Strictly Confidential : (For Internal and Restricted use only)
Secondary School Examination
Term–II, 2022

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

[Paper Code : 30/3/3]

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.

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

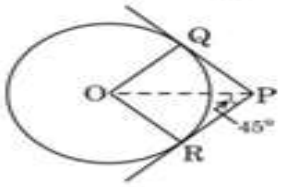
Secondary School Examination TERM–II, 2022

MATHEMATICS (Standard) (Subject Code–041)

[Paper Code : 30/3/3]

General 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.	In Figure 2, PQ and PR are tangents to the circle centred at O. If $\angle OPR = 45°$, then prove that ORPQ is a square.  	
Sol.	$\Delta OQP \cong \Delta ORP \Rightarrow \angle QPO = \angle RPO = 45°$ $\Rightarrow \angle QPR = 90°$. Also $\angle OQP = \angle ORP = \angle QOR = 90°$ Also $OR = OQ$. This implies $ORPQ$ is a square.	½ 1 ½
2.	Find the mode of the given frequency distribution *Class* / *Frequency*: 15 – 25: 6; 25 – 35: 11; 35 – 45: 22; 45 – 55: 23; 55 – 65: 14; 65 – 75: 5	
Sol.	Modal class is $45-55$	½

	Mode $= 45 + 10 \times \dfrac{23-22}{46-22-14}$	1
	$= 46$	½
3.	Find the common difference 'd' of an AP whose first term is 10 and the sum of the first 14 terms is 1505.	
Sol.	Here $a = 10$, $n = 14$, $S_{14} = 1505$	1
	$1505 = \dfrac{14}{2}[20 + 13d]$	½
	$\Rightarrow d = 15$	½
4.	For what value of 'n', are the n^{th} terms of the APs : 9, 7, 5, ... and 15, 12, 9, ... the same ?	
Sol.	nth terms are $9 + (n-1)(-2)$ and $15 + (n-1)(-3)$	½+½
	Thus, $9 - 2(n-1) = 15 - 3(n-1)$ gives $n = 7$	1
5.	(a) Solve the quadratic equation for x : $x^2 - 2ax - (4b^2 - a^2) = 0$	
Sol.	$x^2 - 2ax - (4b^2 - a^2) = 0$ gives	
	$x^2 - 2ax + a^2 - 4b^2 = 0$	
	$\Rightarrow (x-a)^2 - (2b)^2 = 0$	1
	$\Rightarrow (x - a + 2b)(x - a - 2b) = 0$	
	$\therefore\ x = a - 2b$ and $a + 2b$	1
	Or	
	(b) If the quadratic equation $(1 + a^2)x^2 + 2abx + (b^2 - c^2) = 0$ has equal and real roots, then prove that : $b^2 = c^2(1 + a^2)$	
Sol.	The equation has equal roots	
	therefore $4a^2b^2 - 4(1+a^2)(b^2 - c^2) = 0$	1
	$\Rightarrow b^2 = c^2(1 + a^2)$	1
6.	(a) 150 spherical marbles, each of diameter 1·4 cm, are dropped in a cylindrical vessel of diameter 7 cm containing some water, and are completely immersed in water. Find the rise in the level of water in the cylindrical vessel.	

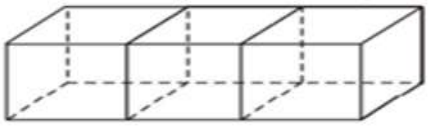
Sol. Let h cm be the rise in the water level. Then — 1½

$$\pi(3\cdot5)^2 h = \frac{4\pi}{3}(0\cdot7)^3(150)$$ — ½

$$\Rightarrow h = 5\cdot6 \text{ cm}$$

Or

(b) Three cubes of side 6 cm each, are joined as shown in Figure 1. Find the total surface area of the resulting cuboid.



