Series WX1YZ/2 **SET~3**

प्रश्न–पत्र कोड **Q.P. Code 30/2/3**

रोल नं.
Roll No.

परीक्षार्थी प्रश्न-पत्र कोड को उत्तर-पुस्तिका के मुख-पृष्ठ पर अवश्य लिखें ।
Candidates must write the Q.P. Code on the title page of the answer-book.

गणित (मानक)
MATHEMATICS (STANDARD)

*

निर्धारित समय : 3 घण्टे *अधिकतम अंक : 80*
Time allowed : 3 hours *Maximum Marks : 80*

नोट / NOTE :

(i) *कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ **23** हैं ।*
*Please check that this question paper contains **23** printed pages.*

(ii) *प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को परीक्षार्थी उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें ।*
Q.P. Code given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.

(iii) *कृपया जाँच कर लें कि इस प्रश्न-पत्र में **38** प्रश्न हैं ।*
*Please check that this question paper contains **38** questions.*

(iv) *कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में प्रश्न का क्रमांक अवश्य लिखें ।*
Please write down the serial number of the question in the answer-book before attempting it.

(v) *इस प्रश्न-पत्र को पढ़ने के लिए 15 मिनट का समय दिया गया है । प्रश्न-पत्र का वितरण पूर्वाह्न में 10.15 बजे किया जाएगा । 10.15 बजे से 10.30 बजे तक छात्र केवल प्रश्न-पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर-पुस्तिका पर कोई उत्तर नहीं लिखेंगे ।*
15 minute time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the students will read the question paper only and will not write any answer on the answer-book during this period.

General Instructions :

Read the following instructions very carefully and strictly follow them :

(i) *This question paper contains **38** questions. **All** questions are **compulsory**.*

(ii) *This question paper is divided into **five** Sections – **A, B, C, D** and **E**.*

(iii) *In **Section A,** Questions no. **1** to **18** are multiple choice questions (MCQs) and questions number **19** and **20** are Assertion-Reason based questions of **1** mark each.*

(iv) *In **Section B,** Questions no. **21** to **25** are very short answer (VSA) type questions, carrying **2** marks each.*

(v) *In **Section C,** Questions no. **26** to **31** are short answer (SA) type questions, carrying **3** marks each.*

(vi) *In **Section D,** Questions no. **32** to **35** are long answer (LA) type questions carrying **5** marks each.*

(vii) *In **Section E,** Questions no. **36** to **38** are case study based questions carrying **4** marks each. Internal choice is provided in **2** marks questions in each case-study.*

(viii) *There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 2 questions in Section C, 2 questions in Section D and 3 questions in Section E.*

(ix) *Draw neat diagrams wherever required. Take $\pi = \frac{22}{7}$ wherever required, if not stated.*

(x) *Use of calculators is **not** allowed.*

SECTION A

This section comprises multiple choice questions (MCQs) of 1 mark each.

1. If 'n' is a natural number, then which of the following numbers end with zero ?

(a) $(3 \times 2)^n$ (b) $(2 \times 5)^n$

(c) $(6 \times 2)^n$ (d) $(5 \times 3)^n$

2. In a lottery, there are 5 prizes and 20 blanks. The probability of getting a prize is :

(a) $\frac{1}{4}$ (b) $\frac{1}{20}$

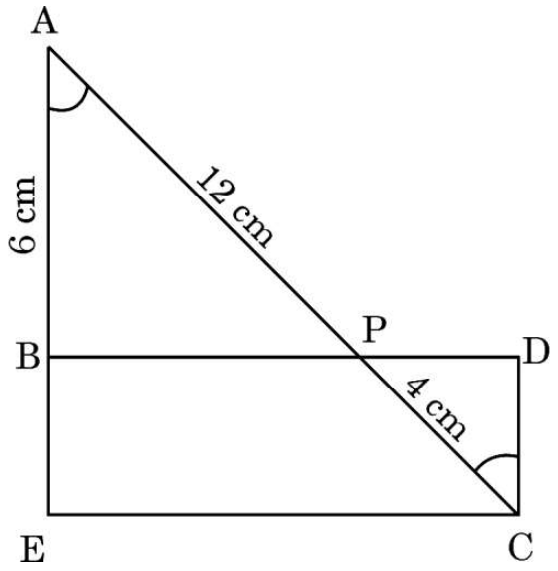
(c) $\frac{1}{25}$ (d) $\frac{1}{5}$

3. If $2x + 3y = 15$ and $3x + 2y = 25$, then the value of $x - y$ is :

(a) -10 (b) 8

(c) 10 (d) -8

4. In the given figure, $\angle A = \angle C$, AB = 6 cm, AP = 12 cm, CP = 4 cm. Then length of CD is :



(a) 2 cm (b) 6 cm

(c) 8 cm (d) 18 cm

5. The sum of zeroes of the polynomial $\sqrt{2}x^2 - 17$ are given as :

(a) $\frac{17\sqrt{2}}{2}$ (b) $-\frac{17\sqrt{2}}{2}$

(c) 0 (d) 1

6. If the area of the base of a cone is 51 cm^2 and its volume is 85 cm^3, then the vertical height of the cone is given as :

(a) $\frac{5}{6}$ cm (b) $\frac{5}{3}$ cm

(c) $\frac{5}{2}$ cm (d) 5 cm

7. What is the length of the arc of the sector of a circle with radius 14 cm and of central angle 90° ?

(a) 22 cm (b) 44 cm

(c) 88 cm (d) 11 cm

8. The coordinates of the vertex A of a rectangle ABCD whose three vertices are given as B(0, 0), C(3, 0) and D(0, 4) are :

(a) (4, 0) (b) (0, 3)

(c) (3, 4) (d) (4, 3)

