Series : GE1FH

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.

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नोट

(I) कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ **27** हैं।

(II) प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को परीक्षार्थी उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें।

(III) कृपया जाँच कर लें कि इस प्रश्न-पत्र में **38** प्रश्न हैं।

(IV) **कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में यथा स्थान पर प्रश्न का क्रमांक अवश्य लिखें।**

(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।

NOTE

(I) Please check that this question paper contains **27** printed pages.

(II) 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) Please check that this question paper contains **38** questions.

(IV) Please write down the Serial Number of the question in the answer-book at the given place before attempting it.

(V) 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.

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गणित (मानक)

MATHEMATICS (STANDARD)

निर्धारित समय : ***3*** *घण्टे* | *अधिकतम अंक :* ***80***

Time allowed : ***3*** *hours* | *Maximum Marks :* ***80***

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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 **पाँच** खण्डों में विभाजित है – **क, ख, ग, घ** एवं **ङ**।*

(iii) ***खण्ड क** में प्रश्न संख्या **1** से **18** तक बहुविकल्पीय (MCQ) 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 ङ** 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 ङ के 3 प्रश्नों में आंतरिक विकल्प का प्रावधान दिया गया है।*

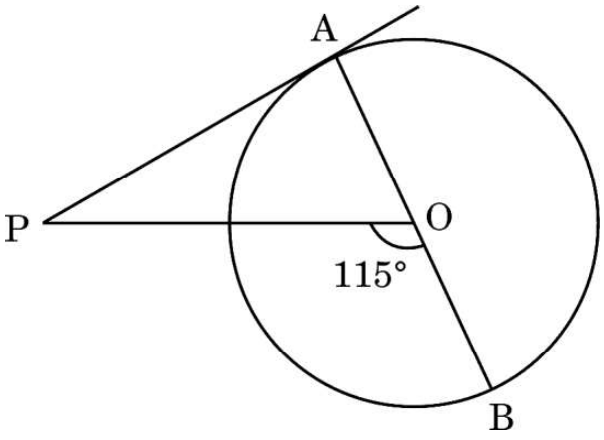
(ix) *जहाँ आवश्यक हो स्वच्छ आकृतियाँ बनाइए। जहाँ आवश्यक हो $\pi = \frac{22}{7}$ लीजिए, यदि अन्यथा न दिया गया हो।*

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

खण्ड क

*इस खण्ड में **20** बहुविकल्पीय प्रश्न (MCQ) हैं, जिनमें प्रत्येक प्रश्न **1** अंक का है।* *20×1=20*

1. दी गई आकृति में, केंद्र O वाले वृत्त पर एक बाह्य बिंदु P से एक स्पर्श-रेखा PA खींची गई है। यदि $\angle POB = 115°$ है, तो $\angle APO$ बराबर है :



(A) 25° (B) 65°

(C) 90° (D) 35°

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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.*

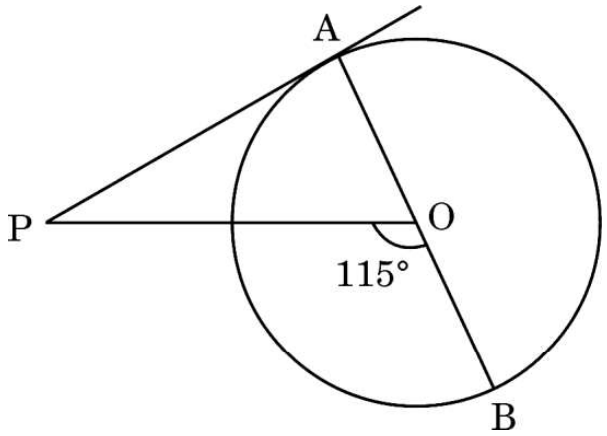
(ix) *Draw neat diagrams wherever required. Take* $\pi = \frac{22}{7}$ *wherever required, if not stated.*

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

SECTION A

*This section has **20** Multiple Choice Questions (MCQs) carrying **1** mark each. 20×1=20*

1. In the given figure, PA is a tangent from an external point P to a circle with centre O. If $\angle$ POB = 115°, then $\angle$ APO is equal to :



(A) 25° (B) 65°

(C) 90° (D) 35°

• • •

2. 20 cm लंबे तार के एक टुकड़े को $\frac{60}{\pi}$ cm त्रिज्या वाले वृत्त की एक चाप के रूप में मोड़ा गया। इस वृत्त के केन्द्र पर चाप द्वारा अंतरित कोण है :

(A) $30°$

(B) $60°$

(C) $90°$

(D) $50°$

3. तीन संख्याएँ जो एक समांतर श्रेढ़ी में हैं, का योगफल 30 है। इनका मध्य पद क्या है ?

(A) 4

(B) 10

(C) 16

(D) 8

4. एक वृत्त की एक चाप की लंबाई 5π cm है तथा इसके द्वारा बने त्रिज्यखण्ड का क्षेत्रफल 20π cm^2 है। इसकी त्रिज्या है :

(A) 10 cm

(B) 1 cm

(C) 5 cm

(D) 8 cm

5. यदि $x = 1$ तथा $y = 2$, रैखिक समीकरण युग्म $2x - 3y + a = 0$ तथा $2x + 3y - b = 0$ का एक हल है, तो :

(A) $a = 2b$

(B) $2a = b$

(C) $a + 2b = 0$

(D) $2a + b = 0$

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2. A piece of wire 20 cm long is bent into the form of an arc of a circle of radius $\frac{60}{\pi}$ cm. The angle subtended by the arc at the centre of the circle is :

(A) 30°

(B) 60°

(C) 90°

(D) 50°

3. Three numbers in AP have the sum 30. What is its middle term ?

(A) 4

(B) 10

(C) 16

(D) 8

4. An arc of a circle is of length 5π cm and the sector it bounds has an area of 20π cm^2. Its radius is :

(A) 10 cm

(B) 1 cm

(C) 5 cm

(D) 8 cm

5. If $x = 1$ and $y = 2$ is a solution of the pair of linear equations $2x - 3y + a = 0$ and $2x + 3y - b = 0$, then :

(A) $a = 2b$

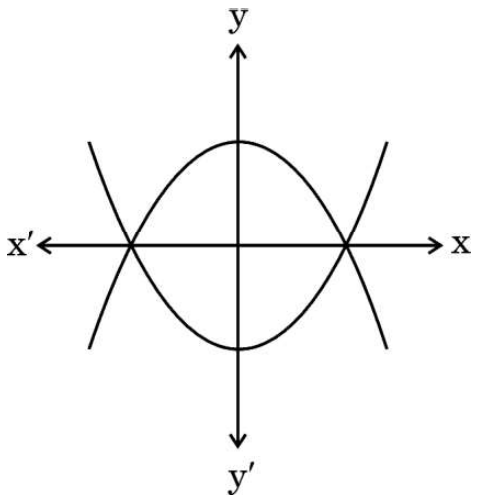
(B) $2a = b$

(C) $a + 2b = 0$

(D) $2a + b = 0$

• • •

6. नीचे दिए गए ग्राफ में, दो बहुपदों को दिखाया गया है। इन दोनों बहुपदों के भिन्न शून्यकों की संख्या है :



(A) 3 (B) 5

(C) 2 (D) 4

7. यदि $\alpha + \beta = 90°$ तथा $\alpha = 2\beta$ है, तो $\cos^2 \alpha + \sin^2 \beta$ बराबर है :

