Series : NL1KM **SET ~ 2**

रोल नं.
Roll No.

प्रश्न–पत्र कोड
Q.P. Code **30/1/2**

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.

नोट / NOTE

(I) कृपया जाँच कर लें कि इस प्रश्न–पत्र में मुद्रित पृष्ठ **15** हैं।
Please check that this question paper contains **15** printed pages.

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

(III) 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.

(IV) **कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर–पुस्तिका में यथास्थान पर प्रश्न का क्रमांक अवश्य लिखें।**
Please write down the Serial Number of the question in the answer-book at the given place 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 परीक्षार्थी 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 candidates will read the question paper only and will not write any answer on the answer-book during this period. ( )

गणित (मानक)
MATHEMATICS (STANDARD)

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

सामान्य निर्देश :

निम्नलिखित निर्देशों को बहुत सावधानी से पढ़िए और उनका सख़्ती से पालन कीजिए :

(i) *इस प्रश्न-पत्र में **38** प्रश्न हैं। **सभी** प्रश्न **अनिवार्य** हैं।*

(ii) *यह प्रश्न-पत्र **पांच** खण्डों में विभाजित है - **क, ख, ग, घ** एवं **ड़**।*

(iii) ***खण्ड क** में प्रश्न संख्या **1** से **18** तक बहुविकल्पीय प्रश्न (MCQs) तथा प्रश्न संख्या **19** एवं **20** अभिकथन एवं तर्क आधारित **1** अंक के प्रश्न हैं।*

(iv) ***खण्ड ख** में प्रश्न संख्या **21** से **25** तक अति लघु-उत्तरीय (VSA) प्रकार के **2** अंकों के प्रश्न हैं।*

(v) ***खण्ड ग** में प्रश्न संख्या **26** से **31** तक लघु-उत्तरीय (SA) प्रकार के **3** अंकों के प्रश्न हैं।*

(vi) ***खण्ड घ** में प्रश्न संख्या **32** से **35** तक दीर्घ-उत्तरीय (LA) प्रकार के **5** अंकों के प्रश्न हैं।*

(vii) ***खण्ड ड़** में प्रश्न संख्या **36** से **38** तक **प्रकरण अध्ययन आधारित 4** अंकों के प्रश्न हैं। प्रत्येक प्रकरण अध्ययन में आंतरिक विकल्प **2** अंकों के प्रश्न में दिया गया है।*

(viii) *प्रश्न-पत्र में समग्र विकल्प नहीं दिया गया है। यद्यपि, खण्ड **ख** के 2 प्रश्नों में, खण्ड **ग** के 2 प्रश्नों में, खण्ड **घ** के 2 प्रश्नों में तथा खण्ड **ड़** के **2** अंकों के 3 प्रश्नों में आंतरिक विकल्प का प्रावधान दिया गया है।*

(ix) *जहाँ आवश्यक हो, स्वच्छ आकृतियाँ बनाइए। आवश्यक हो तो $\pi = \frac{22}{7}$ लीजिए, यदि अन्यथा न दिया गया हो।*

(x) *कैलकुलेटर का उपयोग **वर्जित** है।*

खण्ड – क $20 \times 1 = 20$

प्रश्न संख्या 1 से 20 तक बहुविकल्पीय प्रश्न हैं, जिनमें प्रत्येक प्रश्न 1 अंक का है।

1. प्राकृत संख्या 2 है : **1**

(a) एक अभाज्य संख्या (b) एक भाज्य संख्या

(c) भाज्य और अभाज्य दोनों (d) न तो भाज्य और न ही अभाज्य

2. प्राकृतिक संख्या n के लिए, 6^n का अंतिम अंक है : **1**

(a) 0 (b) 6 (c) 3 (d) 2

3. 960 और 432 का महत्तम समापवर्तक (HCF) है : **1**

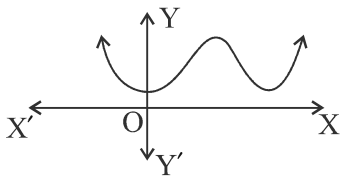
(a) 48 (b) 54 (c) 72 (d) 36

4. किसी घटना E के लिए $P(E) + P(\bar{E}) = x$ है, तो $x^2 - 3$ का मान है : **1**

(a) -2 (b) 2 (c) 1 (d) -1

5. $y = f(x)$ का ग्राफ दिया गया है। **1**

$f(x)$ के शून्यकों की संख्या है :



(a) 0 (b) 1

(c) 2 (d) 4

6. यदि दो चरों में रैखिक समीकरणों का एक युग्म दो संपाती रेखाओं द्वारा निरूपित किया जाता है, तो समीकरणों के युग्म का/के : **1**

(a) एक अद्वितीय हल है (b) दो हल हैं

(c) कोई हल नहीं है (d) अपरिमित रूप से अनेक हल हैं

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** – Question Nos. **1** to **18** are multiple choice questions (MCQs) and question numbers **19** and **20** are Assertion – Reason based questions of **1** mark each.*

(iv) *In **Section B –** Question Nos. **21** to **25** are Very Short Answer (VSA) type questions, carrying **2** marks each.*

(v) *In **Section C** – Question Nos. **26** to **31** are Short Answer (SA) type questions, carrying **3** marks each.*

(vi) *In **Section D** – Question Nos. **32** to **35** are Long Answer (LA) type questions carrying **5** marks each.*

(vii) *In **Section E** – Question Nos. **36** to **38** are **Case Study Based** questions carrying **4** marks each. Internal choice is provided in **2** marks question 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 of **2** marks in Section **E**.*

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

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

SECTION – A $20 \times 1 = 20$

Question numbers 1 to 20 are multiple choice questions of 1 mark each.

1. The natural number 2 is : **1**

(a) a prime number (b) a composite number

(c) prime as well as composite (d) neither prime nor composite

2. For any natural number n, 6^n ends with the digit : **1**

(a) 0 (b) 6 (c) 3 (d) 2

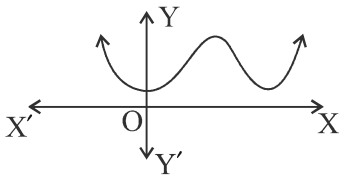
3. The HCF of 960 and 432 is : **1**

(a) 48 (b) 54 (c) 72 (d) 36

4. For an event E, $P(E) + P(\overline{E}) = x$, then the value of $x^2 - 3$ is : **1**

(a) -2 (b) 2 (c) 1 (d) -1

5. The graph of $y = f(x)$ is given.
The number of zeroes of $f(x)$ is : **1**



(a) 0 (b) 1

(c) 2 (d) 4

6. If a pair of linear equations in two variables is represented by two coincident lines, then the pair of equations has : **1**

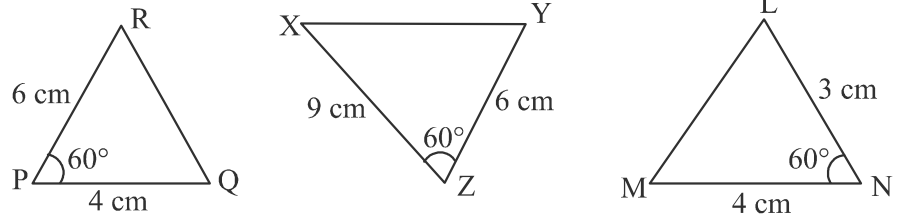
(a) a unique solution (b) two solutions

(c) no solution (d) an infinite number of solutions

7. एक समांतर श्रेढ़ी (AP) का प्रथम पद p और सार्वअंतर q है, तो इसका 10वाँ पद है : **1**

(a) $q - 9p$ (b) $p - 9q$ (c) $p + 9q$ (d) $2p + 9q$

8. नीचे तीन त्रिभुज दर्शाए गए हैं। प्रत्येक त्रिभुज के लिए दो संलग्न भुजाओं और उनके बीच के कोण का माप दिया गया है :



इनमें से कौन-कौनसे त्रिभुज समरूप (similar) हैं ? **1**

(a) Δ RPQ और Δ XZY

(b) Δ RPQ और Δ MNL

(c) Δ XZY और Δ MNL

(d) Δ RPQ, Δ XZY और Δ MNL परस्पर समरूप हैं।

9. बिन्दुओं $(5, -4)$ और $(6, 4)$ को मिलाने वाले रेखाखंड का मध्य बिन्दु स्थित है : **1**

(a) x-अक्ष पर (b) y-अक्ष पर

(c) मूल बिन्दु पर (d) न x-अक्ष न ही y-अक्ष पर

10. यदि $\cos y = 0$ है, तो $\frac{1}{2} \cos \frac{y}{2}$ का मान क्या होगा ? **1**

(a) 0 (b) $\frac{1}{2}$ (c) $\frac{1}{\sqrt{2}}$ (d) $\frac{1}{2\sqrt{2}}$

11. यदि $\cos A = \frac{1}{2}$ है, तो $\sin^2 A + 2 \cos^2 A$ का मान है : **1**

(a) $\frac{3}{2}$ (b) $\frac{5}{4}$ (c) -1 (d) $\frac{1}{2}$

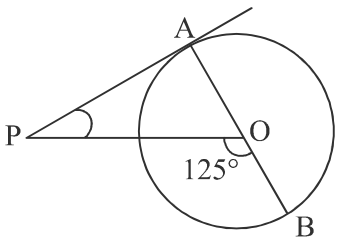
12. एक कार 30 मीटर ऊँचे टॉवर के आधार से दूर जा रही है। जब कार आधार से $10\sqrt{3}$ मीटर दूर है, तो कार से टॉवर के शीर्ष का उन्नयन कोण है : **1**