9. The area of the triangle formed by the line $\frac{x}{a}+\frac{y}{b}=1$ with the coordinate axes is :

(a) ab (b) $\frac{1}{2}ab$

(c) $\frac{1}{4}ab$ (d) 2ab

10. The hour-hand of a clock is 6 cm long. The angle swept by it between 7:20 a.m. and 7:55 a.m. is :

(a) $\left(\frac{35}{4}\right)^\circ$ (b) $\left(\frac{35}{2}\right)^\circ$

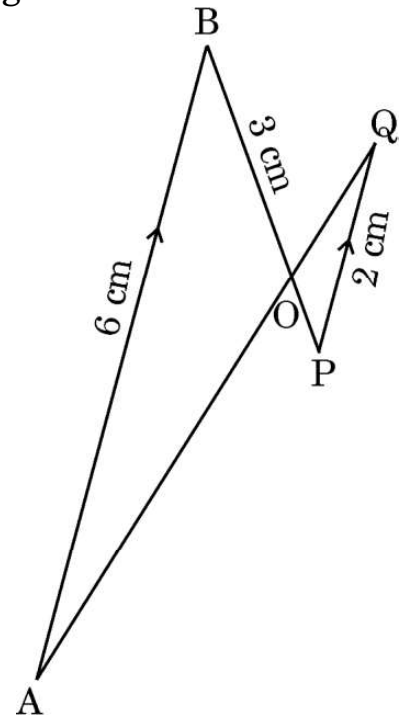
(c) 35° (d) 70°

11. The zeroes of the polynomial $p(x) = x^2 + 4x + 3$ are given by :

(a) 1, 3 (b) $-1, 3$

(c) $1, -3$ (d) $-1, -3$

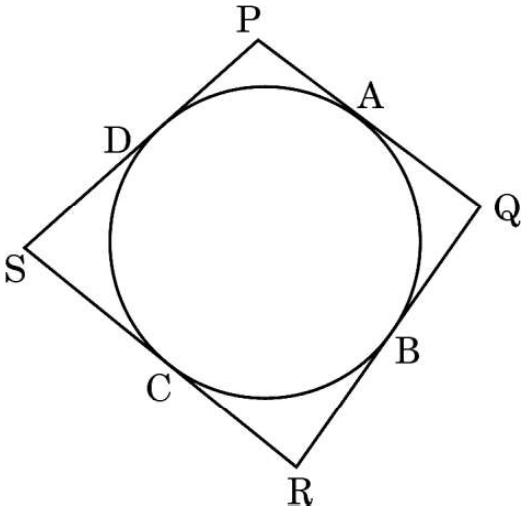
12. In the given figure, AB $\parallel$ PQ. If AB = 6 cm, PQ = 2 cm and OB = 3 cm, then the length of OP is :



(a) 9 cm (b) 3 cm

(c) 4 cm (d) 1 cm

13. In the given figure, the quadrilateral PQRS circumscribes a circle. Here PA + CS is equal to :



(a) QR (b) PR
(c) PS (d) PQ

14. If one zero of the polynomial $6x^2 + 37x - (k - 2)$ is reciprocal of the other, then what is the value of k ?

(a) -4 (b) -6
(c) 6 (d) 4

15. If three coins are tossed simultaneously, what is the probability of getting at most one tail ?

(a) $\frac{3}{8}$ (b) $\frac{4}{8}$
(c) $\frac{5}{8}$ (d) $\frac{7}{8}$

16. If the pair of equations $3x - y + 8 = 0$ and $6x - ry + 16 = 0$ represent coincident lines, then the value of 'r' is :

(a) $-\frac{1}{2}$ (b) $\frac{1}{2}$
(c) -2 (d) 2

17. If Δ ABC $\sim \Delta$ PQR with $\angle$ A = 32° and $\angle$ R = 65°, then the measure of $\angle$ B is :

(a) 32° (b) 65°

(c) 83° (d) 97°

18. Which of the following quadratic equations has sum of its roots as 4 ?

(a) $2x^2 - 4x + 8 = 0$ (b) $-x^2 + 4x + 4 = 0$

(c) $\sqrt{2}\,x^2 - \frac{4}{\sqrt{2}}x + 1 = 0$ (d) $4x^2 - 4x + 4 = 0$

*Questions number **19** and **20** are Assertion and Reason based questions carrying 1 mark each. Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.*

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is ***not*** the correct explanation of the Assertion (A).

(c) Assertion (A) is true, but Reason (R) is false.

(d) Assertion (A) is false, but Reason (R) is true.

19. *Assertion (A) :* A tangent to a circle is perpendicular to the radius through the point of contact.

Reason (R) : The lengths of tangents drawn from an external point to a circle are equal.

20. *Assertion (A) :* The polynomial $p(x) = x^2 + 3x + 3$ has two real zeroes.

Reason (R): A quadratic polynomial can have at most two real zeroes.

SECTION B

This section comprises very short answer (VSA) type questions of 2 marks each.

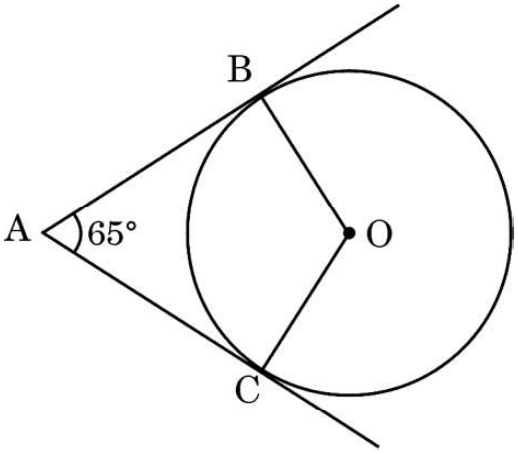
21. (a) The length of the shadow of a tower on the plane ground is $\sqrt{3}$ times the height of the tower. Find the angle of elevation of the sun.

OR

(b) The angle of elevation of the top of a tower from a point on the ground which is 30 m away from the foot of the tower, is 30°. Find the height of the tower.

22. Show that the points $(-2, 3)$, $(8, 3)$ and $(6, 7)$ are the vertices of a right-angled triangle.

23. In the given figure, O is the centre of the circle. AB and AC are tangents drawn to the circle from point A. If $\angle BAC = 65°$, then find the measure of $\angle BOC$.



24. (a) If $4 \cot^2 45° - \sec^2 60° + \sin^2 60° + p = \frac{3}{4}$, then find the value of p.

OR

(b) If $\cos A + \cos^2 A = 1$, then find the value of $\sin^2 A + \sin^4 A$.

25. Prove that $6 - \sqrt{7}$ is irrational number, given that $\sqrt{7}$ is an irrational number.

SECTION C

This section comprises of short answer (SA) type questions of 3 marks each.

26. Prove that :

$$\frac{\cos^2 \theta}{1 - \tan \theta} + \frac{\sin^3 \theta}{\sin \theta - \cos \theta} = 1 + \sin \theta \cos \theta$$

27. A chord of a circle of radius 14 cm subtends an angle of 60° at the centre. Find the area of the corresponding minor segment of the circle.

