CBSE Class 10 Mathematics Standard Answer Key 2022

(May 5, Set 3 - 30/4/3)

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Secondary School Examination

Term–II, 2022

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

[Paper Code : 30/4/3]

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.

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.

***These answers are meant to be used by evaluators.**

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.

***These answers are meant to be used by evaluators.**

MARKING SCHEME

Secondary School Examination TERM–II, 2022

MATHEMATICS (Standard) (Subject Code–041)

[Paper Code : 30/4/3]

***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)	Find the value of 'k' for which the quadratic equation $2kx^2 - 40x + 25 = 0$ has real and equal roots.	
Sol.	$2kx^2 - 40x + 25 = 0$	
	$a = 2k,\ b = -40,\ c = 25$	
	Q.E. has equal roots $\Rightarrow D = 0$	1
	$b^2 - 4ac = 0 \Rightarrow 1600 - 200k = 0$	
	$k = 8$	1
	Or	
1.(b)	Solve for x : $\frac{5}{2}x^2 + \frac{2}{5} = 1 - 2x.$	
Sol.	$\frac{5}{2}x^2 + \frac{2}{5} = 1 - 2x$	
	$\frac{25x^2 + 4}{10} = 1 - 2x \Rightarrow 25x^2 + 4 = 10 - 20x$	½
	$25x^2 + 20x - 6 = 0$	
	$a = 25, b = 20, c = -6$	

***These answers are meant to be used by evaluators.**

	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-20 \pm \sqrt{400 + 600}}{2 \times 25}$ $x = \frac{-20 \pm \sqrt{1000}}{50} = \frac{-20 \pm 10\sqrt{10}}{50}$ $x = \frac{-2 \pm \sqrt{10}}{5}; x = \frac{-2 + \sqrt{10}}{5}, \frac{-2 - \sqrt{10}}{5}$	1 ½
2.	The mode of a grouped frequency distribution is 75 and the modal class is 65-80. The frequency of the class preceding the modal class is 6 and the frequency of the class succeeding the modal class is 8. Find the frequency of the modal class.	
Sol.	Mode = 75, Modal class = 65 – 80 $l = 65\ f_0 = 6,\ f_2 = 8$ Mode $= l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h$ $75 = 65 + \left(\frac{f_1 - 6}{2f_1 - 6 - 8}\right) \times 15$ $4f_1 - 28 = 3f_1 - 18 \Rightarrow f_1 = 10$ ∴ Frequency of modal class is 10.	½ 1 ½
3.(a)	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 ?	
Sol.	Let h be the height of cylinder CSA of cylinder = 176 $\Rightarrow 2\pi rh = 176 \ldots (i)$ Volume of cylinder = 1232 $\Rightarrow \pi r^2 h = 1232$ on dividing, $\frac{\pi r^{\cancel{2}} \cancel{h}}{2\pi \cancel{r} \cancel{h}} = \frac{1232}{176}$ we get, $r = 14$ cm $\therefore (i) \Rightarrow 2 \times \frac{22}{\cancel{7}} \times \cancel{14}^{2} \times h = 176$ $\Rightarrow h = 2$ cm	½ ½ ½ ½
	Or	
3.(b)	The largest sphere is carved out of a solid cube of side 21 cm. Find the volume of the sphere.	
Sol.	Diameter of sphere = side of cube = 21 cm	

*These answers are meant to be used by evaluators.

$\therefore$ radius $r = \frac{21}{2}$ cm ½

Volume of sphere $= \frac{4}{3}\pi r^3 = \frac{4}{3} \times \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2} \times \frac{21}{2}$ 1

$= 4851\,\text{cm}^3$ ½

4. Find the sum of all 11 terms of an A.P. whose 6th term is 30.

Sol.

$n = 11$

$a_6 = 30$ ½

$a + 5d = 30 \ldots (i)$

Now $S_{11} = \frac{11}{2}[2a + (11-1)d]$ ½

$= \frac{11}{2}[2a + 10d] = \frac{11}{\cancel{2}} \times \cancel{2}[a + 5d]$ ½

$= 11 \times 30$ [Using (i)]

$= 330$ ½

5. Find the median of the following distribution :

Marks	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
Number of students	5	8	20	15	7	5

Sol.

