = 30$ $\Rightarrow \frac{n}{2}(5 + 15) = 30 \Rightarrow n = 3$	

6.	If the mean of the following frequency distribution is 18, then find the missing frequency 'f'.							1 for correct table																																				
Sol.	Class	11 – 13	13 – 15	15 – 17	17 – 19	19 – 21	21 – 23		23 – 25																																			
	Frequency	3	6	9	13	f	5		4																																			
	<table><tr><td>Class Interval</td><td>x_i</td><td>f_i</td><td>$x_i f_i$</td></tr><tr><td>11–13</td><td>12</td><td>3</td><td>36</td></tr><tr><td>13–15</td><td>14</td><td>6</td><td>84</td></tr><tr><td>15–17</td><td>16</td><td>9</td><td>144</td></tr><tr><td>17–19</td><td>18</td><td>13</td><td>234</td></tr><tr><td>19–21</td><td>20</td><td>f</td><td>$20f$</td></tr><tr><td>21–23</td><td>22</td><td>5</td><td>110</td></tr><tr><td>23–25</td><td>24</td><td>4</td><td>96</td></tr><tr><td></td><td></td><td>$40 + f$</td><td>$704 + 20f$</td></tr></table>								Class Interval	x_i	f_i	$x_i f_i$	11–13	12	3	36	13–15	14	6	84	15–17	16	9	144	17–19	18	13	234	19–21	20	f	$20f$	21–23	22	5	110	23–25	24	4	96			$40 + f$	$704 + 20f$
	Class Interval	x_i	f_i	$x_i f_i$																																								
	11–13	12	3	36																																								
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Mean = 18 $\Rightarrow \frac{\sum x_i f_i}{\sum f_i} = 18$																																												
$\Rightarrow \frac{704 + 20f}{40 + f} = 18 \Rightarrow 704 + 20f = 720 + 18f$																																												
$20f - 18f = 720 - 704 \Rightarrow 2f = 16$																																												
$f = 8$																																												
SECTION—B																																												
7.(a)	Find the value of 'p' for which the quadratic equation $p(x - 4)(x - 2) + (x - 1)^2 = 0$ has real and equal roots.							1/2																																				
Sol.	$p(x - 4)(x - 2) + (x - 1)^2 = 0$																																											
	$p(x^2 - 6x + 8) + x^2 - 2x + 1 = 0$																																											
	$(p + 1)x^2 - (6p + 2)x + (8p + 1) = 0$																																											
	$a = p + 1, b = 6p + 2, c = 8p + 1$																																											
	For real and equal roots,																																											
	$\therefore D = 0 \Rightarrow b^2 - 4ac = 0$																																											
	$\Rightarrow (6p + 2)^2 - 4(p + 1)(8p + 1) = 0$																																											
	$36p^2 + 24p + 4 - 4(8p^2 + 9p + 1) = 0$																																											
	$4p^2 - 12p = 0 \Rightarrow 4p(p - 3) = 0$																																											
	$\Rightarrow p = 0, 3$																																											

	Or	
7.(b)	Had Aarush scored 8 more marks in a Mathematics test, out of 35 marks, 7 times these marks would have been 4 less than square of his actual marks. How many marks did he get in the test ?	
Sol.	<p>Let actual marks be x</p> <p>ATQ $7(x+8) = x^2 - 4$</p> $x^2 - 7x - 60 = 0$ $x^2 - 12x + 5x - 60 = 0$ $(x-12)(x+5) = 0$ $x = 12, x = -5 \text{ (rejecting)}$ <p>\therefore Actual marks obtained by Aarush = 12</p>	<p>1</p> <p>$\frac{1}{2}$</p> <p>1</p> <p>$\frac{1}{2}$</p>
8.	Construct a pair of tangents to a circle of radius 4 cm which are inclined to each other at an angle of 60° .	
Sol.	For Correct Construction	3
9.	There is a small island in the middle of a 100 m wide river and a tall tree stands on the island. P and Q are points directly opposite to each other on two banks and in line with the tree. If the angles of elevation of the top of the tree from P and Q are respectively 30° and 45° , find the height of the tree. (Use $\sqrt{3} = 1.732$)	
Sol.	<p>Let AB = height of tree = h</p> <p>$\angle APB = 30^\circ$, $\angle AQB = 45^\circ$</p> <p>Let $BQ = x$</p> <p>$\therefore PB = 100 - x$</p> <p>In $\triangle ABQ$, $\tan 45^\circ = \frac{h}{x} \Rightarrow h = x$</p> <p>In $\triangle ABP$, $\tan 30^\circ = \frac{h}{100 - x}$</p> $\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{100 - x} \Rightarrow 100 - x = h\sqrt{3}$ $100 - h = h\sqrt{3} \Rightarrow 100 = h(\sqrt{3} + 1)$ $h = \frac{100}{\sqrt{3} + 1} = \frac{100(\sqrt{3} - 1)}{(\sqrt{3} + 1)(\sqrt{3} - 1)} = \frac{100(\sqrt{3} - 1)}{(\sqrt{3})^2 - (1)^2}$ $h = \frac{50}{1} \frac{(\sqrt{3} - 1)}{1} = 50(1.732 - 1) = 36.6 \text{ m}$	<p>Correct Figure</p>  <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2} + \frac{1}{2}$</p>