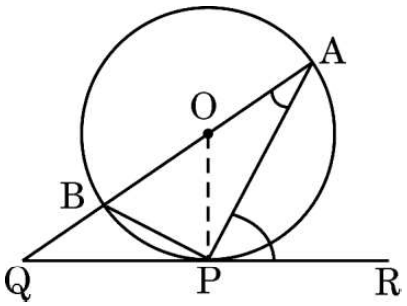
(Use $\pi = 3{\cdot}14$ and $\sqrt{3} = 1{\cdot}73$)

28. (a) Find by prime factorisation the LCM of the numbers 18180 and 7575. Also, find the HCF of the two numbers.

OR

(b) Three bells ring at intervals of 6, 12 and 18 minutes. If all the three bells rang at 6 a.m., when will they ring together again ?

29. In the given figure, O is the centre of the circle and QPR is a tangent to it at P. Prove that $\angle QAP + \angle APR = 90°$.



30. If Q(0, 1) is equidistant from P(5, – 3) and R(x, 6), find the values of x.

31. (a) If the system of linear equations

$2x + 3y = 7$ and $2ax + (a + b)y = 28$

have infinite number of solutions, then find the values of 'a' and 'b'.

OR

(b) If $217x + 131y = 913$ and

$131x + 217y = 827$,

then solve the equations for the values of x and y.

SECTION D

This section comprises long answer (LA) type questions of 5 marks each.

32. The mode of the following frequency distribution is 55. Find the missing frequencies 'a' and 'b'.

Class Interval	0 – 15	15 – 30	30 – 45	45 – 60	60 – 75	75 – 90	Total
Frequency	6	7	a	15	10	b	51

33. Prerna saves ₹ 32 during the first month, ₹ 36 in the second month and ₹ 40 in the third month. If she continues to save in this manner, in how many months will she save ₹ 2,000 ?

34. (a) Sides AB and BC and median AD of a triangle ABC are respectively proportional to sides PQ and QR and median PM of Δ PQR. Show that Δ ABC ~ Δ PQR.

OR

(b) Through the mid-point M of the side CD of a parallelogram ABCD, the line BM is drawn intersecting AC in L and AD (produced) in E. Prove that EL = 2BL.

35. (a) As observed from the top of a 75 m high lighthouse from the sea-level, the angles of depression of two ships are 30° and 60°. If one ship is exactly behind the other on the same side of the lighthouse, find the distance between the two ships.
(Use $\sqrt{3}$ = 1·73)

OR

(b) From a point on the ground, the angle of elevation of the bottom and top of a transmission tower fixed at the top of 30 m high building are 30° and 60°, respectively. Find the height of the transmission tower. (Use $\sqrt{3}$ = 1·73)

SECTION E

This section comprises 3 case study based questions of 4 marks each.

Case Study – 1

36. In a coffee shop, coffee is served in two types of cups. One is cylindrical in shape with diameter 7 cm and height 14 cm and the other is hemispherical with diameter 21 cm.

Based on the above, answer the following questions :

(i) Find the area of the base of the cylindrical cup. *1*

(ii) (a) What is the capacity of the hemispherical cup ? *2*

OR

(ii) (b) Find the capacity of the cylindrical cup. *2*

(iii) What is the curved surface area of the cylindrical cup ? *1*

Case Study – 2

37. Computer-based learning (CBL) refers to any teaching methodology that makes use of computers for information transmission. At an elementary school level, computer applications can be used to display multimedia lesson plans. A survey was done on 1000 elementary and secondary schools of Assam and they were classified by the number of computers they had.

Number of Computers	1 – 10	11 – 20	21 – 50	51 – 100	101 and more
Number of Schools	250	200	290	180	80

One school is chosen at random. Then :

(i) Find the probability that the school chosen at random has more than 100 computers. *1*

(ii) (a) Find the probability that the school chosen at random has 50 or fewer computers. *2*

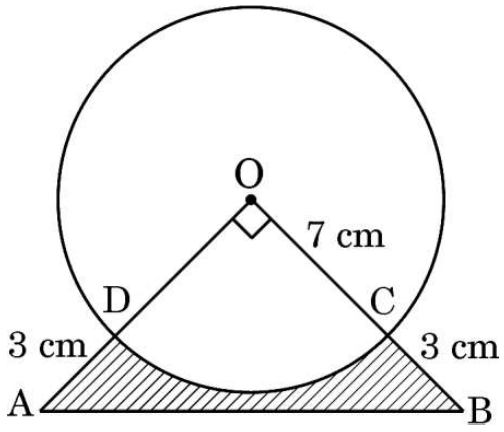
OR

(ii) (b) Find the probability that the school chosen at random has no more than 20 computers. *2*

(iii) Find the probability that the school chosen at random has 10 or less than 10 computers. *1*

Case Study – 3

38. In an annual day function of a school, the organizers wanted to give a cash prize along with a memento to their best students. Each memento is made as shown in the figure and its base ABCD is shown from the front side. The rate of silver plating is ₹ 20 per cm^2.



Based on the above, answer the following questions :

(i) What is the area of the quadrant ODCO ? *1*

(ii) Find the area of Δ AOB. *1*

(iii) (a) What is the total cost of silver plating the shaded part ABCD ? *2*

OR

(iii) (b) What is the length of arc CD ? *2*

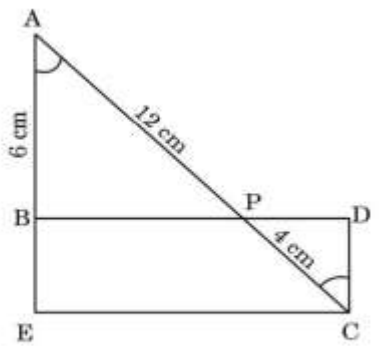
Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2023
MATHEMATICS PAPER CODE 30/2/3

General Instructions: -

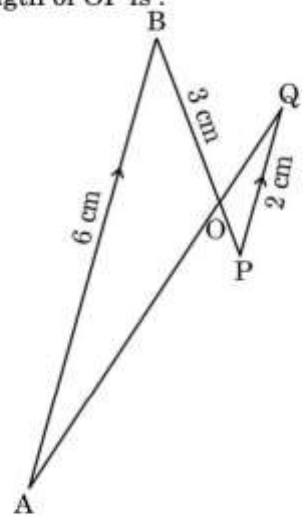
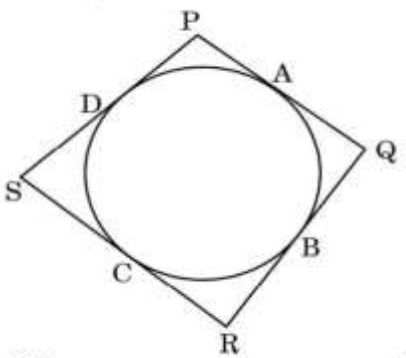
1	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested 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 News Paper/Website etc may invite action under various rules of the Board and IPC."**
3	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. **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 due marks be awarded to them.**
4	The Marking scheme carries only suggested value points for the answers. These are in the nature of Guidelines only and do not constitute the complete answer. The students can have their own expression and if the expression is correct, the due marks should be awarded accordingly.
5	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. If there is any variation, the same should be zero after deliberation and discussion. 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.
6	Evaluators will mark(√) wherever answer is correct. For wrong answer CROSS 'X" be marked. Evaluators will not put right (✓)while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing.**
7	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 totaled up and written in the left-hand margin and encircled. This may be followed strictly.
8	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.