(a) 30° (b) 45° (c) 90° (d) 60°

13. यदि केन्द्र O वाले वृत्त पर बाह्य बिन्दु T से दो स्पर्श रेखाएँ TP और TQ इस प्रकार हैं कि $\angle$ POQ = 120°, तो $\angle$ PTQ बराबर है : **1**

(a) 60° (b) 70° (c) 80° (d) 90°

14. दी गई आकृति में, PA केन्द्र O वाले वृत्त पर बाह्य बिन्दु P से खींची गई स्पर्श रेखा है। यदि $\angle$ POB = 125° है, तो $\angle$ APO बराबर है : **1**



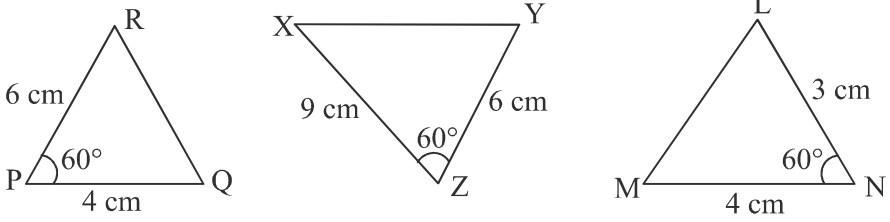
(a) 25° (b) 65°

(c) 90° (d) 35°

7. The first term of an AP is p and the common difference is q, then its 10th term is : **1**

(a) $q - 9p$ (b) $p - 9q$ (c) $p + 9q$ (d) $2p + 9q$

8. Shown below are three triangles. The measures of two adjacent sides and included angle are given for each triangle :



Which of these triangles are similar ? **1**

(a) Δ RPQ and Δ XZY

(b) Δ RPQ and Δ MNL

(c) Δ XZY and Δ MNL

(d) Δ RPQ, Δ XZY and Δ MNL are similar to one another

9. The mid-point of the line segment joining the points (5, – 4) and (6, 4) lies on : **1**

(a) x-axis (b) y-axis

(c) origin (d) neither x-axis nor y-axis

10. If $\cos y = 0$, then what is the value of $\frac{1}{2} \cos \frac{y}{2}$? **1**

(a) 0 (b) $\frac{1}{2}$ (c) $\frac{1}{\sqrt{2}}$ (d) $\frac{1}{2\sqrt{2}}$

11. If $\cos A = \frac{1}{2}$, then the value of $\sin^2 A + 2 \cos^2 A$ is : **1**

(a) $\frac{3}{2}$ (b) $\frac{5}{4}$ (c) -1 (d) $\frac{1}{2}$

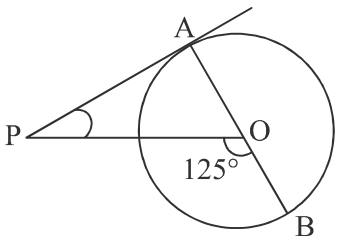
12. A car is moving away from the base of a 30 m high tower. The angle of elevation of the top of the tower from the car at an instant, when the car is $10\sqrt{3}$ m away from the base of the tower, is : **1**

(a) 30° (b) 45° (c) 90° (d) 60°

13. If TP and TQ are two tangents to a circle with centre O from an external point T so that ∠ POQ = 120°, then ∠ PTQ is equal to : **1**

(a) 60° (b) 70° (c) 80° (d) 90°

14. In the given figure, PA is a tangent from an external point P to a circle with centre O. If ∠ POB = 125°, then ∠ APO is equal to : **1**



(a) 25° (b) 65°

(c) 90° (d) 35°

15. 21 cm त्रिज्या और 60° केन्द्रीय कोण वाले त्रिज्यखंड के चाप की लम्बाई है : 1

(a) 22 cm (b) 44 cm (c) 88 cm (d) 11 cm

16. एक घड़ी की घंटे वाली सुई 7 cm लम्बी है। सुबह 7:00 से 8:10 के बीच इसके द्वारा रचित कोण है : 1

(a) $\left(\frac{35}{4}\right)^\circ$ (b) $\left(\frac{35}{2}\right)^\circ$ (c) 35° (d) 70°

17. व्यास '$2d$' वाले ठोस अर्धगोले का कुल पृष्ठीय क्षेत्रफल है : 1

(a) $3\pi d^2$ (b) $2\pi d^2$ (c) $\frac{1}{2}\pi d^2$ (d) $\frac{3}{4}\pi d^2$

18. यदि आँकड़ों के किसी समूह का माध्य 12 तथा बहुलक 21 है, तो उसका माध्यक है : 1

(a) 6 (b) 13.5 (c) 15 (d) 14

निर्देश : प्रश्न संख्या 19 और 20 अभिकथन एवं तर्क आधारित प्रश्न हैं। दो कथन दिए गए हैं, जिनमें एक को अभिकथन (A) तथा दूसरे को तर्क (R) द्वारा अंकित किया गया है। इन प्रश्नों के सही उत्तर नीचे दिए गए कोड (a), (b), (c) और (d) में से चुनकर दीजिए :

(a) अभिकथन (A) तथा तर्क (R) दोनों सत्य हैं और तर्क (R), अभिकथन (A) की सही व्याख्या करता है।

(b) अभिकथन (A) तथा तर्क (R) दोनों सत्य हैं, परन्तु तर्क (R), अभिकथन (A) की सही व्याख्या नहीं करता है।

(c) अभिकथन (A) सत्य है, परन्तु तर्क (R) असत्य है।

(d) अभिकथन (A) असत्य है, परन्तु तर्क (R) सत्य है।

19. **अभिकथन (A)** : अधिवर्ष (leap year) में 53 सोमवार आने की प्रायिकता $\frac{2}{7}$ होती है।

तर्क (R) : सामान्य वर्ष (non-leap year) में 53 सोमवार आने की प्रायिकता $\frac{5}{7}$ होती है। 1

20. **अभिकथन (A)** : बहुपद $p(y) = y^2 + 4y + 3$ के दो शून्यक होते हैं।

तर्क (R) : एक द्विघात बहुपद (quadratic polynomial) के अधिकतम दो शून्यक हो सकते हैं। 1

खण्ड – ख

प्रश्न संख्या 21 से 25 तक अति लघु–उत्तरीय (VSA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक प्रश्न के 2 अंक हैं।

21. **(A)** Δ ABC में, DE || BC है। यदि AD = x, DB = $x - 2$, AE = $x + 2$ और EC = $x - 1$, तो x का मान ज्ञात कीजिए। 2

अथवा

15. The length of the arc of the sector of a circle with radius 21 cm and of central angle 60°, is : **1**

(a) 22 cm (b) 44 cm (c) 88 cm (d) 11 cm

16. The hour hand of a clock is 7 cm long. The angle swept by it between 7:00 a.m. and 8:10 a.m. is : **1**

(a) $\left(\frac{35}{4}\right)^\circ$ (b) $\left(\frac{35}{2}\right)^\circ$ (c) 35° (d) 70°

17. The total surface area of a solid hemisphere of diameter '$2d$' is : **1**

(a) $3\pi d^2$ (b) $2\pi d^2$ (c) $\frac{1}{2}\pi d^2$ (d) $\frac{3}{4}\pi d^2$

18. If the mean and mode of a data are 12 and 21 respectively, then its median is : **1**

(a) 6 (b) 13.5 (c) 15 (d) 14

Directions : Question numbers 19 and 20 are Assertion and Reason based questions. 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) :** The probability that a leap year has 53 Mondays is $\frac{2}{7}$.

Reason (R) : The probability that a non-leap year has 53 Mondays is $\frac{5}{7}$. **1**

20. **Assertion (A) :** The polynomial $p(y) = y^2 + 4y + 3$ has two zeroes.

Reason (R) : A quadratic polynomial can have at most two zeroes. **1**

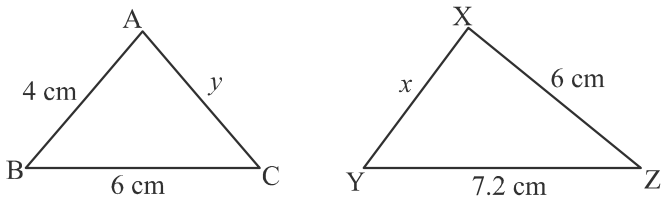
SECTION – B

Question numbers 21 to 25 are Very Short Answer (VSA) type questions, carrying 2 marks each.