Sol. Length of cuboid=18cm — ½

Total surface area of solid =2(18x6+6x6+6x18) — 1

$= 504 \text{ cm}^2$ — ½

SECTION—B

7. **Two boats are sailing in the sea 80 m apart from each other towards a cliff AB. The angles of depression of the boats from the top of the cliff are 30° and 45° respectively, as shown in Figure 3. Find the height of the cliff.**

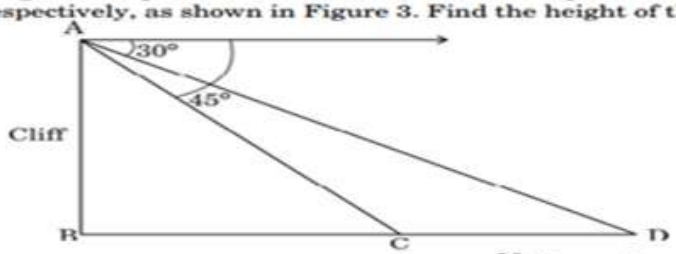
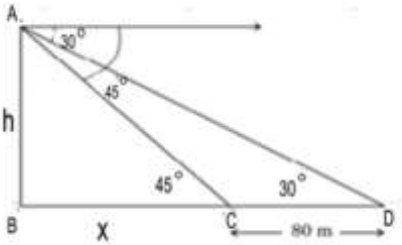


Figure 3

Sol.



$$\tan 45° = \frac{h}{x} = 1$$

$$\Rightarrow h = x \ \ldots\ldots\ldots \text{(i)}$$ — 1

$$\tan 30° = \frac{1}{\sqrt{3}} = \frac{h}{x+80} \ \ldots\ldots\ldots \text{(ii)}$$ — 1

Using (i) and (ii)

$$h = \frac{80}{\sqrt{3}-1} = 40(\sqrt{3}+1) \text{ m}$$ — 1

∴ Height of the cliff =40(√3+1)m

8. For the following frequency distribution, find the median :

Class	*Frequency*
1400 – 1550	6
1550 – 1700	13
1700 – 1850	25
1850 – 2000	10

Sol.

Class	*f*	*Cf*
1400–1550	6	6
1550–1700	13	19
1700–1850	25	44
1850–2000	10	54 = *N*

Correct Table — 1

Median class is 1700 –1850 — ½

Median = $1700 + \frac{150}{25}(27 - 19)$ — 1

= 1748 — ½

9. (a) Draw a line segment AB of length 8 cm and locate a point P on AB such that AP : PB = 1 : 5.

OR

(b) Draw a circle of radius 3 cm. From a point P lying outside the circle at a distance of 6 cm from its centre, construct two tangents PA and PB to the circle.

Sol. Correct construction — 3

10. Find the mean of the following frequency distribution :

Class	*Frequency*
0 – 10	12
10 – 20	18
20 – 30	27
30 – 40	20
40 – 50	17
50 – 60	6

Sol.

Class	*x*	*f*	$d = x - 25$	*fd*
0–10	5	12	–20	–240
10–20	15	18	–10	–180
20–30	25	27	0	0
30–40	35	20	10	200
40–50	45	17	20	340
50–60	55	6	30	180
		100		300

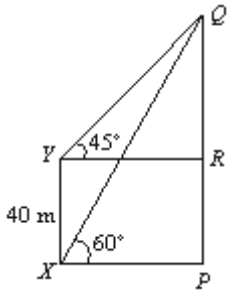
Correct Table — 2

$\overline{x} = 25 + \frac{300}{100} = 28$ — 1

SECTION—C

11. The angle of elevation of the top Q of a vertical tower PQ from a point X on the ground is 60°. From a point Y, 40 m vertically above X, the angle of elevation of the top Q of tower PQ is 45°. Find the height of the tower PQ and the distance PX. [Use $\sqrt{3} = 1{\cdot}73$]

Sol.



Correct Figure — 1

In ΔYRQ, $\tan 45° = \frac{QR}{YR} \Rightarrow QR = YR$ … … … (i) — 1

In ΔXPQ, $\tan 60° = \frac{PQ}{XP} \Rightarrow \sqrt{3} = \frac{PQ}{XP}$ … … … (ii) — 1

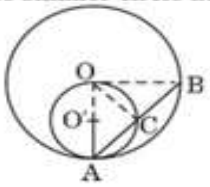
Further, $PR = 40$ m … … … (iii)

From (i) to (iii), we get

PQ=94.6m , PX=54.6m — ½+½

12.

(a) In Figure 3, two circles with centres at O and O′ of radii 2r and r respectively, touch each other internally at A. A chord AB of the bigger circle meets the smaller circle at C. Show that C bisects AB.