9	**In Q1-Q20, if a candidate attempts the question more than once (without canceling the previous attempt), marks shall be awarded for the first attempt only and the other answer scored out with a note "Extra Question".**
10	**In Q21-Q38, if a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note "Extra Question".**
11	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
12	A full scale of marks _____(example 0 to 80/70/60/50/40/30 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.
13	Every examiner has to necessarily do evaluation work for full working hours i.e., 8 hours every day 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). This is in view of the reduced syllabus and number of questions in question paper.
14	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 totaling of marks awarded on an answer. ● Wrong transfer of marks from the inside pages of the answer book to the title page. ● Wrong question wise totaling on the title page. ● Wrong totaling of marks of the two columns on the title page. ● Wrong grand total. ● Marks in words and figures not tallying/not same. ● 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 X for incorrect answer.) ● Half or a part of answer marked correct and the rest as wrong, but no marks awarded.
15	While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0) Marks.
16	Any unassessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate 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.
17	The Examiners should acquaint themselves with the guidelines given in the "**Guidelines for spot Evaluation**" before starting the actual evaluation.
18	Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totaled and written in figures and words.
19	The candidates are entitled to obtain photocopy of the Answer Book on request on payment of the prescribed processing fee. All Examiners/Additional Head 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.

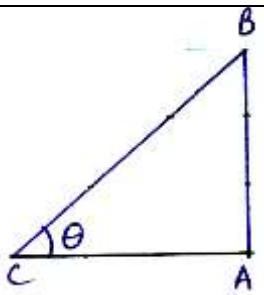
MARKING SCHEME
MATHEMATICS (Subject Code–041)
(PAPER CODE: 30/2/3)

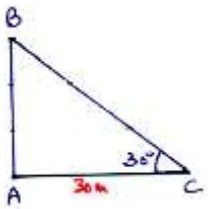
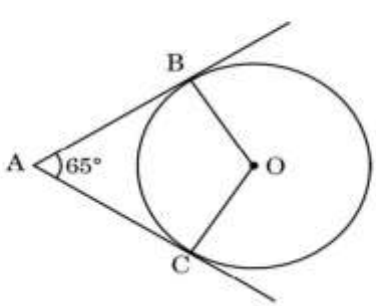
Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Marks
	SECTION A **Questions no. 1 to 18 are multiple choice questions (MCQs) and questions number 19 and 20 are Assertion-Reason based questions of 1 mark each.**	
1.	If 'n' is a natural number, then which of the following numbers end with zero ? (a) $(3 \times 2)^n$ (b) $(2 \times 5)^n$ (c) $(6 \times 2)^n$ (d) $(5 \times 3)^n$	
Sol.	**(b)** $(2 \times 5)^n$	**1**
2.	In a lottery, there are 5 prizes and 20 blanks. The probability of getting a prize is : (a) $\frac{1}{4}$ (b) $\frac{1}{20}$ (c) $\frac{1}{25}$ (d) $\frac{1}{5}$	
Sol.	**(d)** $\frac{1}{5}$	**1**
3.	If $2x + 3y = 15$ and $3x + 2y = 25$, then the value of $x - y$ is : (a) -10 (b) 8 (c) 10 (d) -8	
Sol.	**(c) 10**	**1**
4.	In the given figure, $\angle A = \angle C$, AB = 6 cm, AP = 12 cm, CP = 4 cm. Then length of CD is :  (a) 2 cm (b) 6 cm (c) 8 cm (d) 18 cm	
Sol.	**(a) 2 cm**	**1**

5.	The sum of zeroes of the polynomial $\sqrt{2}x^2 - 17$ are given as : (a) $\frac{17\sqrt{2}}{2}$ (b) $-\frac{17\sqrt{2}}{2}$ (c) 0 (d) 1	
Sol.	**(c) 0**	**1**
6.	If the area of the base of a cone is 51 cm^2 and its volume is 85 cm^3, then the vertical height of the cone is given as : (a) $\frac{5}{6}$ cm (b) $\frac{5}{3}$ cm (c) $\frac{5}{2}$ cm (d) 5 cm	
Sol.	**(d) 5 cm**	**1**
7.	What is the length of the arc of the sector of a circle with radius 14 cm and of central angle 90° ? (a) 22 cm (b) 44 cm (c) 88 cm (d) 11 cm	
Sol.	**(a) 22 cm**	**1**
8.	The coordinates of the vertex A of a rectangle ABCD whose three vertices are given as B(0, 0), C(3, 0) and D(0, 4) are : (a) (4, 0) (b) (0, 3) (c) (3, 4) (d) (4, 3)	
Sol.	**(c) (3, 4)**	**1**
9.	The area of the triangle formed by the line $\frac{x}{a}+\frac{y}{b} = 1$ with the coordinate axes is : (a) ab (b) $\frac{1}{2}$ab (c) $\frac{1}{4}$ab (d) 2ab	
Sol.	**(b) $\frac{1}{2}$ ab**	**1**
10.	The hour-hand of a clock is 6 cm long. The angle swept by it between 7:20 a.m. and 7:55 a.m. is : (a) $\left(\frac{35}{4}\right)^\circ$ (b) $\left(\frac{35}{2}\right)^\circ$ (c) 35° (d) 70°	
Sol.	**(b) $\left(\frac{35}{2}\right)^\circ$**	**1**