21. **(A)** In Δ ABC, DE || BC. If AD = x, DB = $x - 2$, AE = $x + 2$ and EC = $x - 1$, then find the value of x. **2**

OR

(B)



ऊपर दी गई आकृति में, यदि $\Delta ABC \sim \Delta XYZ$, तो x और y के मान ज्ञात कीजिए। **2**

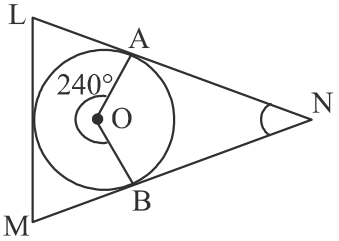
22. एक वृत्त के केन्द्र के निर्देशांक $(x - 7, 2x)$ हैं। यदि वृत्त बिन्दु $(-9, 11)$ से गुजरता है और त्रिज्या $5\sqrt{2}$ इकाई है, तो *'x'* का मान ज्ञात कीजिए। **2**

23. **(A)** यदि $\tan\theta = \frac{24}{7}$, तो $\sin\theta + \cos\theta$ का मान ज्ञात कीजिए। **2**

अथवा

(B) यदि $\cot\theta = \frac{7}{8}$ है, तो $\frac{(1+\sin\theta)(1-\sin\theta)}{(1+\cos\theta)(1-\cos\theta)}$ का मान ज्ञात कीजिए। **2**

24. दी गई आकृति में केन्द्र O वाला एक वृत्त ΔLMN के अंदर अंकित है। स्पर्श बिन्दु A और B हैं। $\angle ANB$ का मान ज्ञात कीजिए। **2**



25. द्विघात बहुपद $x^2 + 7x + 10$ के शून्यक ज्ञात कीजिए तथा शून्यकों और गुणांकों के बीच के संबंध को सत्यापित कीजिए। **2**

खण्ड – ग

प्रश्न संख्या 26 से 31 तक लघु–उत्तरीय (SA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक प्रश्न के 3 अंक हैं।

26. सिद्ध कीजिए कि $\sqrt{2}$ एक अपरिमेय संख्या है। **3**

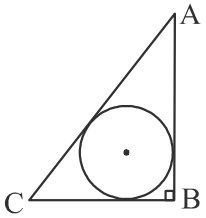
27. **(A)** यदि $x = h + a\cos\theta$, $y = k + b\sin\theta$, तो सिद्ध कीजिए :

$$\left(\frac{x-h}{a}\right)^2 + \left(\frac{y-k}{b}\right)^2 = 1$$ **3**

अथवा

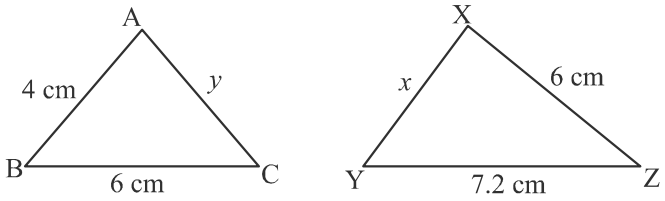
(B) सिद्ध कीजिए : $\frac{\tan A}{1+\sec A} - \frac{\tan A}{1-\sec A} = 2\,\text{cosec}\,A$ **3**

28. **(A)** दी गई आकृति में एक समकोण ΔABC दर्शाया गया है, जिसमें $\angle B = 90°$, AB = 4 cm तथा BC = 3 cm हैं। त्रिभुज ABC में बने अंतःवृत्त की त्रिज्या ज्ञात कीजिए। **3**



अथवा

(B)



In the figure given above, Δ ABC ~ Δ XYZ, then find the values of x and y. **2**

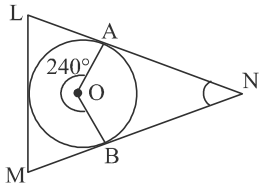
22. The coordinates of the centre of a circle are $(x - 7, 2x)$. Find the value(s) of 'x', if the circle passes through the point $(-9, 11)$ and has radius $5\sqrt{2}$ units. **2**

23. **(A)** If $\tan\theta = \frac{24}{7}$, then find the value of $\sin\theta + \cos\theta$. **2**

OR

(B) If $\cot\theta = \frac{7}{8}$, then find the value of $\frac{(1+\sin\theta)(1-\sin\theta)}{(1+\cos\theta)(1-\cos\theta)}$. **2**

24. In the given figure, a circle with centre O is inscribed inside Δ LMN. A and B are the points of tangency. Find ∠ANB. **2**



25. Find the zeroes of the quadratic polynomial $x^2 + 7x + 10$, and verify the relationship between the zeroes and its coefficients. **2**

SECTION – C

Question numbers 26 to 31 are Short Answer (SA) type questions, carrying 3 marks each.

26. Prove that $\sqrt{2}$ is an irrational number. **3**

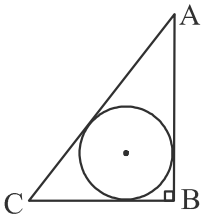
27. **(A)** If $x = h + a\cos\theta$, $y = k + b\sin\theta$, then prove that :

$$\left(\frac{x-h}{a}\right)^2 + \left(\frac{y-k}{b}\right)^2 = 1$$ **3**

OR

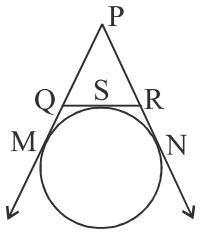
(B) Prove that : $\frac{\tan A}{1+\sec A} - \frac{\tan A}{1-\sec A} = 2\,\text{cosec}\,A$ **3**

28. **(A)** In the given figure, Δ ABC is a right triangle in which ∠ B = 90°, AB = 4 cm and BC = 3 cm. Find the radius of the circle inscribed in the triangle ABC. **3**



OR

(B) दी गई आकृति में, यदि एक वृत्त, Δ PQR की भुजा QR को S पर और बढ़ाई गई भुजाओं PQ और PR को क्रमशः M और N पर स्पर्श करता है, तो सिद्ध कीजिए : $PM = \frac{1}{2}(PQ + QR + PR)$



3

29. एक ठोस पिंड एक बेलन (cylinder) के आकार का है, जिसके दोनों सिरों पर अर्धगोले (hemisphere) लगे हुए हैं। इस ठोस पिंड की कुल ऊँचाई 20 cm है तथा बेलन का व्यास 7 cm है। इस ठोस पिंड का कुल आयतन ज्ञात कीजिए। $\left(\pi = \frac{22}{7} \text{ प्रयोग कीजिए}\right)$ **3**

30. दो विभिन्न रंगों के पासे, एक साथ उछाले जाते हैं। सभी संभावित परिणाम लिखिए। प्रायिकता ज्ञात कीजिए कि :

(i) दोनों पासों पर समान संख्या आएँ।

(ii) दोनों पासों पर भिन्न संख्याएँ आएँ। **3**

31. पार्थी और अलीशा को एक खजाना मिला जो उन दोनों के स्थानों को मिलाने वाली सरल रेखा पर स्थित है। पार्थी का स्थान बिंदु $(-6, -5)$ और अलीशा का स्थान बिंदु $(10, 11)$ है। खजाने से पार्थी की दूरी खजाने की अलीशा से दूरी की तीन गुनी है। खजाने के स्थान के निर्देशांक ज्ञात कीजिए। **3**

खण्ड – घ

प्रश्न संख्या 32 से 35 तक दीर्घ–उत्तरीय (LA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक प्रश्न के 5 अंक हैं।

32. **(A)** एक तेज़ चलने वाली ट्रेन 200 किमी की यात्रा के लिए धीमी चलने वाली ट्रेन से एक घंटा कम समय लेती है। यदि धीमी चलने वाली ट्रेन की चाल तेज़ चलने वाली ट्रेन से 10 किमी/घंटा कम है, तो दोनों ट्रेनों की चाल ज्ञात कीजिए। **5**

अथवा

(B) दो वर्गों के क्षेत्रफलों का योग 640 वर्गमीटर है। यदि उनके परिमापों का अंतर 64 मीटर है, तो दोनों वर्गों की भुजाएँ ज्ञात कीजिए। **5**

33. **(A)** आधारभूत समानुपातिकता प्रमेय (Basic Proportionality Theorem) का कथन लिखिए और सिद्ध कीजिए। **5**

अथवा

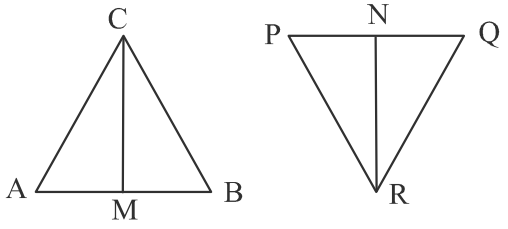
(B) दी गई आकृति में, Δ ABC तथा Δ PQR की क्रमशः CM तथा RN रेखाएँ माध्यिका (medians) हैं।

यदि $\Delta ABC \sim \Delta PQR$,

तो सिद्ध कीजिए :

(i) $\Delta AMC \sim \Delta PNR$

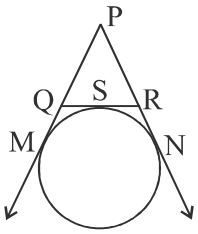
(ii) $\Delta CMB \sim \Delta RNQ$



5

(B) In the given figure, if a circle touches the side QR of Δ PQR at S and extended sides PQ and PR at M and N respectively, then prove that :

$PM = \frac{1}{2}(PQ + QR + PR)$



3

29. A solid is in the form of a cylinder with hemispherical ends. The total height of the solid is 20 cm and the diameter of the cylinder is 7 cm. Find the total volume of the solid. $\left(\text{Use } \pi = \frac{22}{7}\right)$ **3**

30. Two dice of different colours are thrown at the same time. Write down all the possible outcomes. What is the probability that :

(i) same number appears on both the dice ?

(ii) different number appears on both the dice ? **3**

31. Parthi and Alisha found a treasure that is exactly on the straight line joining their locations. Parthi's location is at point (– 6, – 5) and Alisha's location is at point (10, 11). The distance from the treasure to Parthi's location is three times that of the distance to Alisha's location. Find the coordinates of the location of the treasure. **3**

SECTION – D

Question numbers 32 to 35 are Long Answer (LA) type questions, carrying 5 marks each.