(A) 0

(B) $\frac{1}{2}$

(C) 1

(D) 2

8. ताश की 52 पत्तों की गड्डी में से यादृच्छया एक पत्ता निकाला गया। इस पत्ते के एक लाल रंग की तस्वीर वाला पत्ता होने की प्रायिकता है :

(A) $\frac{3}{13}$

(B) $\frac{2}{13}$

(C) $\frac{1}{2}$

(D) $\frac{3}{26}$

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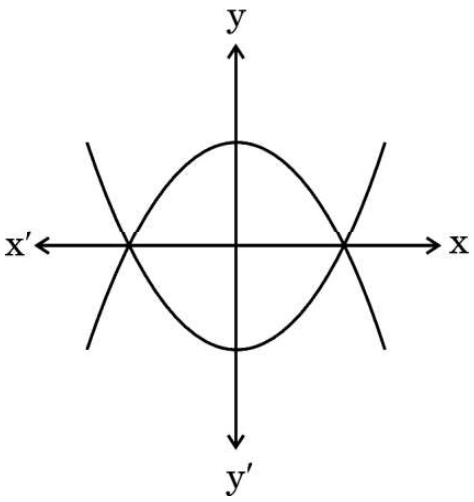
6. Two polynomials are shown in the graph below. The number of distinct zeroes of both the polynomials is :



(A) 3 (B) 5

(C) 2 (D) 4

7. If $\alpha + \beta = 90°$ and $\alpha = 2\beta$, then $\cos^2 \alpha + \sin^2 \beta$ is equal to :

(A) 0

(B) $\frac{1}{2}$

(C) 1

(D) 2

8. A card is selected at random from a deck of 52 playing cards. The probability of it being a red face card is :

(A) $\frac{3}{13}$

(B) $\frac{2}{13}$

(C) $\frac{1}{2}$

(D) $\frac{3}{26}$

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9. यदि α तथा β, बहुपद $3x^2 + 6x + k$ के शून्यक हैं तथा $\alpha + \beta + \alpha\beta = -\frac{2}{3}$ है, तो k का मान है :

(A) -8

(B) 8

(C) -4

(D) 4

10. $\tan^2\theta - \left(\frac{1}{\cos\theta} \times \sec\theta\right)$ का मान है :

(A) 1

(B) 0

(C) -1

(D) 2

11. निम्नलिखित में से कौन-सी परिमेय संख्या $\sqrt{3}$ तथा $\sqrt{5}$ के बीच की एक संख्या है ?

(A) $1{\cdot}4142387954012\ldots.$

(B) $2{\cdot}32\overline{6}$

(C) π

(D) $1{\cdot}857142$

12. यदि HCF(98, 28) = m तथा LCM(98, 28) = n है, तो $n - 7m$ का मान है :

(A) 0

(B) 28

(C) 98

(D) 198

13. यदि एक वृत्त की एक जीवा की लंबाई उसकी त्रिज्या के बराबर है, तो जीवा द्वारा केंद्र पर अंतरित कोण है :

(A) $60°$

(B) $30°$

(C) $120°$

(D) $90°$

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9. If α and β are the zeroes of polynomial $3x^2 + 6x + k$ such that $\alpha + \beta + \alpha\beta = -\frac{2}{3}$, then the value of k is :

(A) -8

(B) 8

(C) -4

(D) 4

10. The value of $\tan^2\theta - \left(\frac{1}{\cos\theta} \times \sec\theta\right)$ is :

(A) 1

(B) 0

(C) -1

(D) 2

11. Which of the following is a rational number between $\sqrt{3}$ and $\sqrt{5}$?

(A) 1·4142387954012 ....

(B) $2{\cdot}32\overline{6}$

(C) π

(D) 1·857142

12. If HCF(98, 28) = m and LCM(98, 28) = n, then the value of $n - 7m$ is :

(A) 0

(B) 28

(C) 98

(D) 198

13. If the length of a chord of a circle is equal to its radius, then the angle subtended by chord at the centre is :

(A) 60°

(B) 30°

(C) 120°

(D) 90°

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14. वह बड़ी-से-बड़ी संख्या जिससे 70 तथा 125 को भाग करने पर क्रमश: 5 तथा 8 शेष बचते हैं, है :

(A) 13

(B) 65

(C) 875

(D) 1750

15. 14 m लंबी एक सीढ़ी एक दीवार के साथ लगी हुई है। यदि सीढ़ी का पाद दीवार से 7 m की दूरी पर है, तो दीवार के शिखर का उन्नयन कोण है :

(A) 15°

(B) 30°

(C) 45°

(D) 60°

16. त्रिभुज ABC तथा DEF में, $\angle B = \angle E$, $\angle F = \angle C$ तथा $AB = 3DE$ है, तो दोनों त्रिभुज :

(A) सर्वांगसम हैं परन्तु समरूप नहीं हैं

(B) सर्वांगसम तथा समरूप हैं

(C) न तो सर्वांगसम और न ही समरूप हैं

(D) समरूप हैं परन्तु सर्वांगसम नहीं हैं

17. बिंदुओं $P(-4, 5)$ तथा $Q(4, 6)$ को मिलाने वाले रेखाखण्ड का मध्य-बिंदु स्थित है :

(A) x-अक्ष पर

(B) y-अक्ष पर

(C) मूल-बिंदु पर

(D) न x-अक्ष पर और न ही y-अक्ष पर

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14. The greatest number which divides 70 and 125, leaving remainders 5 and 8 respectively, is :

(A) 13

(B) 65

(C) 875

(D) 1750

15. A ladder 14 m long leans against a wall. If the foot of the ladder is 7 m from the wall, then the angle of elevation of the top of the wall is :

(A) 15°

(B) 30°

(C) 45°

(D) 60°

16. In triangles ABC and DEF, $\angle B = \angle E$, $\angle F = \angle C$ and AB = 3 DE. Then, the two triangles are :

(A) congruent but not similar

(B) congruent as well as similar

(C) neither congruent nor similar

(D) similar but not congruent

17. The mid-point of the line segment joining the points P(– 4, 5) and Q(4, 6) lies on :

(A) x-axis

(B) y-axis

(C) origin

(D) neither x-axis nor y-axis

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18. किन्हीं आँकड़ों के बहुलक तथा माध्य क्रमश: $15x$ तथा $18x$ हैं। तो इन आँकड़ों का माध्यक है :

(A) x

(B) $11x$

(C) $17x$

(D) $34x$

*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 कोडों (A), (B), (C) और (D) में से चुनकर दीजिए।*

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

(B) अभिकथन (A) और तर्क (R) दोनों सही हैं, परन्तु तर्क (R), अभिकथन (A) की सही व्याख्या ***नहीं*** करता है।

(C) अभिकथन (A) सही है, परन्तु तर्क (R) ग़लत है।

(D) अभिकथन (A) ग़लत है, परन्तु तर्क (R) सही है।

19. *अभिकथन (A)* : यदि हम समान त्रिज्या वाले दो अर्धगोलों को उनके आधारों से जोड़ते हैं, तो हमें एक गोला प्राप्त होता है।

तर्क (R) : r त्रिज्या वाले गोले का संपूर्ण पृष्ठीय क्षेत्रफल $3\pi r^2$ होता है।

20. *अभिकथन (A)* : 1 से 20 तक की संख्याओं में से यादृच्छया एक संख्या चुनने की प्रायिकता 1 है।

तर्क (R) : किसी घटना E के लिए, यदि $P(E) = 1$ है, तो E एक निश्चित घटना होती है।

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18. Mode and Mean of a data are 15x and 18x, respectively. Then the median of the data is :

(A) x

(B) 11x

(C) 17x

(D) 34x

*Questions number **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) :* If we join two hemispheres of same radius along their bases, then we get a sphere.