Marks	*No. of Students* (f)	*cf*
0–10	5	5
10–20	8	13
20–30	20	33
30–40	15	48
40–50	7	55
50–60	5	60

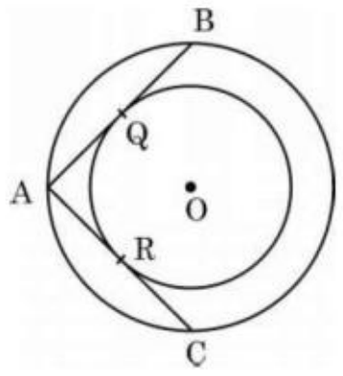
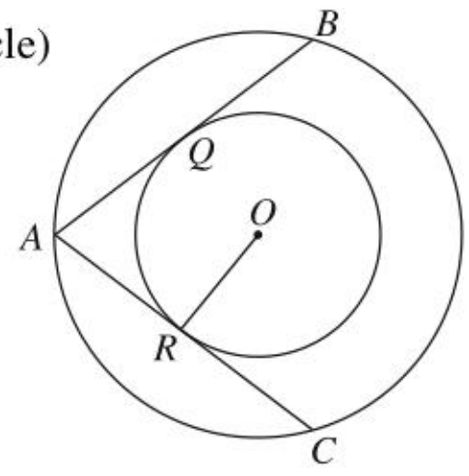
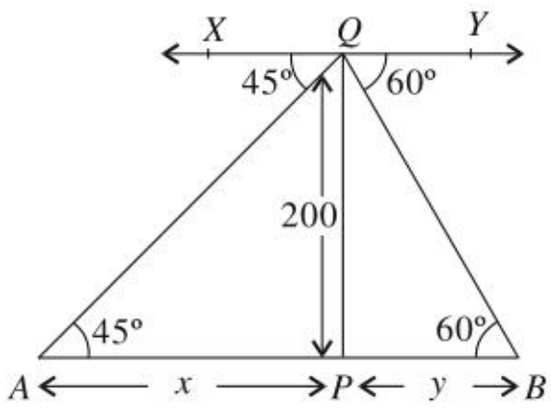
½ for table

$N = 60$, $\frac{N}{2} = 30$, $\therefore$ Median class is 20–30 ½

$l = 20,\ c = 13,\ f = 33,\ h = 10$

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

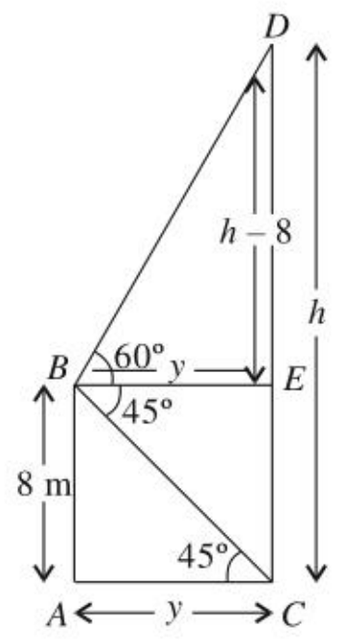
*These answers are meant to be used by evaluators.

	$= 20 + \left(\frac{30-13}{20}\right) \times 10$ $= 20 + \frac{17}{2} = 20 + 8 \cdot 5$ $= 28 \cdot 5$	½ ½
6.	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.  	
Sol.	$AQ = AR$ (tangents drawn from external point to the circle) $\therefore AR = 5$ cm Join OR $\therefore OR \perp AC$ (radius tangent) Now AC is the chord of larger circle and we know that perpendicular from the centre bisects the chord $\therefore AR = RC = 5$ cm $\Rightarrow$ AC = 5 + 5 = 10 cm  	½ ½ ½ ½
	SECTION—B	
7.	An aeroplane at an altitude of 200 metres observes the angles of depression of opposite points on the two banks of a river to be 45° and 60°. Find the width of the river. (Use $\sqrt{3} = 1.732$)	
Sol.	Correct Figure  $AB =$ width of river $PQ =$ Height of aeroplane = 200 m $\angle XQA = \angle QAP = 45°$ $\angle YQB = \angle QBP = 60°$ Let $AP = x$, $BP = y$ In ΔAQP, $\tan 45° = \frac{200}{x} \Rightarrow x = 200$ In ΔBQP, $\tan 45° = \frac{200}{y} \Rightarrow y\sqrt{3} = 200$	1 ½