Sol. $\angle OCA = 90°$ — 1

In Δs OCA and OCB, we have

$OA = OB,\ \angle OCA = \angle OCB = 90°$

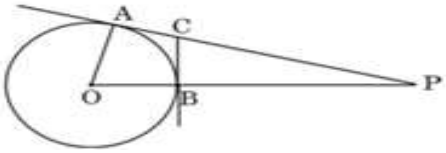
and $OC = OC$

So, $\Delta OCA \cong \Delta OCB$ — 2

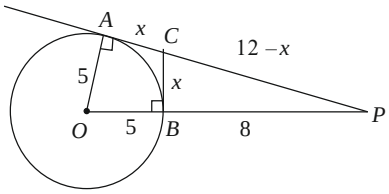
$\Rightarrow AC = BC \Rightarrow C$ bisects AB — 1

Or

(b) In Figure 4, O is centre of a circle of radius 5 cm. PA and BC are tangents to the circle at A and B respectively. If OP = 13 cm, then find the length of tangents PA and BC.



Sol.



$PA^2 = OP^2 - OA^2 = 169 - 25$

$\Rightarrow PA = 12$ cm — 1

Let $BC = x \Rightarrow AC = x$

$\therefore\ PC = 12 - x$ — 1

$OP \perp BC \Rightarrow (12 - x)^2 = x^2 + 8^2$ — 1

$\Rightarrow x = \frac{10}{3}$ cm

$\therefore$BC= $\frac{10}{3}$ cm — 1

Q13.

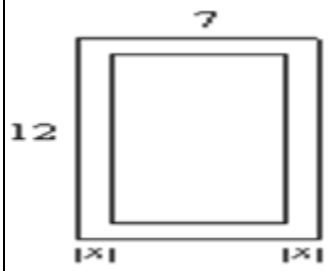
Case Study – 1

In the picture given below, one can see a rectangular in-ground swimming pool installed by a family in their backyard. There is a concrete sidewalk around the pool of width x m. The outside edges of the sidewalk measure 7 m and 12 m. The area of the pool is 36 sq. m.

(a) Based on the information given above, form a quadratic equation in terms of x.

(b) Find the width of the sidewalk around the pool.

Sol.



(a) Sides of pool are $7-2x$ and $12-2x$ ½

Area = 36 sq. m

$\Rightarrow (7-2x)(12-2x)=36$ 1

$\Rightarrow 4x^2-38x+48=0$ ½

(b) $\Rightarrow 2x^2-19x+24=0$

$\Rightarrow (x-8)(2x-3)=0$ 1

$x \neq 8\text{m} \therefore x=\frac{3}{2}\text{ m}$ 1

$\therefore$ width of sidewalk around the pool is $\frac{3}{2}$ m

Q14.

Case Study – 2

John planned a birthday party for his younger sister with his friends. They decided to make some birthday caps by themselves and to buy a cake from a bakery shop. For these two items, they decided the following dimensions :

Cake : Cylindrical shape with diameter 24 cm and height 14 cm.

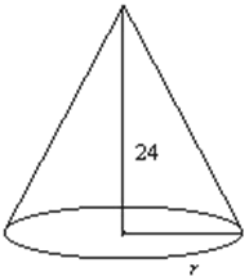
Cap : Conical shape with base circumference 44 cm and height 24 cm.

Based on the above information, answer the following questions :

(a) How many square cm paper would be used to make 4 such caps ?

(b) The bakery shop sells cakes by weight (0·5 kg, 1 kg, 1·5 kg, etc.). To have the required dimensions, how much cake should they order, if 650 cm^3 equals 100 g of cake ?

Sol.



(a) $2\pi r = 44$

$\Rightarrow r = 7$ ½

Therefore, $l = \sqrt{24^2 + 7^2} = 25$ cm ½

Paper required for 4 caps = $4 \times \pi r l$

$= 4 \times \frac{22}{7} \times 7 \times 25$

$= 2200 cm^2$ or $700\ \pi\ cm^2$ 1

(b) Volume of cake $= \frac{22}{7}$ X 12 X 12 X 14

$= 6336\ cm^3$ 1

6336 cm^3 is nearest to 6500 cm^3

Now, $650\ cm^3 = 100$ g

$\Rightarrow 6500\ cm^3 = 1$ kg

$\therefore$ 1 kg cake should be ordered. 1

* * *