Reason (R): Total Surface Area of a sphere of radius r is $3\pi r^2$.

20. *Assertion (A) :* The probability of selecting a number at random from the numbers 1 to 20 is 1.

Reason (R): For any event E, if P(E) = 1, then E is called a sure event.

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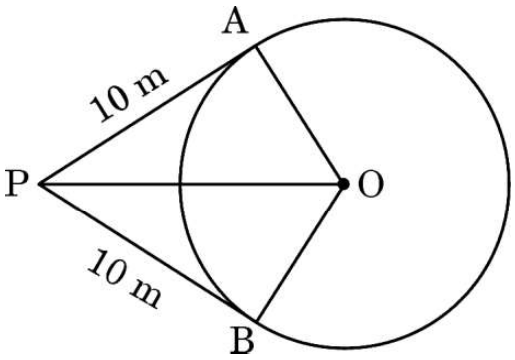
खण्ड ख

*इस खण्ड में **5** अति लघु-उत्तरीय (VSA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक के **2** अंक हैं।* *5×2=10*

21. यदि बहुपद $x^2 + ax + b$ के शून्यक 3 : 4 के अनुपात में हैं, तो सिद्ध कीजिए कि $12a^2 = 49b$.

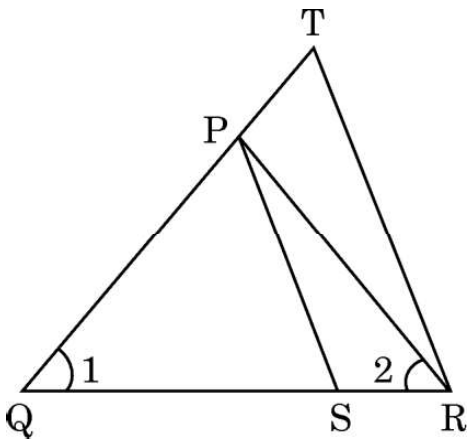
22. एक व्यक्ति एक वृत्ताकार मैदान के केंद्र से 26 m की दूरी पर स्थित एक बाह्य बिंदु P पर खड़ा है। वह देखता है कि मैदान के दो बिंदुओं A तथा B से उसकी दूरी 10 m है (PA और PB वृत्त पर स्पर्श-रेखाएँ हैं)। वृत्ताकार मैदान की त्रिज्या ज्ञात कीजिए।



23. (क) यदि $\Delta ABC \sim \Delta PQR$ है जिसमें AB = 6 cm, BC = 4 cm, AC = 8 cm तथा PR = 6 cm हैं, तो (PQ + QR) की लंबाई ज्ञात कीजिए।

अथवा

(ख) दी गई आकृति में, $\frac{QR}{QS} = \frac{QT}{PR}$ तथा $\angle 1 = \angle 2$ है, तो दर्शाइए कि $\Delta PQS \sim \Delta TQR$.



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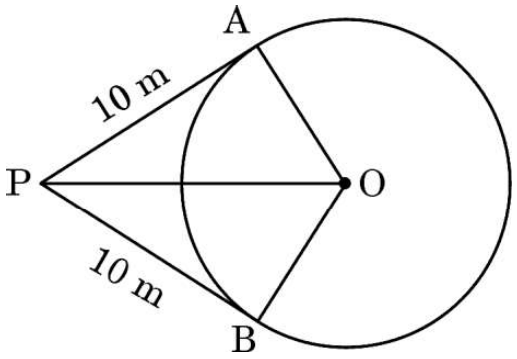
SECTION B

*This section has **5** Very Short Answer (VSA) type questions carrying **2** marks each.* *5×2=10*

21. If the zeroes of the polynomial $x^2 + ax + b$ are in the ratio 3 : 4, then prove that $12a^2 = 49b$.

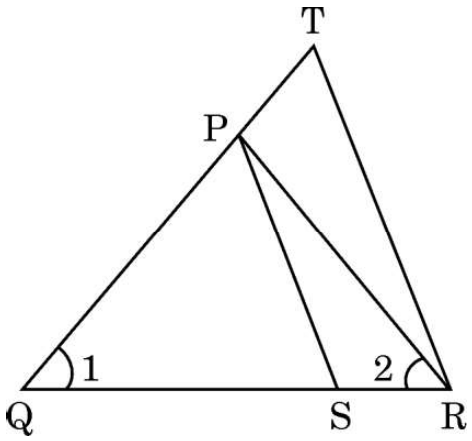
22. A person is standing at P outside a circular ground at a distance of 26 m from the centre of the ground. He found that his distances from the points A and B on the ground are 10 m (PA and PB are tangents to the circle). Find the radius of the circular ground.



23. (a) If $\Delta ABC \sim \Delta PQR$ in which AB = 6 cm, BC = 4 cm, AC = 8 cm and PR = 6 cm, then find the length of (PQ + QR).

OR

(b) In the given figure, $\frac{QR}{QS} = \frac{QT}{PR}$ and $\angle 1 = \angle 2$, show that $\Delta PQS \sim \Delta TQR$.



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24. (क) यदि $x \cos 60° + y \cos 0° + \sin 30° - \cot 45° = 5$ है, तो $x + 2y$ का मान ज्ञात कीजिए।

अथवा

(ख) $\dfrac{\tan^2 60°}{\sin^2 60° + \cos^2 30°}$ का मान ज्ञात कीजिए।

25. एक वृत्त के केंद्र के निर्देशांक $(2a, a - 7)$ हैं। यदि यह वृत्त बिंदु $(11, -9)$ से होकर जाता है तथा इसका व्यास $10\sqrt{2}$ इकाई है, तो 'a' का/के मान ज्ञात कीजिए।

खण्ड ग

*इस खण्ड में **6** लघु-उत्तरीय (SA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक के **3** अंक हैं।* *6×3=18*

26. यदि एक बेलन तथा शंकु के आधारों की त्रिज्याओं में 3 : 4 का अनुपात है तथा उनकी ऊँचाइयों में 2 : 3 का अनुपात है, तो उनके आयतनों में अनुपात ज्ञात कीजिए।

27. भौतिक विज्ञान, रसायन विज्ञान और गणित की पुस्तकों के तीन सेटों को इस प्रकार रखा जाना है कि सभी पुस्तकें विषयवार रखी जाएँ और प्रत्येक ढेर की ऊँचाई समान हो। भौतिक विज्ञान की पुस्तकों की संख्या 144 है, रसायन विज्ञान की पुस्तकों की संख्या 180 है और गणित की पुस्तकों की संख्या 192 है। यह मानते हुए कि सभी पुस्तकों की मोटाई बराबर है, भौतिक विज्ञान, रसायन विज्ञान और गणित की पुस्तकों के ढेरों की संख्या ज्ञात कीजिए।

28. दो पासे एक साथ उछाले गए। दोनों पासों पर आई संख्याओं का अन्तर 2 होने की प्रायिकता ज्ञात कीजिए।

29. (क) सिद्ध कीजिए कि : $\dfrac{\tan\theta}{1 - \cot\theta} + \dfrac{\cot\theta}{1 - \tan\theta} = 1 + \sec\theta \operatorname{cosec}\theta$

अथवा

(ख) सिद्ध कीजिए कि : $\dfrac{\sin A + \cos A}{\sin A - \cos A} + \dfrac{\sin A - \cos A}{\sin A + \cos A} = \dfrac{2}{2\sin^2 A - 1}$

• • •

24. (a) If $x \cos 60° + y \cos 0° + \sin 30° - \cot 45° = 5$, then find the value of $x + 2y$.