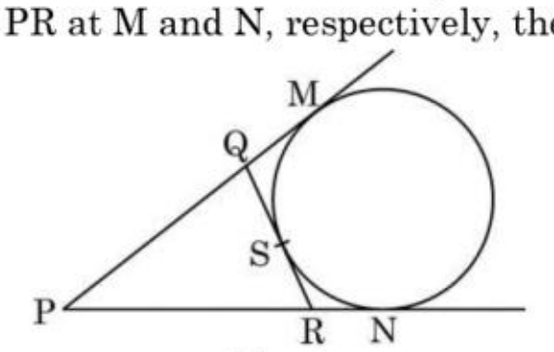
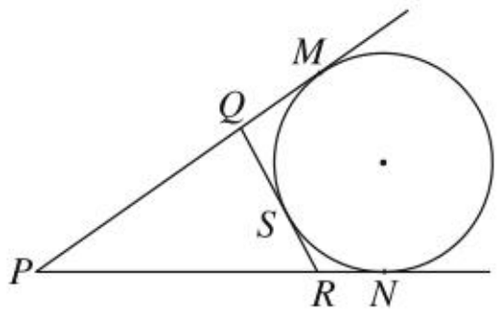
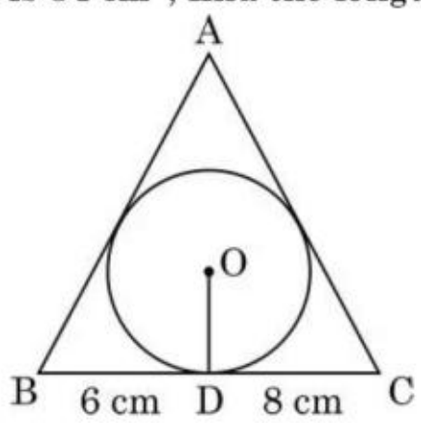
*These answers are meant to be used by evaluators.

	$y = \frac{200}{\sqrt{3}} = \frac{200\sqrt{3}}{3}$ $\therefore$ Width of river $= AB = x + y = 200 + \frac{200\sqrt{3}}{3}$ $AB = 200 + \frac{200(1\cdot732)}{3}$ $= 200 + \frac{346\cdot4}{3} = 200 + 115\cdot46 = 315\cdot46$ m $\therefore$ Width of river $= 315\cdot46$ m	½ ½ ½
8.	The sum of the first three terms of an A.P. is 33. If the product of first and third term exceeds the second term by 29, find the A.P.	
Sol.	Let three terms of AP be $a-d$, a, $a+d$ Sum $= 33 \Rightarrow a-d+a+a+d = 33$ $3a = 33 \Rightarrow a = 11$ ATQ, $(a-d)(a+d) = a+29$ $a^2 - d^2 = 11+29 = 40$ $121 - d^2 = 40$ $d^2 = 121-40 = 81$ $d = \pm 9$ When $d = 9$, $a = 11$; A.P. is 2, 11, 20, … When $d = -9$, $a = 11$; A.P. is 20, 11, 2, …	1 ½ ½ ½ ½
9.(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.	
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, $\therefore D = 0 \Rightarrow b^2 - 4ac = 0$	½

*These answers are meant to be used by evaluators.