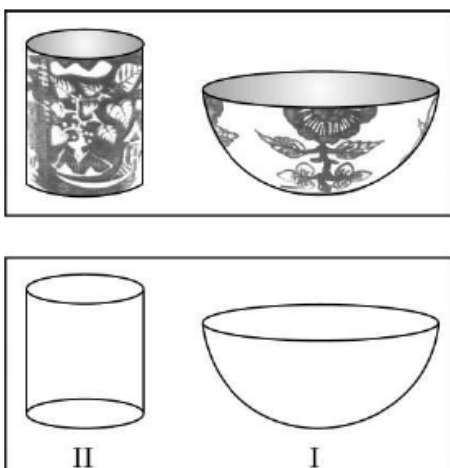
<p>10.</p> <p>Sol.</p>	<p>In an A.P., the sum of first n terms is $\frac{n}{2}(3n + 5)$. Find the 25th term of the A.P.</p> $S_n = \frac{3n^2}{2} + \frac{5n}{2}$ $n = 1, S_1 = \frac{3}{2} + \frac{5}{2} = 4 \rightarrow \text{1st term } a_1$ $n = 2, S_2 = \frac{3 \times 4}{2} + \frac{5(2)}{2} = 11 \text{ (1st term + 2nd term)}$ $\therefore a_2 = S_2 - S_1 = 11 - 4 = 7$ $d = a_2 - a_1 = 7 - 4 = 3$ $a_{25} = a + 24d = 4 + 24(3) = 76$	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>1</p>
<p style="text-align: center;">SECTION—C</p>		
<p>11.</p> <p>Sol.</p>	<p>From the top of an 8 m high building, the angle of elevation of the top of a cable tower is 60° and the angle of depression of its foot is 45°. Determine the height of the tower. (Take $\sqrt{3} = 1.732$).</p> <p style="text-align: right;">Correct figure</p> <div style="display: flex; justify-content: space-between;"> <div style="width: 60%;"> <p>Let AB = height of building = 8 m</p> <p>Let CD = height of tower = h m</p> <p>$\angle DBE = 60^\circ$</p> <p>$\angle ACB = \angle EBC = 45^\circ$</p> <p>$AC = BE = y$ (let)</p> <p>In right $\triangle ABC$,</p> $\tan 45^\circ = \frac{8}{AC}$ $1 = \frac{8}{AC}$ $\Rightarrow AC = 8 \text{ m} \Rightarrow y = 8 \text{ m}$ <p>In right $\triangle BDE$, $\tan 60^\circ = \frac{h-8}{BE}$</p> $\sqrt{3} = \frac{h-8}{y} \Rightarrow \sqrt{3}y = h-8$ $\sqrt{3}(8) = h-8$ $h = 8\sqrt{3} + 8 = 8(\sqrt{3} + 1)$ $h = 8(1.732 + 1) = 8(2.732) = 21.856 \text{ m}$ <p>\therefore Height of tower = 21.856 m</p> </div> <div style="width: 35%; text-align: center;"> </div> </div>	<p>1</p> <p>1</p> <p>1</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p>

<p>12.(a)</p>	<p>In Fig.-2, if a circle touches the side QR of ΔPQR at S and extended sides PQ and PR at M and N, respectively, then</p>  <p style="text-align: center;">Fig. 2</p> <p>prove that $PM = \frac{1}{2} (PQ + QR + PR)$</p> <p>Sol. We know that tangents drawn from the external point to the circle are equal $\therefore QS = QM$ $RS = RN$ $PM = PN$ Now $2 PM = PM + PN$ $= (PQ + QM) + (PR + RN)$ $= PQ + QS + PR + RS$ $= PQ + (QS + RS) + PR$ $= PQ + QR + PR$ $\therefore PM = \frac{1}{2} (PQ + QR + PR)$</p> 	<p>1</p> <p>1</p> <p>$\frac{1}{2}$</p> <p>1</p> <p>$\frac{1}{2}$</p>
	<p>Or</p>	
<p>12.(b)</p>	<p>In Fig. 3, a triangle ABC is drawn to circumscribe a circle of radius 4 cm such that the segments BD and DC into which BC is divided by the point of contact D are of lengths 6 cm and 8 cm respectively. If the area of ΔABC is 84 cm^2, find the lengths of sides AB and AC.</p>   <div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="width: 45%;"> <p>Sol.</p> </div> <div style="width: 45%;"> $\left. \begin{aligned} BF &= BD = 6 \text{ cm} \\ CE &= DC = 8 \text{ cm} \\ \text{Let } AF &= AE = x \text{ cm} \end{aligned} \right\}$ <p>$\Rightarrow AB = (6 + x) \text{ cm}, AC = (8 + x) \text{ cm} \text{ \& } BC = 14 \text{ cm}$</p> <p>$\text{Ar}(\Delta ABC) = \frac{1}{2} [p] \cdot r = \frac{1}{2} \times (28 + 2x) \times 4 = 84$</p> <p>$\Rightarrow 14 + x = 21 \Rightarrow x = 7 \text{ cm}$</p> <p>$\Rightarrow AB = 13 \text{ cm}, AC = 15 \text{ cm}$</p> </div> </div>	<p>1</p> <p>1</p> <p>1</p> <p>$\frac{1}{2} + \frac{1}{2}$</p>

13.