OR

(b) Evaluate : $\dfrac{\tan^2 60°}{\sin^2 60° + \cos^2 30°}$

25. The coordinates of the centre of a circle are $(2a, a - 7)$. Find the value(s) of 'a' if the circle passes through the point $(11, -9)$ and has diameter $10\sqrt{2}$ units.

SECTION C

*This section has **6** Short Answer (SA) type questions carrying **3** marks each.* $6 \times 3 = 18$

26. If the radii of the bases of a cylinder and a cone are in the ratio 3 : 4 and their heights are in the ratio 2 : 3, find the ratio of their volumes.

27. Three sets of Physics, Chemistry and Mathematics books have to be stacked in such a way that all the books are stored subject-wise and the height of each stack is the same. The number of Physics books is 144, the number of Chemistry books is 180 and the number of Mathematics books is 192. Assuming that the books are of same thickness, determine the number of stacks of Physics, Chemistry and Mathematics books.

28. Two dice are thrown at the same time. Determine the probability that the difference of the numbers on the two dice is 2.

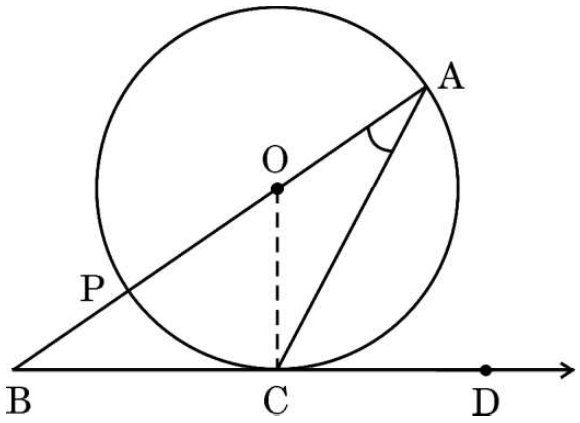
29. (a) Prove that : $\dfrac{\tan\theta}{1 - \cot\theta} + \dfrac{\cot\theta}{1 - \tan\theta} = 1 + \sec\theta \operatorname{cosec}\theta$

OR

(b) Prove that : $\dfrac{\sin A + \cos A}{\sin A - \cos A} + \dfrac{\sin A - \cos A}{\sin A + \cos A} = \dfrac{2}{2\sin^2 A - 1}$

• • •

30. (क) दी गई आकृति में, O वृत्त का केंद्र है तथा BCD बिंदु C पर स्पर्श-रेखा है। सिद्ध कीजिए कि $\angle BAC + \angle ACD = 90°$.



अथवा

(ख) सिद्ध कीजिए कि वृत्त के परिगत बने चतुर्भुज की आमने-सामने की (सम्मुख) भुजाएँ वृत्त के केंद्र पर संपूरक कोण अंतरित करती हैं।

31. वह अनुपात ज्ञात कीजिए जिसमें y-अक्ष बिंदुओं $(5, -6)$ तथा $(-1, -4)$ को मिलाने वाले रेखाखण्ड को विभाजित करता है। प्रतिच्छेदन बिंदु भी ज्ञात कीजिए।

खण्ड घ

*इस खण्ड में **4** दीर्घ-उत्तरीय (LA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक के **5** अंक हैं।* *4×5=20*

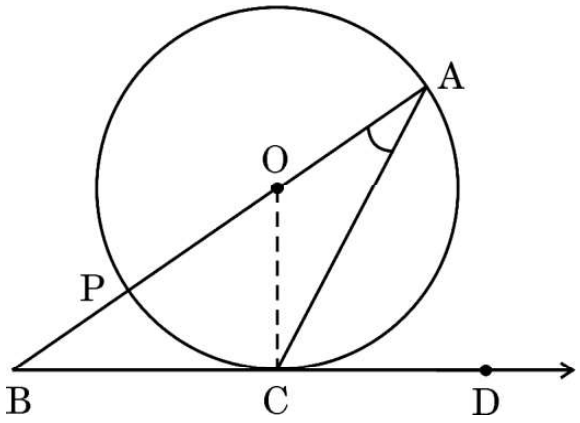
32. (क) एक समांतर चतुर्भुज ABCD का विकर्ण BD, रेखाखण्ड AE को बिंदु F पर काटता है, जहाँ E भुजा BC पर स्थित कोई बिंदु है। सिद्ध कीजिए कि $DF \times EF = FB \times FA$.

अथवा

(ख) ΔABC में, यदि $AD \perp BC$ तथा $AD^2 = BD \times DC$ है, तो सिद्ध कीजिए कि $\angle BAC = 90°$.

• • •

30. (a) In the given figure, O is the centre of the circle and BCD is tangent to it at C. Prove that $\angle BAC + \angle ACD = 90°$.



OR

(b) Prove that opposite sides of a quadrilateral circumscribing a circle subtend supplementary angles at the centre of the circle.

31. Find the ratio in which the y-axis divides the line segment joining the points $(5, -6)$ and $(-1, -4)$. Also find the point of intersection.

SECTION D

*This section has **4** Long Answer (LA) type questions carrying **5** marks each.* *4×5=20*

32. (a) The diagonal BD of a parallelogram ABCD intersects the line segment AE at the point F, where E is any point on the side BC. Prove that $DF \times EF = FB \times FA$.

OR

(b) In ΔABC, if $AD \perp BC$ and $AD^2 = BD \times DC$, then prove that $\angle BAC = 90°$.

• • •

33. निम्नलिखित बारंबारता बंटन एक इलाके के 68 उपभोक्ताओं की मासिक बिजली की खपत दर्शाता है। इन आँकड़ों का माध्य तथा बहुलक ज्ञात कीजिए :

मासिक खपत (यूनिटों में)	*उपभोक्ताओं की संख्या*
65 – 85	4
85 – 105	5
105 – 125	13
125 – 145	20
145 – 165	14
165 – 185	8
185 – 205	4

34. विजय ने दो योजनाओं A तथा B में, जो क्रमश: 8% वार्षिक तथा 9% वार्षिक ब्याज देती हैं, में कुछ-कुछ राशियाँ निवेश कीं। उसे कुल ₹ 1,860 वार्षिक ब्याज प्राप्त हुआ। यद्यपि, अगर उसने दो योजनाओं में निवेश की राशियों को आपस में बदल दिया होता, तो उसे वार्षिक ब्याज ₹ 20 अधिक प्राप्त होता। ज्ञात कीजिए कि उसने प्रत्येक योजना में कितनी राशि निवेश की।

35. (क) 2-अंकों की एक संख्या के अंकों का गुणनफल 12 है। जब इस संख्या में 36 जोड़े जाते हैं, तो अंकों के स्थान पलट जाते हैं। संख्या ज्ञात कीजिए।

अथवा

(ख) एक विद्यार्थी ने एक कक्षा-परीक्षा में गणित और विज्ञान में मिलाकर कुल 32 अंक प्राप्त किए। यदि उसने विज्ञान में 2 अंक कम प्राप्त किए होते तथा गणित में 4 अंक अधिक प्राप्त किए होते, तो उसके प्राप्तांकों का गुणनफल 253 होता। उसके द्वारा दोनों विषयों में प्राप्त अंक ज्ञात कीजिए।

• • •

33. The following frequency distribution gives the monthly consumption of electricity of 68 consumers of a locality. Find the mean and mode of the data :

Monthly Consumption (in units)	*Number of Consumers*
65 – 85	4
85 – 105	5
105 – 125	13
125 – 145	20
145 – 165	14
165 – 185	8
185 – 205	4

34. Vijay invested certain amounts of money in two schemes A and B, which offer interest at the rate of 8% per annum and 9% per annum, respectively. He received ₹ 1,860 as the total annual interest. However, had he interchanged the amounts of investments in the two schemes, he would have received ₹ 20 more as annual interest. How much money did he invest in each scheme ?