32. **(A)** A faster train takes one hour less than a slower train for a journey of 200 km. If the speed of the slower train is 10 km/hr less than that of the faster train, find the speeds of the two trains. **5**

OR

(B) The sum of the areas of two squares is 640 m^2. If the difference in their perimeters is 64 m, find the sides of the two squares. **5**

33. **(A)** State and prove Basic Proportionality Theorem. **5**

OR

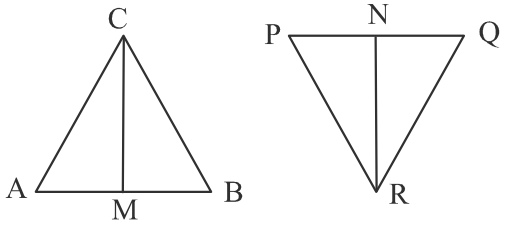
(B) In the given figure, CM and RN are respectively the medians of Δ ABC and Δ PQR.

If Δ ABC ~ Δ PQR,

then prove that :

(i) Δ AMC ~ Δ PNR

(ii) Δ CMB ~ Δ RNQ **5**



34. एक आवासीय सोसाइटी के 200 परिवारों का फलों पर मासिक व्यय नीचे दिया गया है। x का मान ज्ञात कीजिए और साथ ही फलों पर व्यय का **बहुलक** (Mode) तथा **माध्य** (Mean) भी ज्ञात कीजिए। **5**

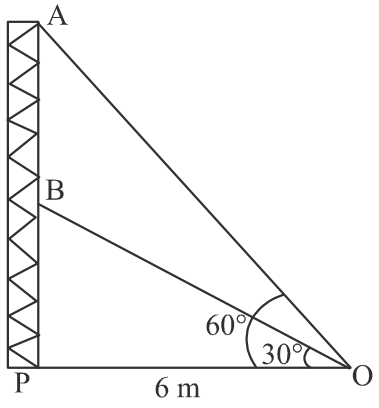
मासिक व्यय (₹ में)	परिवारों की संख्या
1000-1500	24
1500-2000	40
2000-2500	33
2500-3000	28
3000-3500	x
3500-4000	22
4000-4500	16
4500-5000	7

35. कक्षा X के दो अनुभागों (खंडों) A और B ने उत्तराखंड बाढ़ पीड़ितों के लिए कुल ₹ 1500 का योगदान दिया। अनुभाग X-A का योगदान अनुभाग X-B से ₹ 100 कम था। आलेखीय विधि द्वारा, दोनों खंडों द्वारा दी गई राशियाँ ज्ञात कीजिए। **5**

खण्ड – ड़

प्रश्न संख्या 36 से 38 तक प्रकरण अध्ययन आधारित प्रश्न हैं, जिनमें प्रत्येक प्रश्न के 4 अंक हैं।

36. रेडियो टॉवरों का उपयोग रेडियो और टेलीविज़न सहित विभिन्न संचार सेवाओं को प्रसारित करने के लिए किया जाता है। टॉवर या तो स्वयं ऐंटेना के रूप में कार्य करता है या अपनी संरचना पर एक या एक से अधिक ऐंटेना को सहारा देता है। इसी अवधारणा पर आधारित, एक रेडियो स्टेशन का टॉवर दो खंडों 'A' और 'B' में बनाया गया था। टॉवर को बिंदु 'O' से तारों द्वारा सहारा दिया गया है (जैसा कि चित्र में दिखाया गया है)।



टॉवर के आधार और बिंदु 'O' के बीच की दूरी 6 मीटर है। बिंदु 'O' से खंड 'B' के शीर्ष का उन्नयन कोण 30° है तथा खंड 'A' के शीर्ष का उन्नयन कोण 60° है।

उपर्युक्त दी गई जानकारी के आधार पर, निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) बिंदु 'O' से खंड 'B' के शीर्ष तक तार की लंबाई ज्ञात कीजिए। **1**

(ii) बिंदु 'O' से खंड 'A' के शीर्ष तक तार की लंबाई ज्ञात कीजिए। **1**

(iii) (a) AB की दूरी ज्ञात कीजिए। **2**

अथवा

(iii) (b) Δ OPB का क्षेत्रफल ज्ञात कीजिए। **2**

34. The monthly expenditure on fruits in 200 families of a Housing Society is given below. Find the value of x and also find the **mode** and **mean** expenditure on fruits. **5**

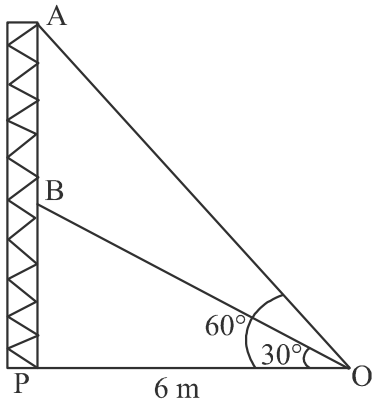
Monthly Expenditure (in ₹)	No. of Families
1000-1500	24
1500-2000	40
2000-2500	33
2500-3000	28
3000-3500	x
3500-4000	22
4000-4500	16
4500-5000	7

35. Two sections, A and B, of class X contributed a total of ₹ 1500 for the Uttarakhand flood victims. The contribution from X-A was ₹ 100 less than that of X-B. Graphically, find the amounts contributed by both sections. **5**

SECTION – E

Question numbers 36 to 38 are Case Study Based questions, carrying 4 marks each.

36. Radio towers are used for transmitting a range of communication services including radio and television. The tower will either act as an antenna itself or support one or more antennas on its structure. On a similar concept, a radio station tower was built in two sections 'A' and 'B'. Tower is supported by wires from a point 'O' (as shown in figure).



Distance between the base of the tower and point 'O' is 6 m. From point 'O', the angle of elevation of the top of the section 'B' is 30° and the angle of elevation of the top of section 'A' is 60°.

Based on the above information, answer the following questions :

(i) Find the length of the wire from the point 'O' to the top of section 'B'. **1**

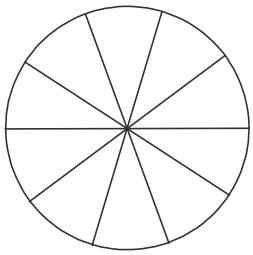
(ii) Find the length of the wire from the point 'O' to the top of section 'A'. **1**

(iii) (a) Find the distance AB. **2**

OR

(iii) (b) Find the area of Δ OPB. **2**

37. एक ब्रूच चाँदी के तार से 35 cm व्यास के वृत्त के आकार में बनाई गई है। तार का उपयोग 5 व्यास बनाने में भी किया जाता है, जो वृत्त को 10 बराबर त्रिज्यखंडों में विभाजित करते हैं।



उपर्युक्त दी गई जानकारी के आधार पर, निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) वृत्त की त्रिज्या बताइए। **1**

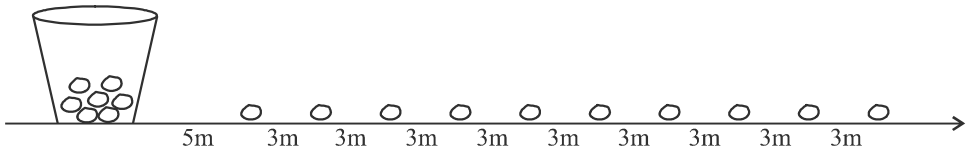
(ii) ब्रूच की परिधि बताइए। **1**

(iii) (a) आवश्यक चाँदी के तार की कुल लम्बाई बताइए। **2**

अथवा

(iii) (b) ब्रूच के प्रत्येक त्रिज्यखंड का क्षेत्रफल बताइए। **2**

38. आलू दौड़ में, प्रारंभिक बिंदु पर एक बाल्टी रखी गई है, जो पहले आलू से 5 मीटर दूर है। शेष आलू एक सीधी रेखा में 3 मीटर के अंतराल पर रखे गए हैं, जबकि कुल 10 आलू हैं, जैसा कि आकृति में दर्शाया गया है :



एक प्रतियोगी बाल्टी से चलकर निकटतम आलू उठाता है और बाल्टी में डालने के लिए लौटता है, फिर अगला आलू उठाता है। यह प्रक्रिया तब तक चलती है जब तक सभी आलू बाल्टी में न आ जाएँ।

उपर्युक्त दी गई जानकारी के आधार पर, निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) पहला आलू उठाने और बाल्टी में डालने में तय की गई दूरी बताइए। **1**

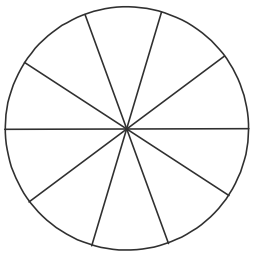
(ii) दूसरा आलू उठाने और बाल्टी में डालने में तय की गई दूरी बताइए। **1**

(iii) (a) प्रतियोगी द्वारा तय की गई कुल दूरी बताइए। **2**

अथवा

(iii) (b) यदि प्रतियोगी की औसत गति 5 मीटर/सेकंड है, तो सभी आलू बाल्टी में डालने में लगा औसत समय ज्ञात कीजिए। **2**

37. A brooch is crafted from silver wire in the shape of a circle with a diameter of 35 cm. The wire is also used to create 5 diameters, dividing the circle into 10 equal sectors as shown in figure.