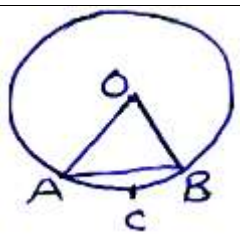
11.	The zeroes of the polynomial $p(x) = x^2 + 4x + 3$ are given by : (a) 1, 3 (b) −1, 3 (c) 1, − 3 (d) −1, − 3	
Sol.	**(d) – 1, – 3**	**1**
12.	In the given figure, AB ∥ PQ. If AB = 6 cm, PQ = 2 cm and OB = 3 cm, then the length of OP is :  (a) 9 cm (b) 3 cm (c) 4 cm (d) 1 cm	
Sol.	**(d) 1 cm**	**1**
13.	In the given figure, the quadrilateral PQRS circumscribes a circle. Here PA + CS is equal to :  (a) QR (b) PR (c) PS (d) PQ	
Sol.	**(c) PS**	**1**

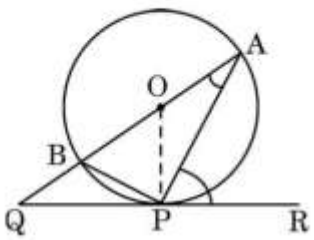
14.	If one zero of the polynomial $6x^2 + 37x - (k - 2)$ is reciprocal of the other, then what is the value of k ? (a) -4 (b) -6 (c) 6 (d) 4	
Sol.	**(a) – 4**	**1**
15.	If three coins are tossed simultaneously, what is the probability of getting at most one tail ? (a) $\frac{3}{8}$ (b) $\frac{4}{8}$ (c) $\frac{5}{8}$ (d) $\frac{7}{8}$	
Sol.	**(b)** $\frac{4}{8}$	**1**
16.	If the pair of equations $3x - y + 8 = 0$ and $6x - ry + 16 = 0$ represent coincident lines, then the value of 'r' is : (a) $-\frac{1}{2}$ (b) $\frac{1}{2}$ (c) -2 (d) 2	
Sol.	**(d) 2**	**1**
17.	If $\Delta ABC \sim \Delta PQR$ with $\angle A = 32°$ and $\angle R = 65°$, then the measure of $\angle B$ is : (a) 32° (b) 65° (c) 83° (d) 97°	
Sol.	**(c) 83°**	**1**
18.	Which of the following quadratic equations has sum of its roots as 4 ? (a) $2x^2 - 4x + 8 = 0$ (b) $-x^2 + 4x + 4 = 0$ (c) $\sqrt{2}x^2 - \frac{4}{\sqrt{2}}x + 1 = 0$ (d) $4x^2 - 4x + 4 = 0$	
Sol.	**(b)** $-x^2 + 4x + 4 = 0$	**1**

	*Questions number **19** and **20** are Assertion and Reason based questions carrying 1 mark each. Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.* (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A). (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is ***not*** the correct explanation of the Assertion (A). (c) Assertion (A) is true, but Reason (R) is false. (d) Assertion (A) is false, but Reason (R) is true.	
19.	*Assertion (A) :* A tangent to a circle is perpendicular to the radius through the point of contact. *Reason (R) :* The lengths of tangents drawn from an external point to a circle are equal.	
Sol.	**(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).**	**1**
20.	*Assertion (A) :* The polynomial $p(x) = x^2 + 3x + 3$ has two real zeroes. *Reason (R):* A quadratic polynomial can have at most two real zeroes.	
Sol.	**(d) Assertion (A) is false, but Reason (R) is true.**	**1**
	SECTION B **This section comprises of Very Short Answer (VSA) type questions of 2 marks each.**	
21(a).	The length of the shadow of a tower on the plane ground is $\sqrt{3}$ times the height of the tower. Find the angle of elevation of the sun.	
Sol.	 Let AB be the tower of height 'h'. $\therefore$ AC = $\sqrt{3}$ h In Δ ABC, $\tan\theta = \frac{AB}{AC} = \frac{h}{\sqrt{3}\,h}$	**1**

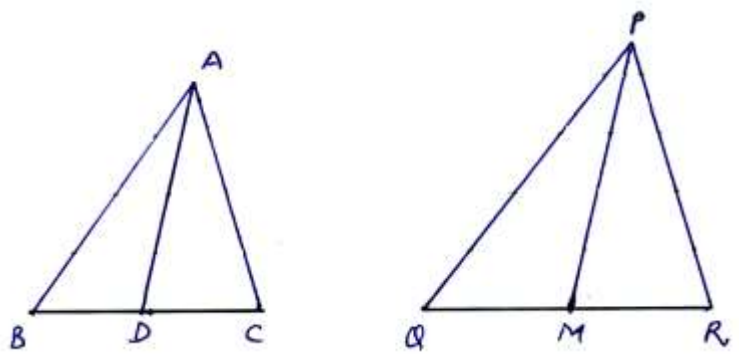
	$\Rightarrow \tan\theta = \frac{1}{\sqrt{3}}$ $\Rightarrow \theta = 30°$	½ ½
	OR	
21(b).	The angle of elevation of the top of a tower from a point on the ground which is 30 m away from the foot of the tower, is 30°. Find the height of the tower.	
Sol.	 Height of tower = AB In Δ ABC, $\tan 30° = \frac{AB}{30}$ $\Rightarrow$ **AB** = $\frac{30}{\sqrt{3}}$ = **10** $\sqrt{3}$ ∴ Height of Tower is $10\sqrt{3}$ m	**1** **1**
22.	Show that the points (– 2, 3), (8, 3) and (6, 7) are the vertices of a right-angled triangle.	
Sol.	Let the given points be A (– 2, 3), B (8, 3) and C (6, 7) Then, AB = 10, BC = $\sqrt{4+16}$ = $\sqrt{20}$, AC = $\sqrt{64+16}$ = $\sqrt{80}$ ∴ $\mathbf{AB^2 = BC^2 + AC^2}$ ∴ the given points are the vertices of a right angled triangle.	**1** ½ ½
23	In the given figure, O is the centre of the circle. AB and AC are tangents drawn to the circle from point A. If ∠ BAC = 65°, then find the measure of ∠ BOC. 	