35. (a) A two-digit number is such that the product of its digits is 12. When 36 is added to this number, the digits interchange their places. Find the number.

OR

(b) A student scored a total of 32 marks in class tests in Mathematics and Science. Had he scored 2 marks less in Science and 4 marks more in Mathematics, the product of his marks would have been 253. Find his marks in the two subjects.

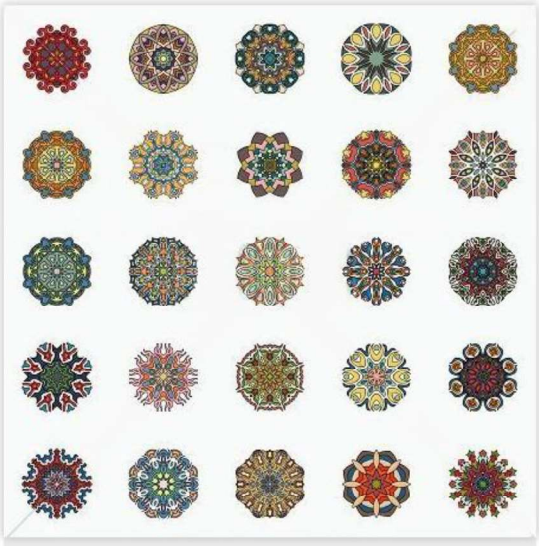
• • •

खण्ड ङ

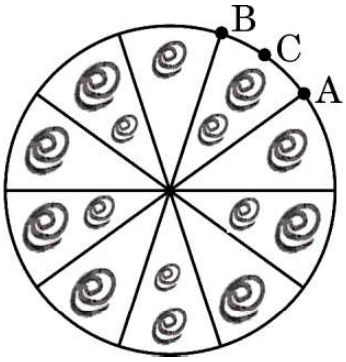
*इस खण्ड में **3** प्रकरण अध्ययन आधारित प्रश्न हैं जिनमें प्रत्येक के **4** अंक हैं।* *3×4=12*

प्रकरण अध्ययन – 1

36. ब्रोच एक सजावटी वस्तु है जिसे अकसर जैकेट, ब्लाउज़ या ड्रेस जैसे कपड़ों पर पहना जाता है ताकि सुंदरता बढ़ाई जा सके। बहुमूल्य धातुओं से निर्मित और रत्नों से सुसज्जित, ब्रोच कई आकार और डिज़ाइन में आते हैं।



एक ऐसे वृत्ताकार ब्रोच को चाँदी के तार से बनाया गया है, जिसका व्यास 35 mm है। तार को वृत्त के 5 व्यासों को बनाने में भी प्रयुक्त किया गया है, जो उसे 10 बराबर त्रिज्यखण्डों में विभाजित करता है, जैसा कि आकृति में दर्शाया गया है।



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

(i) प्रत्येक त्रिज्यखण्ड का केंद्रीय कोण ज्ञात कीजिए। *1*

(ii) चाप ACB की लंबाई ज्ञात कीजिए । *1*

(iii) (क) ब्रोच के प्रत्येक त्रिज्यखण्ड का क्षेत्रफल ज्ञात कीजिए। *2*

अथवा

(iii) (ख) प्रयोग की गई चाँदी के तार की कुल लंबाई ज्ञात कीजिए। *2*

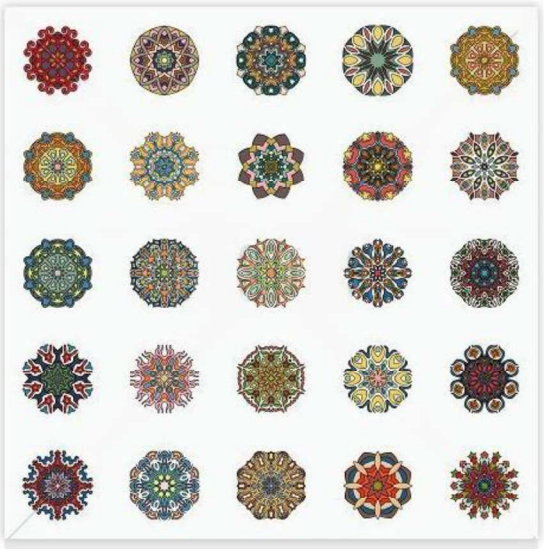
• • •

SECTION E

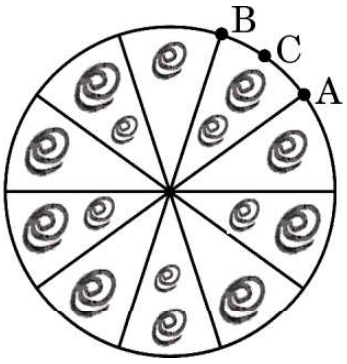
*This section has **3** case study based questions carrying **4** marks each.* *3×4=12*

Case Study – 1

36. A brooch is a decorative piece often worn on clothing like jackets, blouses or dresses to add elegance. Made from precious metals and decorated with gemstones, brooches come in many shapes and designs.



One such brooch is made with silver wire in the form of a circle with diameter 35 mm. The wire is also used in making 5 diameters which divide the circle into 10 equal sectors as shown in the figure.



Based on the above given information, answer the following questions :

(i) Find the central angle of each sector. *1*

(ii) Find the length of the arc ACB. *1*

(iii) (a) Find the area of each sector of the brooch. *2*

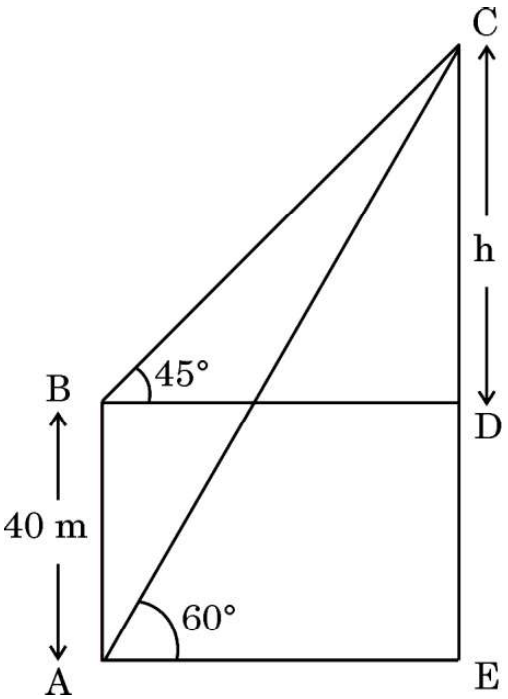
OR

(iii) (b) Find the total length of the silver wire used. *2*

• • •

प्रकरण अध्ययन – 2

37. अमृता एक लाइटहाउस के आधार से कुछ दूरी पर खड़ी है तथा इसके शीर्ष को देख रही है। उसने शीर्ष का उन्नयन कोण 60° पाया। तब, वह अपने प्रारंभिक स्थान से निकट 40 मीटर ऊँचे एक अवलोकन डेक पर चढ़ गई तथा वहाँ से उसने लाइटहाउस के शीर्ष का उन्नयन कोण 45° पाया।