Based on the above information, answer the following questions :

(i) What is the radius of circle ? **1**

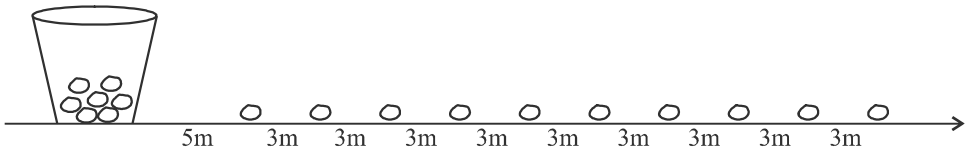
(ii) What is the circumference of the brooch ? **1**

(iii) (a) What is the total length of silver wire required ? **2**

OR

(iii) (b) What is the area of each sector of the brooch ? **2**

38. In a potato race, a bucket is placed at the starting point, which is 5 m from the first potato. The other potatoes are arranged 3 m apart in a straight line, with a total of 10 potatoes, as shown in the figure :



A competitor starts from the bucket, picks up the nearest potato, runs back to the bucket to drop it in, then returns to pick up the next potato. This process continues until all the potatoes are in the bucket.

Based on the above information, answer the following questions :

(i) What is the distance covered to pick up the first potato and drop it in bucket ? **1**

(ii) What is the distance covered to pick up the second potato and drop it in bucket ? **1**

(iii) (a) What is the total distance the competitor has to run ? **2**

OR

(iii) (b) If average speed of competitor is 5 m/s, then find the average time taken by competitor to put all the potatoes in the bucket. **2**



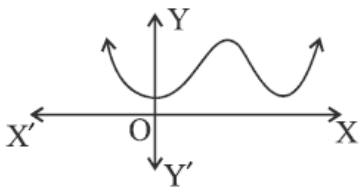
Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2026
MATHEMATICS (STANDARD) (041) (PAPER CODE 30/1/2)

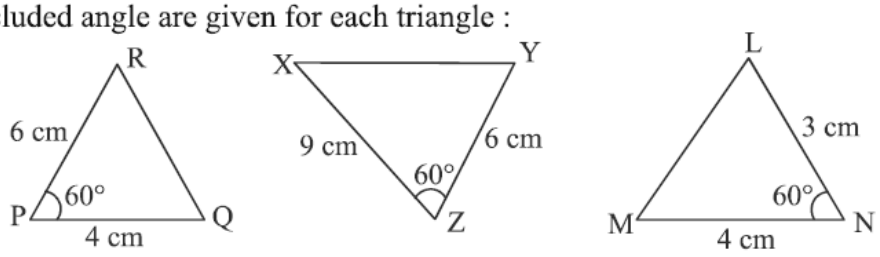
General Instructions: -

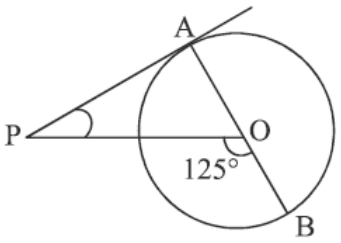
1.	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested 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. It's 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 BNS."**
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. In Class-X, while evaluating the 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, due marks should be awarded.**
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 totalled up and written on the left-hand margin and encircled. This may be followed strictly.
8.	If a question does not have any parts, marks must be awarded on the left-hand margin and encircled. This may also be followed strictly.

9.	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"**.
10.	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
11.	A full scale of marks **0 to 80** (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.
12.	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.
13.	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 to an answer. ● Wrong transfer of marks from the inside pages of the answer book to the title page. ● Wrong question wise 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/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.
14.	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.
15.	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.
16.	The Examiners should acquaint themselves with the guidelines given in the "**Guidelines for spot Evaluation**" before starting the actual evaluation.
17.	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.
18.	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.

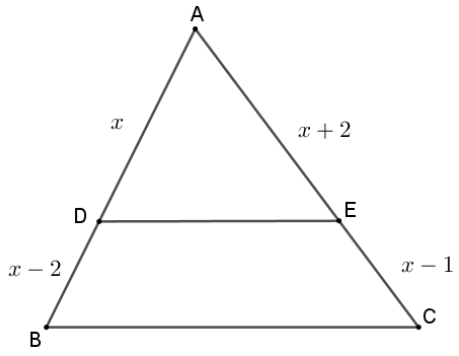
MARKING SCHEME
MATHEMATICS (Subject Code–041)
(PAPER CODE: 30/1/2)

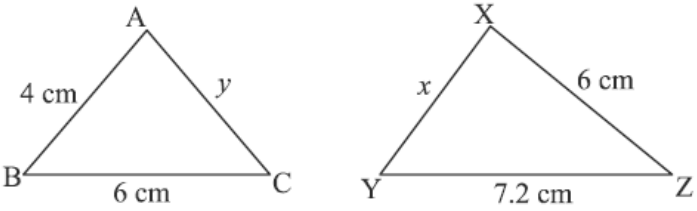
Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Step	Marks
	SECTION – A **Question Numbers 1 to 20 are multiple choice questions of 1 mark each.**		
1.	The natural number 2 is : (a) a prime number (b) a composite number (c) prime as well as composite (d) neither prime nor composite		
Sol.	(a) a prime number		**1**
2.	For any natural number n, 6^n ends with the digit : (a) 0 (b) 6 (c) 3 (d) 2		
Sol.	(b) 6		**1**
3.	The HCF of 960 and 432 is : (a) 48 (b) 54 (c) 72 (d) 36		
Sol.	(a) 48		**1**
4.	For an event E, $P(E)+P(\overline{E})=x$, then the value of x^2-3 is : (a) -2 (b) 2 (c) 1 (d) -1		
Sol.	(a) -2		**1**
5.	The graph of $y=f(x)$ is given. The number of zeroes of $f(x)$ is : (a) 0 (b) 1 (c) 2 (d) 4 		
Sol.	(a) 0		**1**

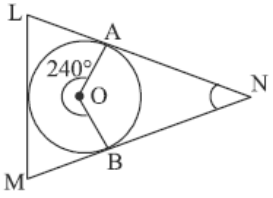
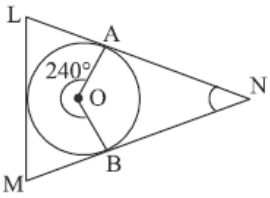
6.	If a pair of linear equations in two variables is represented by two coincident lines, then the pair of equations has : (a) a unique solution (b) two solutions (c) no solution (d) an infinite number of solutions		
Sol.	(d) an infinite number of solutions		**1**
7.	The first term of an AP is p and the common difference is q, then its 10th term is : (a) $q-9p$ (b) $p-9q$ (c) $p+9q$ (d) $2p+9q$		
Sol.	(c) $p+9q$		**1**
8.	Shown below are three triangles. The measures of two adjacent sides and included angle are given for each triangle :  Which of these triangles are similar ? (a) Δ RPQ and Δ XZY (b) Δ RPQ and Δ MNL (c) Δ XZY and Δ MNL (d) Δ RPQ, Δ XZY and Δ MNL are similar to one another		
Sol.	(a) Δ RPQ and Δ XZY		**1**
9.	The mid-point of the line segment joining the points $(5,-4)$ and $(6, 4)$ lies on : (a) x-axis (b) y-axis (c) origin (d) neither x-axis nor y-axis		
Sol.	(a) x-axis		**1**

10.	If $\cos y = 0$, then what is the value of $\frac{1}{2}\cos\frac{y}{2}$? (a) 0 (b) $\frac{1}{2}$ (c) $\frac{1}{\sqrt{2}}$ (d) $\frac{1}{2\sqrt{2}}$		
Sol.	(d) $\frac{1}{2\sqrt{2}}$		**1**
11.	If $\cos A = \frac{1}{2}$, then the value of $\sin^2 A + 2\cos^2 A$ is : (a) $\frac{3}{2}$ (b) $\frac{5}{4}$ (c) -1 (d) $\frac{1}{2}$		
Sol.	(b) $\frac{5}{4}$		**1**
12.	A car is moving away from the base of a 30 m high tower. The angle of elevation of the top of the tower from the car at an instant, when the car is $10\sqrt{3}$ m away from the base of the tower, is : (a) 30° (b) 45° (c) 90° (d) 60°		
Sol.	(d) 60°		**1**
13.	If TP and TQ are two tangents to a circle with centre O from an external point T so that $\angle POQ = 120°$, then $\angle PTQ$ is equal to : (a) 60° (b) 70° (c) 80° (d) 90°		
Sol.	(a) 60°		**1**
14.	In the given figure, PA is a tangent from an external point P to a circle with centre O. If $\angle POB = 125°$, then $\angle APO$ is equal to : (a) 25° (b) 65° (c) 90° (d) 35° 		
Sol.	(d) 35°		**1**

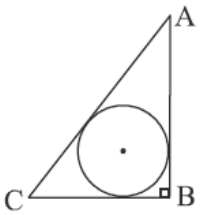
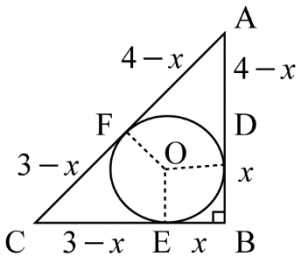
15.	The length of the arc of the sector of a circle with radius 21 cm and of central angle 60°, is : (a) 22 cm (b) 44 cm (c) 88 cm (d) 11 cm		
Sol.	(a) 22 cm		**1**
16.	The hour hand of a clock is 7 cm long. The angle swept by it between 7:00 a.m. and 8:10 a.m. is : (a) $\left(\frac{35}{4}\right)^\circ$ (b) $\left(\frac{35}{2}\right)^\circ$ (c) 35° (d) 70°		
Sol.	(c) 35°		**1**
17.	The total surface area of a solid hemisphere of diameter '$2d$' is : (a) $3\pi d^2$ (b) $2\pi d^2$ (c) $\frac{1}{2}\pi d^2$ (d) $\frac{3}{4}\pi d^2$		
Sol.	(a) $3\pi d^2$		**1**
18.	If the mean and mode of a data are 12 and 21 respectively, then its median is : (a) 6 (b) 13.5 (c) 15 (d) 14		
Sol.	(c) 15		**1**
	Directions : Question numbers 19 and 20 are Assertion and Reason based questions. 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.		