	$\Rightarrow \quad (6p+2)^2 - 4(p+1)(8p+1) = 0$ $36p^2 + 24p + 4 - 4(8p^2 + 9p + 1) = 0$ $4p^2 - 12p = 0 \Rightarrow 4p(p-3) = 0$ $\Rightarrow \quad p = 0, 3$	1 1 ½
	Or	
9.(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.	Let actual marks be x	
	ATQ $\quad 7(x+8) = x^2 - 4$	1
	$x^2 - 7x - 60 = 0$	½
	$x^2 - 12x + 5x - 60 = 0$	
	$(x-12)(x+5) = 0$	1
	$x = 12, \ x = -5$ (rejecting)	½
	∴ Actual marks obtained by Aarush = 12	
10.	Construct a pair of tangents to a circle of radius 5 cm which are inclined to each other at an angle of 60°.	
Sol.	Correct Construction	3
	SECTION—C	
11.	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 $\sqrt{3} = 1.732$).	
Sol.	Correct figure  	1 1
	Let AB = height of building = 8 m Let CD = height of tower = h m $\angle DBE = 60°$ $\angle ACB = \angle EBC = 45°$ $AC = BE = y$ (let) In right ΔABC, $\tan 45° = \frac{8}{AC}$ $1 = \frac{8}{AC}$ $\Rightarrow AC = 8 \text{ m} \Rightarrow y = 8 \text{ m}$ In right ΔBDE, $\tan 60° = \frac{h-8}{BE}$	

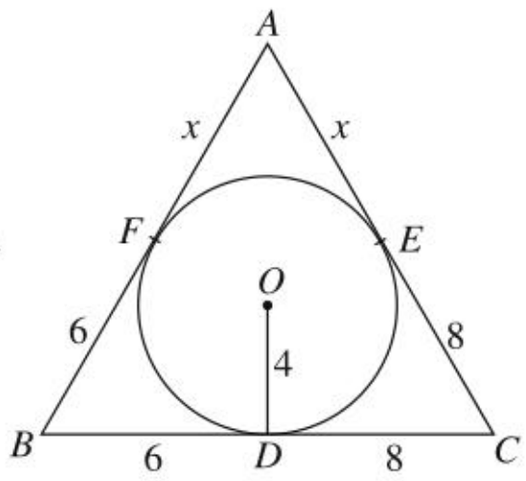
*These answers are meant to be used by evaluators.

	$\sqrt{3} = \frac{h-8}{y} \Rightarrow \sqrt{3}y = h-8$ $\sqrt{3}(8) = h-8$ $h = 8\sqrt{3}+8 = 8(\sqrt{3}+1)$ $h = 8(1\cdot732+1) = 8(2\cdot732) = 21\cdot856$ m $\therefore$ Height of tower = $21\cdot856$ m	1 ½ ½
12.(a)	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  **Fig. 2** prove that PM = $\frac{1}{2}$(PQ + QR + PR)	
Sol.	We know that tangents drawn from the external point to the circle are equal $\therefore\ QS = QM$ $RS = RN$ $PM = PN$ Now $2PM = PM + PN$ $= (PQ + QM) + (PR + RN)$ $= PQ + QS + PR + RS$ $= PQ + (QS + RS) + PR$ $= PQ + QR + PR$ $\therefore$ PM = $\frac{1}{2}(PQ + QR + PR)$  	1 1 ½ 1 ½
	Or	
12.(b)	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.  	

***These answers are meant to be used by evaluators.**

Sol.

$BF = BD = 6$ cm
$CE = DC = 8$ cm
Let $AF = AE = x$ cm



$\Rightarrow AB = (6+x)$ cm, $AC = (8+x)$ cm & $BC = 14$ cm — 1

Ar $(\Delta ABC) = \frac{1}{2}[p] \cdot r = \frac{1}{2} \times (28 + 2x) \times 4 = 84$ — 1