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

(i) यदि CD की लंबाई h मीटर है, तो 'h' के पदों में दूरी BD ज्ञात कीजिए। *1*

(ii) 'h' के पदों में दूरी BC ज्ञात कीजिए। *1*

(iii) (क) लाइटहाउस की ऊँचाई CE ज्ञात कीजिए। [$\sqrt{3}$ = 1·73 प्रयोग कीजिए] *2*

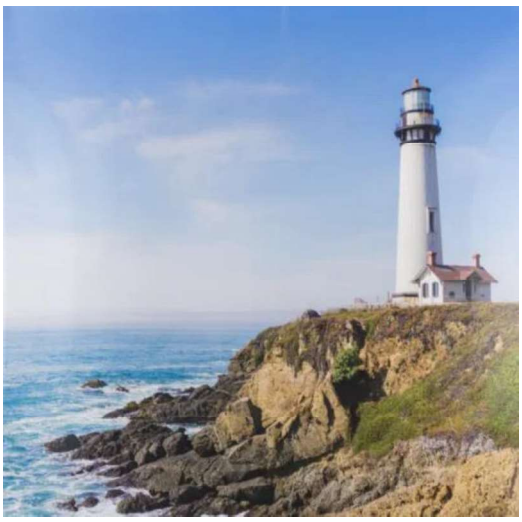
अथवा

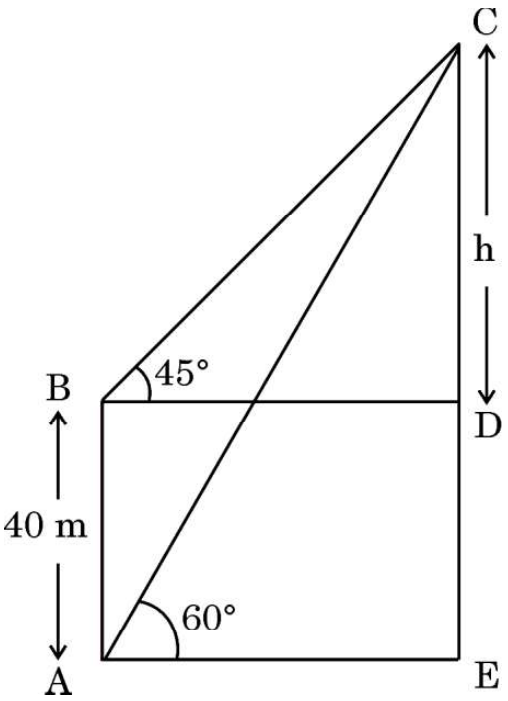
(iii) (ख) यदि AC = 100 m है, तो दूरी AE ज्ञात कीजिए। *2*

• • •

Case Study – 2

37. Amrita stood near the base of a lighthouse, gazing up at its towering height. She measured the angle of elevation to the top and found it to be 60°. Then, she climbed a nearby observation deck, 40 metres higher than her original position and noticed the angle of elevation to the top of lighthouse to be 45°.





Based on the above given information, answer the following questions :

(i) If CD is h metres, find the distance BD in terms of 'h'. *1*

(ii) Find distance BC in terms of 'h'. *1*

(iii) (a) Find the height CE of the lighthouse [Use $\sqrt{3}$ = 1·73] *2*

OR

(iii) (b) Find distance AE, if AC = 100 m. *2*

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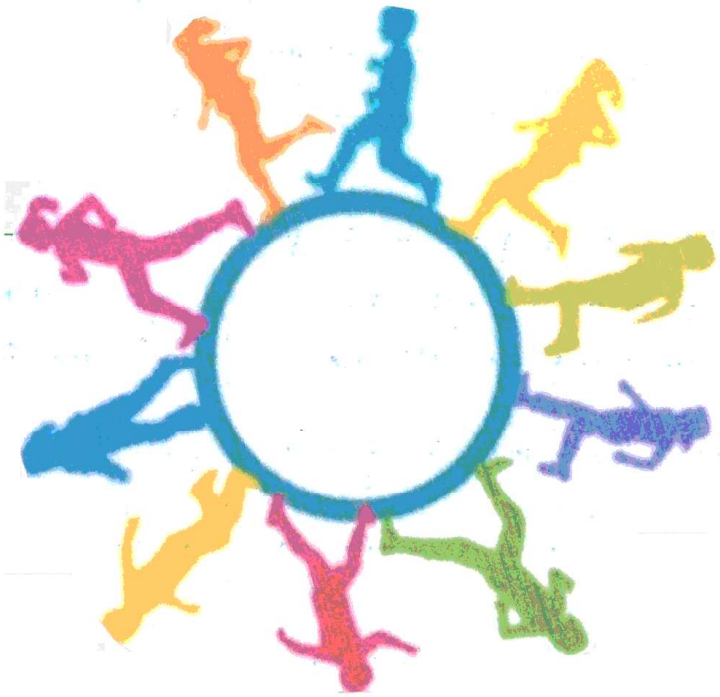
प्रकरण अध्ययन – 3

38. एक विद्यालय स्थानीय अस्पताल के लिए धन जुटाने हेतु चैरिटी दौड़ का आयोजन कर रहा है। दौड़ की योजना एक ट्रैक के चारों ओर कई चक्करों की श्रृंखला के रूप में बनाई गई है, जिसमें प्रत्येक चक्कर 300 मीटर का होगा। इस आयोजन को और अधिक चुनौतीपूर्ण और आकर्षक बनाने के लिए, आयोजकों ने अगले प्रत्येक चक्कर की दूरी को 50 मीटर बढ़ाने का फैसला किया। उदाहरण के लिए, दूसरा चक्कर 350 मीटर, तीसरा चक्कर 400 मीटर और इसी प्रकार आगे। योजनाबद्ध चक्करों की कुल संख्या 10 है।