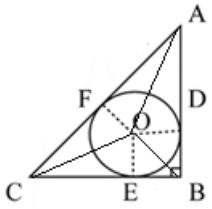
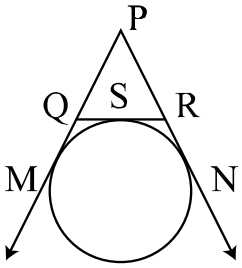
19.	**Assertion (A) :** The probability that a leap year has 53 Mondays is $\frac{2}{7}$. **Reason (R) :** The probability that a non-leap year has 53 Mondays is $\frac{5}{7}$.		
Sol.	(c) Assertion (A) is true, but Reason (R) is false.		**1**
20.	**Assertion (A) :** The polynomial $p(y) = y^2 + 4y + 3$ has two zeroes. **Reason (R) :** A quadratic polynomial can have at most two zeroes.		
Sol.	(b) Both, Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).		**1**
	SECTION – B **Question Numbers 21 to 25 are Very Short Answer (VSA) type questions, carrying 2 marks each.**		
21 (A).	In Δ ABC, DE $\parallel$ BC. If AD = x, DB = $x - 2$, AE = $x + 2$ and EC = $x - 1$, then find the value of x.		
Sol.	 Since DE $\parallel$ BC $\Rightarrow \frac{AD}{DB} = \frac{AE}{EC}$ $\Rightarrow \frac{x}{x-2} = \frac{x+2}{x-1}$ Solving, we get $x = 4$	**I** **II** **III**	**1** **½** **½**
	OR		

21 (B).	 In the figure given above, Δ ABC ~ Δ XYZ, then find the values of x and y.		
Sol.	$\Delta ABC \sim \Delta XYZ \Longrightarrow \frac{AB}{XY} = \frac{BC}{YZ} = \frac{AC}{XZ}$ $\Longrightarrow \frac{4}{x} = \frac{6}{7.2} = \frac{y}{6}$ Solving, we get $x = 4.8$ cm, $y = 5$ cm	**I** **II**	**1** ½ + ½
22.	The coordinates of the centre of a circle are $(x - 7, 2x)$. Find the value(s) of 'x', if the circle passes through the point $(-9, 11)$ and has radius $5\sqrt{2}$ units.		
Sol.	$\sqrt{(x-7+9)^2 + (2x-11)^2} = 5\sqrt{2}$ $\Longrightarrow (x+2)^2 + (2x-11)^2 = 50$ $\Longrightarrow 5x^2 - 40x + 75 = 0$ or $x^2 - 8x + 15 = 0$ $\Longrightarrow (x-5)(x-3) = 0$ $\therefore x = 3,5$	**I** **II** **III**	½ ½ ½ + ½
23 (A).	If $\tan\theta = \frac{24}{7}$, then find the value of $\sin\theta + \cos\theta$.		
Sol.	$\tan\theta = \frac{24}{7} = \frac{P}{B}$ Getting $\sin\theta = \frac{24}{25}$ and $\cos\theta = \frac{7}{25}$ $\therefore \sin\theta + \cos\theta = \frac{24}{25} + \frac{7}{25} = \frac{31}{25}$	**I** **II**	**1½** ½
	OR		

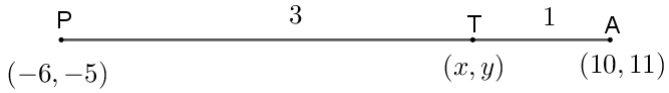
23 (B).	If $\cot\theta = \frac{7}{8}$, then find the value of $\frac{(1+\sin\theta)(1-\sin\theta)}{(1+\cos\theta)(1-\cos\theta)}$.		
Sol.	$\frac{(1+\sin\theta)(1-\sin\theta)}{(1+\cos\theta)(1-\cos\theta)} = \frac{1-\sin^2\theta}{1-\cos^2\theta}$ $= \frac{\cos^2\theta}{\sin^2\theta} = \cot^2\theta$ $= \left(\frac{7}{8}\right)^2 = \frac{49}{64}$	**I** **II** **III**	**1** **½** **½**
24.	In the given figure, a circle with centre O is inscribed inside Δ LMN. A and B are the points of tangency. Find ∠ANB. 		
Sol.	 $\angle AOB = 360° - \text{reflex}(\angle AOB)$ $\angle AOB = 360° - 240° = 120°$ $\angle ANB = 360° - (90° + 90° + 120°) = 60°$	 **I** **II**	 **1** **1**
25.	Find the zeroes of the quadratic polynomial $x^2 + 7x + 10$, and verify the relationship between the zeroes and its coefficients.		
Sol.	$x^2 + 7x + 10 = (x + 2)(x + 5)$ So, the zeroes of the polynomial are -2 and -5 Sum of zeroes $= -7 = \frac{-7}{1} = -\frac{\text{coefficient of } x}{\text{coeffiecient of } x^2}$ Product of zeroes $= 10 = \frac{10}{1} = \frac{\text{constant term}}{\text{coefficient of } x^2}$	 **I** **II** **III**	 **1** **½** **½**

	SECTION – C **Question numbers 26 to 31 are Short Answer (SA) type questions, carrying 3 marks each.**		
26.	Prove that $\sqrt{2}$ is an irrational number.		
Sol.	Let $\sqrt{2}$ be a rational number. $\therefore \sqrt{2} = \frac{p}{q}$, where $q \neq 0$ and p & q are coprime. $2q^2 = p^2 \implies p^2$ is divisible by $2 \implies p$ is divisible by 2 ----- (i) Let $p = 2a$, where 'a' is some integer $4a^2 = 2\,q^2 \implies q^2 = 2\,a^2 \implies q^2$ is divisible by $2 \implies q$ is divisible by 2 ----- (ii) (i) and (ii) leads to a contradiction as 'p' and 'q' are coprime. $\therefore \sqrt{2}$ is an irrational number.	**I** **II** **III** **IV**	**½** **1** **1** **½**
27 (A).	If $x = h + a\cos\theta$, $y = k + b\sin\theta$, then prove that : $\left(\frac{x-h}{a}\right)^2 + \left(\frac{y-k}{b}\right)^2 = 1$		
Sol.	$x = h + a\cos\theta \implies \frac{x-h}{a} = \cos\theta$ $y = k + b\cos\theta \implies \frac{y-k}{b} = \sin\theta$ $\therefore \text{LHS} = \left(\frac{x-h}{a}\right)^2 + \left(\frac{y-k}{b}\right)^2 = \cos^2\theta + \sin^2\theta = 1 = \text{RHS}$	**I** **II** **III**	**1** **1** **1**
	OR		

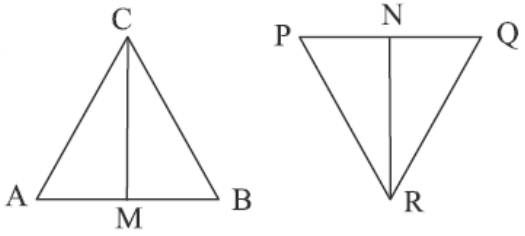
27 (B).	Prove that : $\frac{\tan A}{1+\sec A}-\frac{\tan A}{1-\sec A}=2\ \text{cosec}\ A$		
Sol.	$\text{LHS}=\frac{\tan A}{1+\sec A}-\frac{\tan A}{1-\sec A}=\frac{\frac{\sin A}{\cos A}}{1+\frac{1}{\cos A}}-\frac{\frac{\sin A}{\cos A}}{1-\frac{1}{\cos A}}$	**I**	**1**
	$=\frac{\sin A}{\cos A+1}-\frac{\sin A}{\cos A-1}$	**II**	**½**
	$=\sin A\left(\frac{-2}{-\sin^2 A}\right)$	**III**	**1**
	$=\frac{2}{\sin A}=2\ \text{cosec}\ A=\text{RHS}$	**IV**	**½**
28 (A).	In the given figure, Δ ABC is a right triangle in which ∠ B = 90°, AB = 4 cm and BC = 3 cm. Find the radius of the circle inscribed in the triangle ABC. 		
Sol.			
	AC = $\sqrt{3^2+4^2}=5$ cm	**I**	**½**
	Let BE = BD = x cm	**II**	**½**
	AD = $4-x$ = AF, CE = $3-x$ = CF	**III**	**½**
	AF + CF = AC $\Rightarrow 4-x+3-x=5$		
	$\therefore x=1$	**IV**	**1**
	BD = BE = 1 and ∠B = 90°		
	Hence radius of circle $= x = 1$ cm	**V**	**½**
	ALTERNATE SOLUTION:		