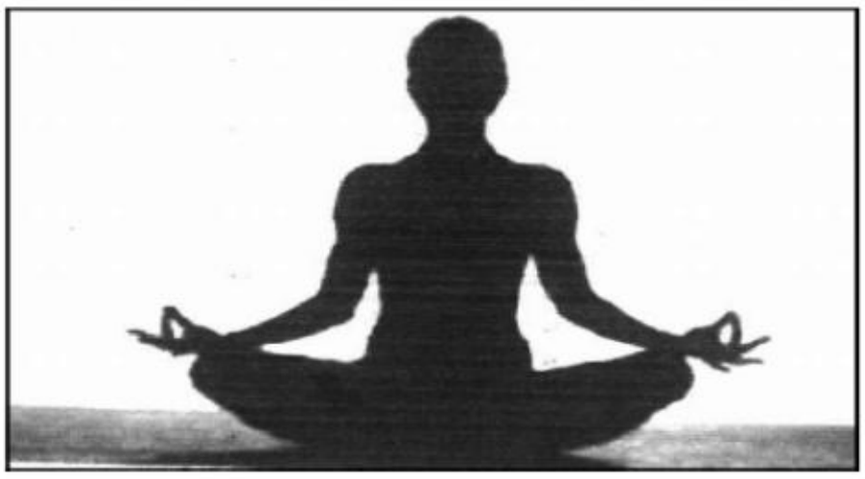
$\Rightarrow 14 + x = 21 \Rightarrow x = 7$ cm

$\Rightarrow AB = 13$ cm, $AC = 15$ cm — 1

½+½

13. 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.

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 :



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

Based on the above, find the following :

(a) Find the median age of people enrolled for the camp.

(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.

Sol.

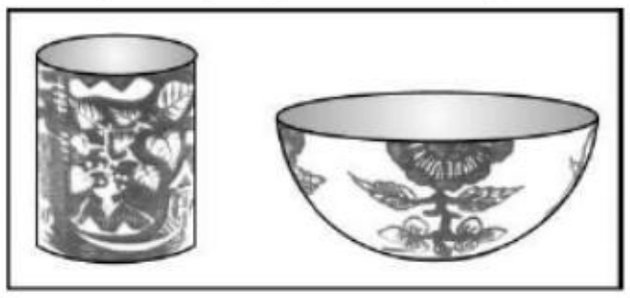
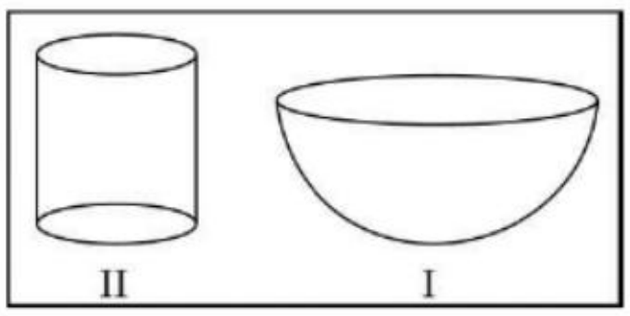
(a)

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

½ for table

$N = 140, \ \therefore \frac{N}{2} = 70$, which corresponds to 55–65

*These answers are meant to be used by evaluators.

	∴ Median class = 55–65 ∴ $l = 55,\ f = 40,\ cf = 58,\ h = 10$ $\text{Median} = l + \dfrac{\frac{N}{2} - cf}{f} \times h$ $= 55 + \frac{70-58}{40} \times 10 = 55 + 3$ ∴ Median = 58	½ 1
	(b) **Any student who has attempted the question (even if deleted) will be awarded full credit of 2 marks**	
14.	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, $r = 1{\cdot}5$ cm $= \dfrac{3}{2}$ cm Volume of cylinder $= \pi r^2 h$	

	$= \pi \times (1.5)^2 \times 4\ cm^3$	½
	Radius of hemisphere $R = 9$ cm	
	Volume of hemisphere $= \frac{2}{3}\pi R^3$	
	$= \frac{2}{3} \times \pi \times (9)^3 cm^3$	½
	Let the number of cylindrical jars be n	
	$\therefore n \times \pi \times (1.5)^2 \times 4 = \frac{2}{3} \times \pi \times (9)^3$	½
	$\Rightarrow \text{n} = \frac{9\times9\times9\times2}{4\times1.5\times1.5\times3} = 54$	½
	$\therefore$ Number of cylindrical jars required $= 54$	
	(b) For conical funnel, $r = \frac{3}{2}\ cm$, $h = 4\ cm$	½
	$\therefore$ Volume of conical funnel $= \frac{1}{3}\pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times \frac{3}{2} \times \frac{3}{2} \times 4$	1
	$= \frac{66}{7}\ cm^3$ of water will flow out.	½

* * *