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

(i) इस प्रकार बनी समांतर श्रेढ़ी का चौथा, पाँचवाँ तथा छठा पद लिखिए। *1*

(ii) 8वें चक्कर में तय की गई दूरी ज्ञात कीजिए। *1*

(iii) (क) 10 चक्कर पूरे करने पर तय की गई कुल दूरी ज्ञात कीजिए। *2*

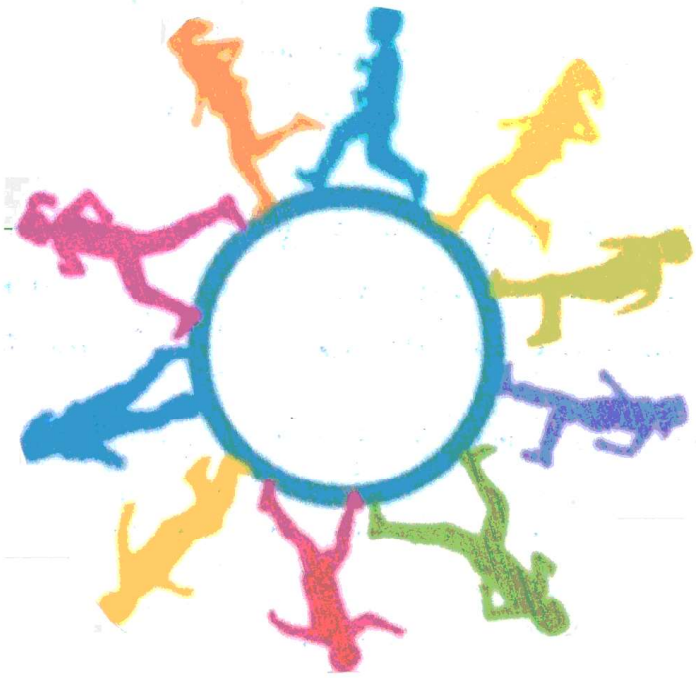
अथवा

(iii) (ख) यदि एक दौड़ने वाला केवल पहले 6 चक्कर पूरे कर पाए, तो उसके द्वारा तय की गई कुल दूरी ज्ञात कीजिए। *2*

• • •

Case Study – 3

38. A school is organizing a charity run to raise funds for a local hospital. The run is planned as a series of rounds around a track, with each round being 300 metres. To make the event more challenging and engaging, the organizers decide to increase the distance of each subsequent round by 50 metres. For example, the second round will be 350 metres, the third round will be 400 metres and so on. The total number of rounds planned is 10.



Based on the information given above, answer the following questions :

(i) Write the fourth, fifth and sixth term of the Arithmetic Progression so formed. *1*

(ii) Determine the distance of the 8^{th} round. *1*

(iii) (a) Find the total distance run after completing all 10 rounds. *2*

OR

(iii) (b) If a runner completes only the first 6 rounds, what is the total distance run by the runner ? *2*

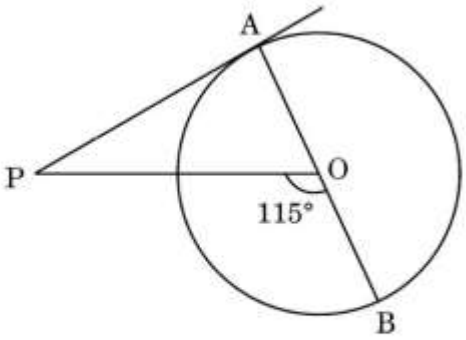
Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2025
MATHEMATICS (Standard) (Q.P. CODE 30/1/2)

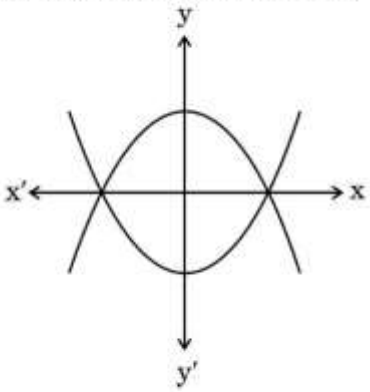
General Instructions: -

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 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. In class-X, while evaluating two competency-based questions, please try to understand given answer and even if reply is not from Marking Scheme but correct competency is enumerated by the candidate, 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 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 un assessed 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)

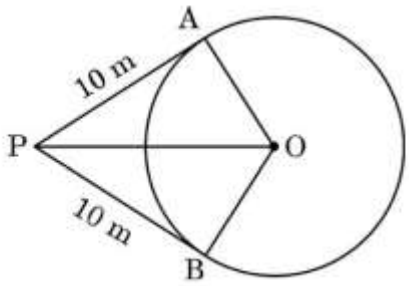
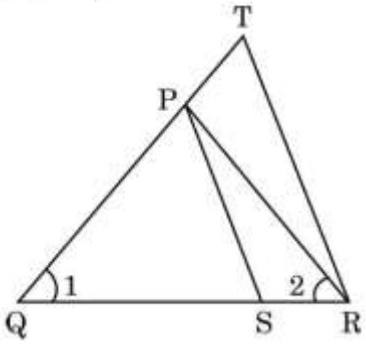
Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Marks
	SECTION A This section has 20 Multiple Choice Questions (MCQs) carrying 1 mark each.	
1.	In the given figure, PA is a tangent from an external point P to a circle with centre O. If $\angle$ POB = 115°, then $\angle$ APO is equal to :  (A) 25° (B) 65° (C) 90° (D) 35°	
Sol.	(A) 25°	**1**
2.	A piece of wire 20 cm long is bent into the form of an arc of a circle of radius $\frac{60}{\pi}$ cm. The angle subtended by the arc at the centre of the circle is : (A) 30° (B) 60° (C) 90° (D) 50°	
Sol.	(B) 60°	**1**
3.	Three numbers in AP have the sum 30. What is its middle term ? (A) 4 (B) 10 (C) 16 (D) 8	
Sol.	(B) 10	**1**

4.	An arc of a circle is of length 5π cm and the sector it bounds has an area of 20π cm^2. Its radius is : (A) 10 cm (B) 1 cm (C) 5 cm (D) 8 cm	
Sol.	(D) 8 cm	**1**
5.	If x = 1 and y = 2 is a solution of the pair of linear equations $2x - 3y + a = 0$ and $2x + 3y - b = 0$, then : (A) $a = 2b$ (B) $2a = b$ (C) $a + 2b = 0$ (D) $2a + b = 0$	
Sol.	(B) $2a = b$	**1**
6.	Two polynomials are shown in the graph below. The number of distinct zeroes of both the polynomials is :  (A) 3 (B) 5 (C) 2 (D) 4	
Sol.	(C) 2	**1**
7.	If $\alpha + \beta = 90°$ and $\alpha = 2\beta$, then $\cos^2\alpha + \sin^2\beta$ is equal to : (A) 0 (B) $\frac{1}{2}$ (C) 1 (D) 2	
Sol.	(B) $\frac{1}{2}$	**1**

8.	A card is selected at random from a deck of 52 playing cards. The probability of it being a red face card is : (A) $\frac{3}{13}$ (B) $\frac{2}{13}$ (C) $\frac{1}{2}$ (D) $\frac{3}{26}$	
Sol.	(D) $\frac{3}{26}$	**1**
9.	If α and β are the zeroes of polynomial $3x^2 + 6x + k$ such that $\alpha + \beta + \alpha\beta = -\frac{2}{3}$, then the value of k is : (A) -8 (B) 8 (C) -4 (D) 4	
Sol.	(D) 4	**1**
10.	The value of $\tan^2\theta - \left(\frac{1}{\cos\theta} \times \sec\theta\right)$ is : (A) 1 (B) 0 (C) -1 (D) 2	
Sol.	(C) -1	**1**
11.	Which of the following is a rational number between $\sqrt{3}$ and $\sqrt{5}$? (A) 1·4142387954012 .... (B) $2{\cdot}32\overline{6}$ (C) π (D) 1·857142	
Sol.	(D) 1.857142	**1**
12.	If HCF(98, 28) = m and LCM(98, 28) = n, then the value of $n - 7m$ is : (A) 0 (B) 28 (C) 98 (D) 198	
Sol.	(C) 98	**1**