	 AC = $\sqrt{3^2 + 4^2} = 5$ cm	I	½
	Let r be the radius of the circle		
	ar(ΔABC) = $\frac{1}{2} \times 4 \times 3 = 6\ cm^2$	II	½
	Also, ar(ΔABC) = $\left(\frac{1}{2} \times r \times 4\right) + \left(\frac{1}{2} \times r \times 3\right) + \left(\frac{1}{2} \times r \times 5\right)$	III	1
	$\Rightarrow 6r = 6 \Rightarrow r = 1$	IV	1
	Hence the radius of the circle is 1 cm.		
	OR		
28 (B).	In the given figure, if a circle touches the side QR of Δ PQR at S and extended sides PQ and PR at M and N respectively, then prove that : PM = $\frac{1}{2}$ (PQ + QR + PR) 		
Sol.			
	PM = PN QS = QM RS = RN	I	1½
	PM + PN = PQ + QM + PR + RN	II	½
	2 PM = PQ + QS + PR + RS = PQ + QS + RS + PR	III	½

	$= PQ + QR + PR$ $\therefore PM = \frac{1}{2}(PQ + QR + PR)$	**IV**	**½**
29.	A solid is in the form of a cylinder with hemispherical ends. The total height of the solid is 20 cm and the diameter of the cylinder is 7 cm. Find the total volume of the solid. $\left(\text{Use } \pi = \frac{22}{7}\right)$		
Sol.	Radius of cylinder = radius of hemisphere $= \frac{7}{2}$ cm	**I**	**½**
	Total height of solid = 20 cm		
	Height of cylinder $= \left(20 - \frac{7}{2} - \frac{7}{2}\right)$ cm = 13 cm	**II**	**½**
	Total volume of solid $= \left[\frac{22}{7} \times \left(\frac{7}{2}\right)^2 \times 13 + 2 \times \frac{2}{3} \times \frac{22}{7} \times \left(\frac{7}{2}\right)^3\right]$	**III**	**1**
	$= \frac{22}{7} \times \left(\frac{7}{2}\right)^2 \times \left(13 + \frac{14}{3}\right)$		
	$= \frac{4081}{6} = 680.1 \text{ cm}^3$ (approx.)	**IV**	**1**
30.	Two dice of different colours are thrown at the same time. Write down all the possible outcomes. What is the probability that : (i) same number appears on both the dice ? (ii) different number appears on both the dice ?		
Sol.	Possible outcomes are $(1,1)(1,2), (1,3), (1,4), (1,5), (1,6)$ $(2,1), (2,2), (2,3), (2,4), (2,5), (2,6)$ $(3,1)(3,2), (3,3), (3,4), (3,5), (3,6)$ $(4,1)(4,2), (4,3), (4,4), (4,5), (4,6)$ $(5,1), (5,2), (5,3), (5,4), (5,5), (5,6)$ $(6,1), (6,2), (6,3), (6,4), (6,5), (6,6)$	**I**	**1**

	(i) P(same number appears on both the dice) $= \frac{6}{36}$ or $\frac{1}{6}$	**II**	**1**
	(ii) P(different numbers appear on both the dice) $= 1 - \frac{1}{6} = \frac{5}{6}$	**III**	**1**
31.	Parthi and Alisha found a treasure that is exactly on the straight line joining their locations. Parthi's location is at point $(-6, -5)$ and Alisha's location is at point $(10, 11)$. The distance from the treasure to Parthi's location is three times that of the distance to Alisha's location. Find the coordinates of the location of the treasure.		
Sol.	Let the points P, A and T represent the location of Parthi, Alisha and Treasure respectively. Let the cordinates of T be (x, y)  		
	$PT = 3\ AT$	**I**	**1**
	$\Rightarrow \frac{PT}{AT} = \frac{3}{1}$	**II**	**½**
	Coordinates of T are $\left(\frac{10\times3-6}{3+1}, \frac{11\times3-5}{3+1}\right)$	**III**	**1**
	$= (6,7)$	**IV**	**½**
	SECTION – D **Question numbers 32 to 35 are Long Answer (LA) type questions, carrying 5 marks each.**		
32 (A).	A faster train takes one hour less than a slower train for a journey of 200 km. If the speed of the slower train is 10 km/hr less than that of the faster train, find the speeds of the two trains.		
Sol.	Let the speed of faster train be x km/h $\therefore$ speed of slower train $= (x - 10)$ km/h According to the question,		

	$\frac{200}{x-10} - \frac{200}{x} = 1$	I	2
	$\Rightarrow x^2 - 10x - 2000 = 0$	II	1
	$\Rightarrow (x-50)(x+40) = 0$	III	1
	$\therefore x = 50$	IV	½
	$x = -40$ (Rejected)		
	Hence, speed of faster train $= 50$ km/h		
	and speed of slower train $= 40$ km/h	V	½
	OR		
32 (B).	The sum of the areas of two squares is 640 m^2. If the difference in their perimeters is 64 m, find the sides of the two squares.		
Sol.	Let the sides of the two squares be x m and y m $(x > y)$		
	$x^2 + y^2 = 640$	I	1
	and $4x - 4y = 64 \Rightarrow y = x - 16$	II	1
	$\therefore x^2 + (x-16)^2 = 640$		
	$\Rightarrow x^2 - 16x - 192 = 0$	III	1
	$\Rightarrow (x-24)(x+8) = 0$	IV	1
	$\therefore x = 24$	V	½
	$x = -8$ (Rejected)		
	$\Rightarrow y = 24 - 16 = 8$	VI	½
	Hence the sides of the two squares are 24 m and 8 m		
33 (A).	State and prove Basic Proportionality Theorem.		

Sol.	For Correct Statement - If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, the other two sides are divided in the same ratio.	**I**	**1**
	For Correct given , to prove, construction and figure	**II**	**2**
	For correct proof	**III**	**2**
	OR		
33 (B).	In the given figure, CM and RN are respectively the medians of Δ ABC and Δ PQR. If Δ ABC ~ Δ PQR, then prove that : (i) Δ AMC ~ Δ PNR (ii) Δ CMB ~ Δ RNQ 		
Sol.	(i) $\Delta ABC \sim \Delta PQR \Rightarrow \angle A = \angle P$	**I**	**½**
	$\frac{AB}{PQ} = \frac{AC}{PR} \Rightarrow \frac{2\,AM}{2\,PN} = \frac{AC}{PR}$ (as CM and RN are the medians)	**II**	**1½**
	$\therefore \Delta AMC \sim \Delta PNR$	**III**	**½**
	(ii) $\Delta ABC \sim \Delta PQR \Rightarrow \angle B = \angle Q$	**IV**	**½**
	$\frac{AB}{PQ} = \frac{BC}{QR} \Rightarrow \frac{2\,MB}{2\,NQ} = \frac{BC}{QR}$ (as CM and RN are the medians)	**V**	**1½**
	$\therefore \Delta CMB \sim \Delta RNQ$	**VI**	**½**
34.	The monthly expenditure on fruits in 200 families of a Housing Society is given below. Find the value of x and also find the **mode** and **mean** expenditure on fruits.		

Monthly Expenditure (in ₹)	No. of Families
1000-1500	24
1500-2000	40
2000-2500	33
2500-3000	28
3000-3500	x
3500-4000	22
4000-4500	16
4500-5000	7

Sol.

Class Interval	Frequency (f_i)	x_i	$f_i x_i$
$1000 - 1500$	24	1250	30000
$1500 - 2000$	40	1750	70000
$2000 - 2500$	33	2250	74250
$2500 - 3000$	28	2750	77000
$3000 - 3500$	x	3250	$3250\,x$
$3500 - 4000$	22	3750	82500
$4000 - 4500$	16	4250	68000
$4500 - 5000$	7	4750	33250
Total	$170 + x$		$435000 + 3250\,x$

Correct Table — **I** — **1½**

$170 + x = 200 \Longrightarrow x = 30$ — **II** — **½**

$1500 - 2000$ is the modal class — **III** — **½**

$\Longrightarrow$ Mode $= 1500 + \left(\frac{40-24}{2\times40-24-33}\right) \times 500$ — **IV** — **1**

$= 1500 + 347.82$

$= 1847.82$ — **V** — **½**

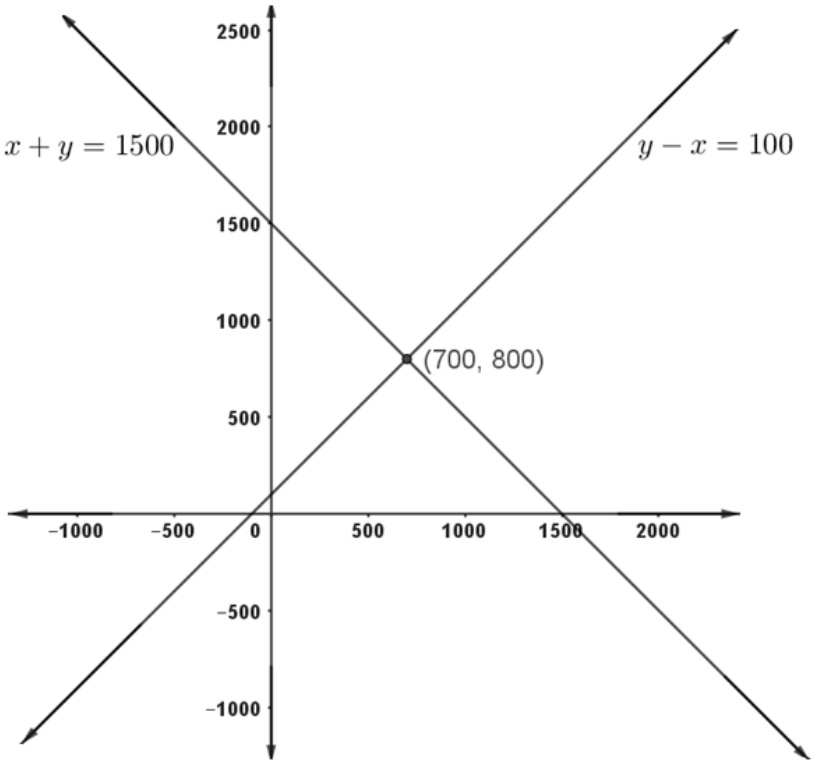
Hence the modal monthly expenditure is ₹ 1847.82