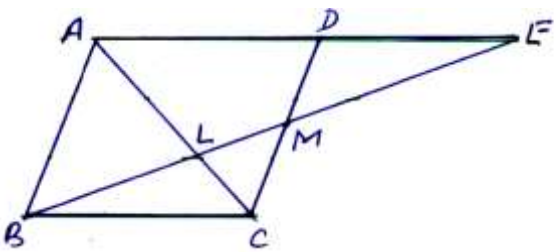
Sol.	$\angle BAC + \angle BOC = 180°$ $\Rightarrow \angle BOC = 180° - 65°$ $\Rightarrow$ **$\angle BOC = 115°$**	**1** **1**
24(a).	If $4\cot^2 45° - \sec^2 60° + \sin^2 60° + p = \frac{3}{4}$, then find the value of p.	
Sol.	$4\cot^2 45° - \sec^2 60° + \sin^2 60° + p = \frac{3}{4}$ $\Rightarrow 4(1)^2 - (2)^2 + \left(\frac{\sqrt{3}}{2}\right)^2 + p = \frac{3}{4}$ $\Rightarrow 4 - 4 + \frac{3}{4} + p = \frac{3}{4}$ $\Rightarrow p = 0$	 **1** ½ ½
	OR	
24(b).	If $\cos A + \cos^2 A = 1$, then find the value of $\sin^2 A + \sin^4 A$.	
Sol.	$\cos A + \cos^2 A = 1 \Rightarrow \cos A = 1 - \cos^2 A = \sin^2 A$ $\therefore \sin^2 A + \sin^4 A = \cos A + \cos^2 A$ ($\because \sin^2 A = \cos A$) **$= 1$**	**1** **1**
25.	Prove that $6 - \sqrt{7}$ is irrational number, given that $\sqrt{7}$ is an irrational number.	
Sol.	Let us assume that $6 - \sqrt{7}$ is rational $\therefore 6 - \sqrt{7} = \frac{p}{q}$; $q \neq 0$ and p, q are integers $\Rightarrow \sqrt{7} = \frac{6q - p}{q}$ p, q are integers, $\therefore$ 6q – p is an integer $\Rightarrow \frac{6q - p}{q}$ is a rational number $\Rightarrow \sqrt{7}$ is rational number which contradicts our assumption that $\sqrt{7}$ is an irrational number $\Rightarrow 6 - \sqrt{7}$ is an irrational number	 ½ ½ ½ ½
	SECTION C **This section comprises of Short Answer (SA) type questions of 3 marks each.**	
26.	Prove that : $\frac{\cos^2\theta}{1-\tan\theta} + \frac{\sin^3\theta}{\sin\theta - \cos\theta} = 1 + \sin\theta\cos\theta$	

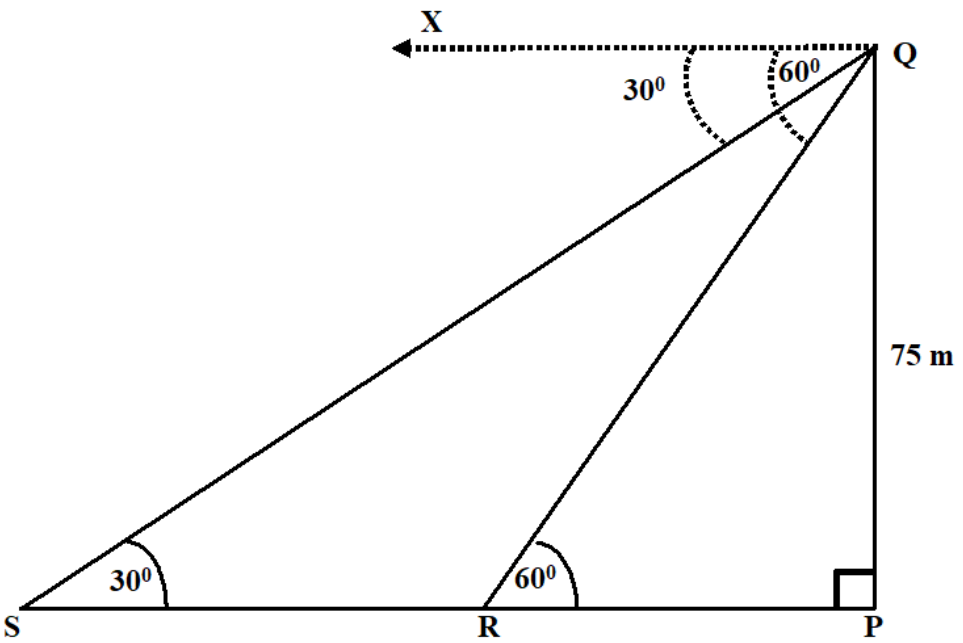
Sol.	LHS = $\frac{cos^2\ \theta}{1 - tan\ \theta} + \frac{sin^3\ \theta}{sin\ \theta - cos\ \theta}$ $= \frac{cos^2\ \theta}{1 - \frac{sin\ \theta}{cos\ \theta}} + \frac{sin^3\ \theta}{sin\ \theta - cos\ \theta}$ $= \frac{cos^3\ \theta}{cos\ \theta - sin\ \theta} - \frac{sin^3\ \theta}{cos\ \theta - sin\ \theta}$ $= \frac{cos^3\ \theta - sin^3\ \theta}{cos\ \theta - sin\ \theta}$ $= \frac{(cos\ \theta - sin\ \theta)\ (cos^2\ \theta + sin^2\ \theta + cos\ \theta\ sin\ \theta)}{(cos\ \theta - sin\ \theta)}$ = 1 + cos θ sin θ = RHS	½ 1 1 ½
27.	A chord of a circle of radius 14 cm subtends an angle of 60° at the centre. Find the area of the corresponding minor segment of the circle. (Use π = 3·14 and $\sqrt{3}$ = 1·73)	
Sol.	 Area of minor sector = $\frac{3{\cdot}14 \times (14)^2}{6} = 102.57$ Area of Δ AOB = $\frac{1{\cdot}73}{4}(14)^2 = 84{\cdot}77$ Area of minor segment = Area of minor sector – Area of Δ AOB = 102·57 – 84·77 = 17·8 ∴ Area of minor segment is17·8 cm^2	1 1 **1**
28(a).	Find by prime factorisation the LCM of the numbers 18180 and 7575. Also, find the HCF of the two numbers.	
Sol.	$18180 = 2^2 \times 3^2 \times 5 \times 101$ $7575 = 3 \times 5^2 \times 101$ LCM = $2^2 \times 3^2 \times 5^2 \times 101 = 90900$ HCF = $3 \times 5 \times 101 = 1515$	½ ½ **1** **1**
	OR	
28(b).	Three bells ring at intervals of 6, 12 and 18 minutes. If all the three bells rang at 6 a.m., when will they ring together again ?	