Khurja is a city in the Indian state of Uttar Pradesh famous for the pottery. Khurja pottery is traditional Indian pottery work which has attracted Indians as well as foreigners with a variety of tea-sets, crockery and ceramic tile works. A huge portion of the ceramics used in the country is supplied by Khurja and is also referred as 'The Ceramic Town'.

One of the private schools of Bulandshahr organised an Educational Tour for class 10 students to Khurja. Students were very excited about the trip. Following are the few pottery objects of Khurja.



Students found the shapes of the objects very interesting and they could easily relate them with mathematical shapes viz sphere, hemisphere, cylinder etc. Maths teacher who was accompanying the students asked following questions :

- (a) The internal radius of hemispherical bowl (filled completely with water) in I is 9 cm and radius and height of cylindrical jar in II is 1.5 cm and 4 cm respectively. If the hemispherical bowl is to be emptied in cylindrical jars, then how many cylindrical jars are required ?
- (b) If in the cylindrical jar full of water, a conical funnel of same height and same diameter is immersed, then how much water will flow out of the jar ?

Sol.

(a) Cylinder— $h = 4$ cm, $r = 1.5$ cm $= \frac{3}{2}$ cm

$$\begin{aligned}\text{Volume of cylinder} &= \pi r^2 h \\ &= \pi \times (1.5)^2 \times 4 \text{ cm}^3\end{aligned}$$


Radius of hemisphere $R = 9$ cm

$$\begin{aligned}\text{Volume of hemisphere} &= \frac{2}{3}\pi R^3 \\ &= \frac{2}{3} \times \pi \times (9)^3 \text{ cm}^3\end{aligned}$$

Let the number of cylindrical jars be n

$$\therefore n \times \pi \times (1.5)^2 \times 4 = \frac{2}{3} \times \pi \times (9)^3$$

 $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$

	$\Rightarrow n = \frac{9 \times 9 \times 9 \times 2}{4 \times 1.5 \times 1.5 \times 3} = 54$ <p>\therefore Number of cylindrical jars required = 54</p>	$\frac{1}{2}$																
	(b) For conical funnel, $r = \frac{3}{2} \text{ cm}$, $h = 4 \text{ cm}$ \therefore Volume of conical funnel $= \frac{1}{3} \pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times \frac{3}{2} \times \frac{3}{2} \times 4$ $= \frac{66}{7} \text{ cm}^3$ of water will flow out.	$\frac{1}{2}$ 1 $\frac{1}{2}$																
	Or																	
14.	<p>Yoga is an ancient practice which is a form of meditation and exercise. By practising yoga, we not even make our body healthy but also achieve inner peace and calmness. The International Yoga Day is celebrated on 21st of June every year since 2015.</p> <p>To promote Yoga, Green park society in Pune organised a 7-day Yoga camp in their society. The number of people of different age groups who enrolled for this camp is given as follows :</p> <div style="text-align: center;"></div> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"><tr><th>Age Group</th><td>15 – 25</td><td>25 – 35</td><td>35 – 45</td><td>45 – 55</td><td>55 – 65</td><td>65 – 75</td><td>75 – 85</td></tr><tr><th>Number of People</th><td>8</td><td>10</td><td>15</td><td>25</td><td>40</td><td>24</td><td>18</td></tr></table> <p>Based on the above, find the following :</p> <p>(a) Find the median age of people enrolled for the camp.</p> <p>(b) If x more people of age group 65 – 75 had enrolled for the camp, the mean age would have been 58. Find the value of x.</p>	Age Group	15 – 25	25 – 35	35 – 45	45 – 55	55 – 65	65 – 75	75 – 85	Number of People	8	10	15	25	40	24	18	
Age Group	15 – 25	25 – 35	35 – 45	45 – 55	55 – 65	65 – 75	75 – 85											
Number of People	8	10	15	25	40	24	18											

Sol.	(a)			$\frac{1}{2}$ for table
	Age Group	No. of people (f)	Cf	
	15–25	8	8	
	25–35	10	18	
	35–45	15	33	
	45–55	25	58	
	55–65	40	98	
	65–75	24	122	
	75–85	18	140	
	$N = 140, \therefore \frac{N}{2} = 70$, which corresponds to 55–65 \therefore Median class = 55–65 $\therefore l = 55, f = 40, cf = 58, h = 10$ $\text{Median} = l + \frac{\frac{N}{2} - cf}{f} \times h$ $= 55 + \frac{70 - 58}{40} \times 10 = 55 + 3 = 58$ \therefore Median = 58			$\frac{1}{2}$
	(b) Any student who has attempted the question (even if deleted) will be awarded full credit of 2 marks			1

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