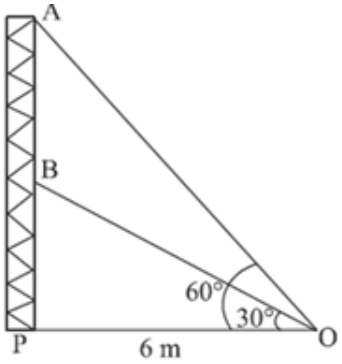
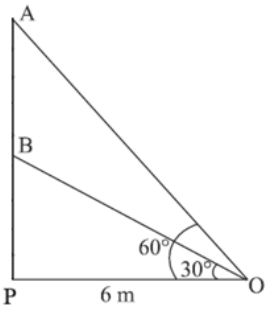
$\therefore \sum f_i x_i = 435000 + 3250 \times 30 = 532500$ — **VI** — **½**

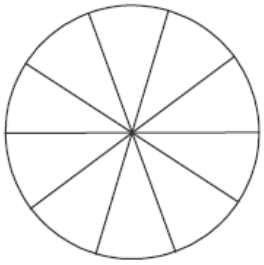
	Mean $= \frac{532500}{200} = 2662.50$	VII	½
	Hence the mean monthly expenditure is ₹ 2662.50		
	ALTERNATE SOLUTION:		
	$\sum f_i = 170 + x = 200$		
	$\Longrightarrow x = 30$	I	½

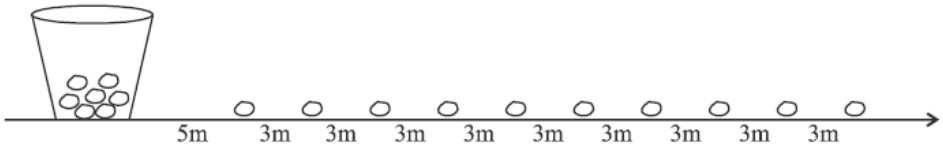
Class Interval	Frequency (f_i)	x_i	u_i	$f_i u_i$
$1000 - 1500$	24	1250	-3	-72
$1500 - 2000$	40	1750	-2	-80
$2000 - 2500$	33	2250	-1	-33
$2500 - 3000$	28	2750	0	0
$3000 - 3500$	30	3250	1	30
$3500 - 4000$	22	3750	2	44
$4000 - 4500$	16	4250	3	48
$4500 - 5000$	7	4750	4	28
Total	200			-35

Correct Table	II	1½
$1500 - 2000$ is the modal class	III	½
$\Longrightarrow$ Mode $= 1500 + \left(\frac{40-24}{2\times40-24-33}\right) \times 500$	IV	1
$= 1500 + 347.82$		
$= 1847.82$	V	½

	Hence the modal monthly expenditure is ₹ 1847.82 Mean $= 2750 + \frac{(-35)}{200} \times 500$ $= 2662.50$ Hence the mean monthly expenditure is ₹ 2662.50	**VI** **VII**	½ ½
35.	Two sections, A and B, of class X contributed a total of ₹ 1500 for the Uttarakhand flood victims. The contribution from X-A was ₹ 100 less than that of X-B. Graphically, find the amounts contributed by both sections.		
Sol.	Let x and y be the amounts contributed by the classes X-A and X-B respectively. According to question, $x + y = 1500$ and $x = y - 100$ or $y - x = 100$	**I**	½ + ½
			
	Correct Graph of the equation $x + y = 1500$	**II**	1½
	Correct graph of the equation $y - x = 100$	**III**	1½
	∴ Amount contributed by class X-A = ₹ 700	**IV**	½
	and amount contributed by class X-B = ₹ 800	**V**	½

	SECTION – E **Question numbers 36 to 38 are Case Study Based questions, carrying 4 marks each**		
36.	Radio towers are used for transmitting a range of communication services including radio and television. The tower will either act as an antenna itself or support one or more antennas on its structure. On a similar concept, a radio station tower was built in two sections 'A' and 'B'. Tower is supported by wires from a point 'O' (as shown in figure).  Distance between the base of the tower and point 'O' is 6 m. From point 'O', the angle of elevation of the top of the section 'B' is 30° and the angle of elevation of the top of section 'A' is 60°. **Based on the above information, answer the following questions :** (i) Find the length of the wire from the point 'O' to the top of section 'B'. (ii) Find the length of the wire from the point 'O' to the top of section 'A'. (iii) (a) Find the distance AB. **OR** (iii) (b) Find the area of Δ OPB.		
Sol.	 		
	(i) $\cos 30° = \frac{\sqrt{3}}{2} = \frac{6}{OB}$	**I**	½
	$\Rightarrow OB = \frac{12}{\sqrt{3}}$ or $4\sqrt{3}$ m	**II**	½
	(ii) $\cos 60° = \frac{1}{2} = \frac{6}{OA}$	**I**	½
	$\Rightarrow OA = 12$ m	**II**	½
	(iii) (a) $\tan 30° = \frac{1}{\sqrt{3}} = \frac{BP}{6}$		

	$\Rightarrow BP = 2\sqrt{3}$ m	I	1
	$\tan 60° = \sqrt{3} = \frac{AP}{6}$		
	$\Rightarrow AP = 6\sqrt{3}$ m	II	½
	$AB = AP - BP = 6\sqrt{3} - 2\sqrt{3} = 4\sqrt{3}$ m	III	½
	OR		
	(iii) (b) $\tan 30° = \frac{1}{\sqrt{3}} = \frac{BP}{6}$		
	$\Rightarrow BP = 2\sqrt{3}$ m	I	1
	$ar(\Delta OPB) = \frac{1}{2} \times BP \times OP$		
	$= \frac{1}{2} \times 2\sqrt{3} \times 6 = 6\sqrt{3}\, m^2$	II	1
37.	A brooch is crafted from silver wire in the shape of a circle with a diameter of 35 cm. The wire is also used to create 5 diameters, dividing the circle into 10 equal sectors as shown in figure.  **Based on the above information, answer the following questions :** (i) What is the radius of circle ? (ii) What is the circumference of the brooch ? (iii) (a) What is the total length of silver wire required ? **OR** (iii) (b) What is the area of each sector of the brooch ?		
Sol.	(i) $r = \frac{35}{2}$ cm = 17.5 cm	I	1
	(ii) Circumference $= 2 \times \frac{22}{7} \times \frac{35}{2} = 110$ cm	I	1
	(iii) (a) Total length of wire required $= (5 \times 35 + 110)$ cm	I	1
	$= 285$ cm	II	1

	OR		
	(iii) (b) Central angle of each sector $= \frac{360}{10} = 36°$	**I**	**1**
	Area of each sector $= \frac{36}{360} \times \frac{22}{7} \times \frac{35}{2} \times \frac{35}{2}$		
	$= \frac{385}{4}$ or $96.25\ cm^2$	**II**	**1**
38.	In a potato race, a bucket is placed at the starting point, which is 5 m from the first potato. The other potatoes are arranged 3 m apart in a straight line, with a total of 10 potatoes, as shown in the figure :  A competitor starts from the bucket, picks up the nearest potato, runs back to the bucket to drop it in, then returns to pick up the next potato. This process continues until all the potatoes are in the bucket. **Based on the above information, answer the following questions :** (i) What is the distance covered to pick up the first potato and drop it in bucket ? (ii) What is the distance covered to pick up the second potato and drop it in bucket ? (iii) (a) What is the total distance the competitor has to run ? **OR** (iii) (b) If average speed of competitor is 5 m/s, then find the average time taken by competitor to put all the potatoes in the bucket.		
Sol.	(i) Required distance for the first potato = 5 + 5 = 10 m	**I**	**1**
	(ii) Required distance for the second potato = 8 + 8 = 16 m	**I**	**1**
	(iii) (a) Distances covered form an A.P. with $a = 10$ and $d = 6$	**I**	**1**
	$\therefore S_{10} = \frac{10}{2}[2 \times 10 + 9 \times 6]$		
	$= 5 \times 74 = 370$ m	**II**	**1**
	OR		
	(iii) (b) Distances covered form an A.P. with $a = 10$ and $d = 6$	**I**	**½**

	$\therefore S_{10} = \frac{10}{2}[2 \times 10 + 9 \times 6]$		
	$= 5 \times 74 = 370$ m	**II**	**1**
	Time $= \frac{370}{5} = 74$ seconds	**III**	**½**