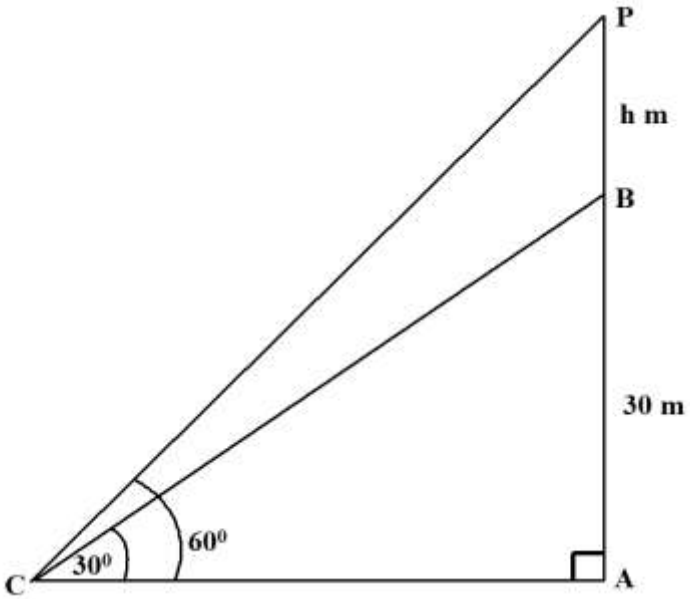
Sol.	LCM of 6, 12, 18 = 36 So, all the three bells ring together after 36 minutes at 6 : 36 AM	**2** **1**
29.	In the given figure, O is the centre of the circle and QPR is a tangent to it at P. Prove that $\angle QAP + \angle APR = 90°$.  	
Sol.	OA = OP $\therefore$ In Δ OAP, $\angle$ OPA = $\angle$ OAP ... (i) $\Rightarrow \angle$ OPA + $\angle$ APR = 90° $\Rightarrow \angle$ OAP + $\angle$ APR = 90° Using (i) **$\Rightarrow \angle$ QAP + $\angle$ APR = 90°**	**1** **1** **½** **½**
30.	If Q(0, 1) is equidistant from P(5, – 3) and R(x, 6), find the values of x.	
Sol.	PQ = QR $\Rightarrow$ $PQ^2 = QR^2$ $(5 – 0)^2 + (– 3 – 1)^2 = (x – 0)^2 + (6 – 1)^2$ $\Rightarrow 25 + 16 = x^2 + 25$ $\Rightarrow x^2 = 16$ $\Rightarrow$ x = 4, x = – 4	**1** **1** **½ + ½**
31(a).	If the system of linear equations $2x + 3y = 7$ and $2ax + (a + b)y = 28$ have infinite number of solutions, then find the values of 'a' and 'b'.	
Sol.	system has infinite number of solutions $\therefore \frac{2}{2a} = \frac{3}{a+b} = \frac{7}{28}$ $\Rightarrow \frac{1}{a} = \frac{1}{4} \Rightarrow$ a = 4 and a + b = 12 $\Rightarrow$ b = 8	**1** **1** **1**
	OR	

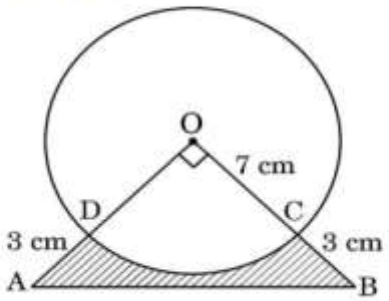
31(b).	If $217x + 131y = 913$ and $131x + 217y = 827$, then solve the equations for the values of x and y.	
Sol.	$\left.\begin{matrix} 217x + 131y = 913 \\ 131x + 217y = 827 \end{matrix}\right]$ Adding $348 (x + y) = 1740$ $x + y = 5$ Subtracting, $86 (x – y) = 86$ $x – y = 1$ $\Rightarrow x = 3, y = 2$	**1** **1** ½ + ½
	SECTION D **This section comprises of Long Answer (LA) type questions of 5 marks each.**	
32.	The mode of the following frequency distribution is 55. Find the missing frequencies 'a' and 'b'. Class Interval | 0 – 15 | 15 – 30 | 30 – 45 | 45 – 60 | 60 – 75 | 75 – 90 | Total Frequency | 6 | 7 | a | 15 | 10 | b | 51	
Sol.	Modal Class: 45 – 60 Mode = 55 $55 = 45 + \frac{15 - a}{30 - (a + 10)} \times 15$ $\Rightarrow a = 5$ $6 + 7 + a + 15 + 10 + b = 51$ $\Rightarrow a + b = 13$ $\Rightarrow b = 13 – 5 = 8$	½ 2 1 1 ½
33.	Prerna saves ₹ 32 during the first month, ₹ 36 in the second month and ₹ 40 in the third month. If she continues to save in this manner, in how many months will she save ₹ 2,000 ?	

Sol.	ATQ, $32 + 36 + 40 + ... = 2{,}000$ $a = 32, d = 4$ Let 'n' be the number of months. $S_n = 2000$ $\frac{n}{2}[2(32) + (n-1)4] = 2000$ $n^2 + 15n - 1000 = 0$ $n^2 + 40n - 25n - 1000 = 0$ $(n + 40)(n - 25) = 0$ $\Rightarrow n = -40, n = 25$ (rejecting) $\therefore n = 25$ So, Prerna will save ₹ 2,000, in 25 months.	½ + ½ 1 1 1 1
34(a).	Sides AB and BC and median AD of a triangle ABC are respectively proportional to sides PQ and QR and median PM of Δ PQR. Show that Δ ABC ~ Δ PQR.	
Sol.	 In Δ ABC and Δ PQR $\frac{AB}{PQ} = \frac{BC}{QR} = \frac{AD}{PM}$ $\frac{AB}{PQ} = \frac{2\,BD}{2\,QM} = \frac{AD}{PM}$ ($\because$ D is midpoint of BC and M is midpoint of QR) $\frac{AB}{PQ} = \frac{BD}{QM} = \frac{AD}{PM} \Rightarrow \Delta ABD \sim \Delta PQM$ $\Rightarrow \angle B = \angle Q$ — (i) Now, In Δ ABC and Δ PQR $\frac{AB}{PQ} = \frac{BC}{QR}$ (given)	**1 for correct figure** **1** **1** ½

	$\angle B = \angle Q$ from (i) $\therefore$ **$\Delta ABC \sim \Delta PQR$**	½ **1**
	OR	
34(b).	Through the mid-point M of the side CD of a parallelogram ABCD, the line BM is drawn intersecting AC in L and AD (produced) in E. Prove that EL = 2BL.	
Sol.	 In Δ BMC and Δ EMD MC = MD $\angle$ CMB = $\angle$ EMD $\angle$ MBC = $\angle$ MED $\therefore$ Δ BMC $\cong$ Δ EMD $\Rightarrow$ BC = DE But AD = BC $\therefore$ AD = DE $\Rightarrow$ AE = 2 BC Δ AEL ~ Δ CBL $\therefore \frac{EL}{BL} = \frac{AE}{BC}$ $\Rightarrow \frac{EL}{BL} = \frac{2BC}{BC}$ $\Rightarrow \frac{EL}{BL} = 2$ **$\Rightarrow$ EL = 2 BL**	**1 for correct figure** **1** **1** ½ ½ **1**
35(a).	As observed from the top of a 75 m high lighthouse from the sea-level, the angles of depression of two ships are 30° and 60°. If one ship is exactly behind the other on the same side of the lighthouse, find the distance between the two ships. (Use $\sqrt{3}$ = 1·73)	

Sol.	 PQ = Height of Light house = 75 m $\angle$ XQS = $\angle$ QSP = 30° $\angle$ XQR = $\angle$ QRP = 60° R and S are position of ships. In Δ PQR, $\frac{75}{PR} = \tan 60° = \sqrt{3} \Rightarrow PR = \frac{75}{\sqrt{3}} = 25\sqrt{3}$ In Δ PQS, $\frac{75}{PS} = \tan 30°$ $\Rightarrow PS = 75\sqrt{3}$ $\therefore$ Distance between the ships, RS = PS – PR $= 75\sqrt{3} - 25\sqrt{3} = 50\sqrt{3}$ $= 50 \times 1{\cdot}73 = 86{\cdot}5$ $\therefore$ Distance between the ships is 86.5 m	**1 for correct figure** **1½** **1** **1** **½**
	OR	
35(b).	From a point on the ground, the angle of elevation of the bottom and top of a transmission tower fixed at the top of 30 m high building are 30° and 60°, respectively. Find the height of the transmission tower. (Use $\sqrt{3} = 1{\cdot}73$)	

Sol.	 Height of building AB = 30 m BP = transmission tower = h(say) $\angle$ ACB = 30°, $\angle$ ACP = 60° In Δ ABC, $\tan 30^\circ = \frac{AB}{AC}$ $\Rightarrow \frac{1}{\sqrt{3}} = \frac{30}{AC} \Rightarrow AC = 30\sqrt{3}$ In Δ APC, $\tan 60^\circ = \frac{AP}{AC}$ $\sqrt{3} = \frac{30 + h}{30\sqrt{3}} \Rightarrow 30\sqrt{3} \cdot \sqrt{3} = 30 + h$ h = 30 (3 – 1) h = 60 $\therefore$ Height of transmission tower = 60 m	**1 for correct figure** **1½** **1½** **1**

	SECTION E **This section comprises of 3 case-study based questions of 4 marks each.**	
36.	**Case Study – 1** In an annual day function of a school, the organizers wanted to give a cash prize along with a memento to their best students. Each memento is made as shown in the figure and its base ABCD is shown from the front side. The rate of silver plating is ₹ 20 per cm^2.  Based on the above, answer the following questions : (i) What is the area of the quadrant ODCO ? (ii) Find the area of Δ AOB. (iii) (a) What is the total cost of silver plating the shaded part ABCD ? **OR** (iii) (b) What is the length of arc CD ?	
Sol.	(i)Area of sector ODCO $= \frac{22}{7} \times 7 \times 7 \times \frac{90}{360} = \frac{77}{2}$ or 38·5 ∴ Area of sector ODCO is $\frac{77}{2}$ cm^2 or 38·5 cm^2 (ii) ar (Δ AOB) $= \frac{1}{2} \times 10 \times 10 = 50$ ∴ ar (Δ AOB) is 50 cm^2 (iii) (a) Required cost = (50 – 38·5) × 20 = 230 ∴ required cost is ₹ 230. OR (iii) (b) Length of arc CD $= \frac{90}{360} \times 2 \times \frac{22}{7} \times 7$ = 11 ∴ Length of arc CD is 11 cm.	½ + ½ **1** **1** **1** **1** **1**

37.	**Case Study – 2** In a coffee shop, coffee is served in two types of cups. One is cylindrical i shape with diameter 7 cm and height 14 cm and the other i hemispherical with diameter 21 cm.  Based on the above, answer the following questions : (i) Find the area of the base of the cylindrical cup. (ii) (a) What is the capacity of the hemispherical cup ? **OR** (ii) (b) Find the capacity of the cylindrical cup. (iii) What is the curved surface area of the cylindrical cup ?	
Sol.	(i) Area of base of the cylindrical cup = $\frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} = \frac{77}{2}$ or 38.5 ∴ Area of base of the cylindrical cup is $\frac{77}{2}$ or 38.5 cm^2 (ii) (a) Capacity of hemispherical cup = $\frac{2}{3} \times \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2} \times \frac{21}{2}$ $= \frac{4851}{2}$ or 2425.5 ∴ Capacity of hemispherical cup is $\frac{4851}{2}$ cm^3 or 2425.5 cm^3 OR (ii) (b) Capacity of cylindrical cup = $\frac{22}{7} \times (7)^2 \times 14$ $= 539$ ∴ Capacity of cylindrical cup is 539 cm^3 (iii) External Curved surface area of cylindrical cup = $2 \times \frac{22}{7} \times \frac{7}{2} \times 14 = 308$ ∴ External Curved surface area of cylindrical cup is 308 cm^2	**1** **1** **1** **1** **1** **1**

38.

Case Study – 3

Computer-based learning (CBL) refers to any teaching methodology that makes use of computers for information transmission. At an elementary school level, computer applications can be used to display multimedia lesson plans. A survey was done on 1000 elementary and secondary schools of Assam and they were classified by the number of computers they had.

Number of Computers	1 – 10	11 – 20	21 – 50	51 – 100	101 and more
Number of Schools	250	200	290	180	80

One school is chosen at random. Then :

(i) Find the probability that the school chosen at random has more than 100 computers.

(ii) (a) Find the probability that the school chosen at random has 50 or fewer computers.

OR

(ii) (b) Find the probability that the school chosen at random has no more than 20 computers.

(iii) Find the probability that the school chosen at random has 10 or less than 10 computers.

Sol.

(i) P (more than 100 computers) = $\frac{80}{1000}$ or 0·08 **1**

(ii)(a) 50 or fewer computers = 250 + 200 + 290 = 740 **1**

Required probability = $\frac{740}{1000}$ or 0·74 **1**

OR

(ii)(b) No more than 20 computers = 250 + 200 = 450 **1**

Required probability = $\frac{450}{1000}$ or 0·45 **1**

(iii) P (10 or less than 10 computer) = $\frac{250}{1000}$ or 0·25 **1**