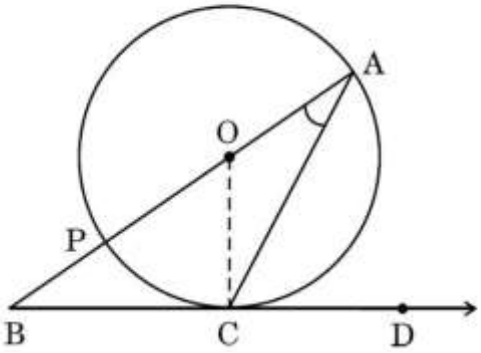
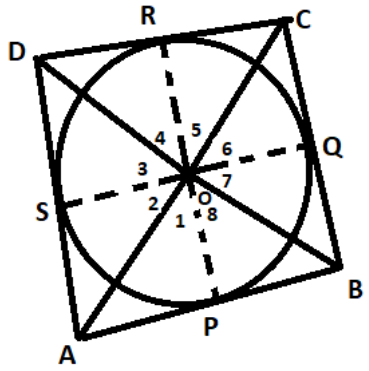
13.	If the length of a chord of a circle is equal to its radius, then the angle subtended by chord at the centre is : (A) 60° (B) 30° (C) 120° (D) 90°	
Sol.	(A) 60°	**1**
14.	The greatest number which divides 70 and 125, leaving remainders 5 and 8 respectively, is : (A) 13 (B) 65 (C) 875 (D) 1750	
Sol.	(A) 13	**1**
15.	A ladder 14 m long leans against a wall. If the foot of the ladder is 7 m from the wall, then the angle of elevation of the top of the wall is : (A) 15° (B) 30° (C) 45° (D) 60°	
Sol.	(D) 60°	**1**
16.	In triangles ABC and DEF, $\angle B = \angle E$, $\angle F = \angle C$ and AB = 3 DE. Then, the two triangles are : (A) congruent but not similar (B) congruent as well as similar (C) neither congruent nor similar (D) similar but not congruent	
Sol.	(D) similar but not congruent	**1**
17.	The mid-point of the line segment joining the points P(– 4, 5) and Q(4, 6) lies on : (A) x-axis (B) y-axis (C) origin (D) neither x-axis nor y-axis	
Sol.	(B) y – axis	**1**

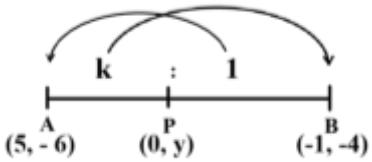
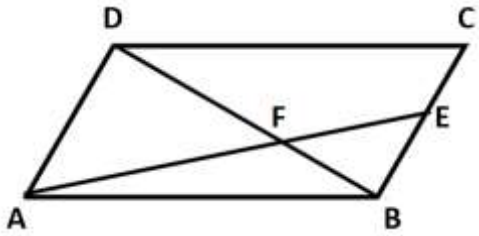
18.	Mode and Mean of a data are 15x and 18x, respectively. Then the median of the data is : (A) x (B) 11x (C) 17x (D) 34x	
Sol.	(C) 17x	**1**
	*Questions number **19** and **20** are Assertion and Reason based questions. Two statements are given, one labelled as Assertion (A) and the other is labelled 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) :* If we join two hemispheres of same radius along their bases, then we get a sphere. *Reason (R):* Total Surface Area of a sphere of radius r is $3\pi r^2$.	
Sol.	(C) Assertion (A) is true, but Reason (R) is false.	**1**
20.	*Assertion (A) :* The probability of selecting a number at random from the numbers 1 to 20 is 1. *Reason (R):* For any event E, if P(E) = 1, then E is called a sure event.	
Sol.	(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).	**1**
	SECTION B This section has **5** Very Short Answer (VSA) type questions carrying **2** marks each.	
21.	If the zeroes of the polynomial $x^2 + ax + b$ are in the ratio 3 : 4, then prove that $12a^2 = 49b$.	
Sol.	Let the zeroes are 3α and 4α $3\alpha + 4\alpha = -a$ $\Rightarrow 7\alpha = -a$ Also, $12\alpha^2 = b$ $LHS = 12a^2 = 12(-7\alpha)^2 = 49 \times 12(\alpha)^2 = 49b$ = RHS	 ½ ½ **1**

22.	A person is standing at P outside a circular ground at a distance of 26 m from the centre of the ground. He found that his distances from the points A and B on the ground are 10 m (PA and PB are tangents to the circle). Find the radius of the circular ground.  	
Sol.	$\angle$ OAP = 90° In right Δ OAP, $(26)^2 = OA^2 + (10)^2$ $\Rightarrow$ OA = $\sqrt{576}$ = 24 $\therefore$ radius = 24 m	½ **1** ½
23 (a)	If Δ ABC ~ Δ PQR in which AB = 6 cm, BC = 4 cm, AC = 8 cm and PR = 6 cm, then find the length of (PQ + QR).	
Sol.	$\frac{6}{PQ} = \frac{4}{QR} = \frac{8}{6}$ $\Rightarrow$ PQ = $\frac{9}{2}$ cm or 4.5 cm and QR = 3 cm $\therefore$ PQ + QR = 7.5cm	½ ½ ½ ½
	OR	
23 (b)	In the given figure, $\frac{QR}{QS} = \frac{QT}{PR}$ and $\angle 1 = \angle 2$, show that Δ PQS ~ Δ TQR.  	
Sol.	In Δ PQR, $\angle 1 = \angle 2$ $\therefore$ PR = PQ $\therefore$ $\frac{QR}{QS} = \frac{QT}{PR} \Rightarrow \frac{QR}{QS} = \frac{QT}{PQ}$ Also, $\angle 1 = \angle 1$ $\therefore$ Δ PQS ~ Δ TQR	½ ½ ½ ½

24 (a)	If $x \cos 60° + y \cos 0° + \sin 30° - \cot 45° = 5$, then find the value of $x + 2y$.	
Sol.	$x\left(\frac{1}{2}\right) + y\,(1) + \frac{1}{2} - 1 = 5$ $\Rightarrow \quad x + 2y = 11$	**1½** ½
	OR	
24 (b)	Evaluate : $\frac{\tan^2 60°}{\sin^2 60° + \cos^2 30°}$	
Sol.	$\frac{(\sqrt{3})^2}{\left(\frac{\sqrt{3}}{2}\right)^2 + \left(\frac{\sqrt{3}}{2}\right)^2}$ $= 2$	**1½** ½
25.	The coordinates of the centre of a circle are $(2a, a - 7)$. Find the value(s) of 'a' if the circle passes through the point $(11, -9)$ and has diameter $10\sqrt{2}$ units.	
Sol.	radius = $5\sqrt{2}$ units $(2a - 11)^2 + (a - 7 + 9)^2 = 50$ $\Rightarrow a^2 - 8a + 15 = 0$ $\Rightarrow (a - 5)(a - 3) = 0$ $\Rightarrow a = 5, 3$	½ ½ ½ ½
	SECTION C This section has **6** Short Answer (SA) type questions carrying **3** marks each.	
26.	If the radii of the bases of a cylinder and a cone are in the ratio 3 : 4 and their heights are in the ratio 2 : 3, find the ratio of their volumes.	
Sol.	Let radius of cylinder = r_1 & height of cylinder = h_1 Let radius of cone = r_2 & height of cone = h_2 $\frac{r_1}{r_2} = \frac{3}{4}, \quad \frac{h_1}{h_2} = \frac{2}{3}$ $\frac{volume\ of\ cylinder}{volume\ of\ cone} = \frac{\pi {r_1}^2 h_1}{\frac{1}{3}\pi {r_2}^2 h_2} = 3 \times \left(\frac{r_1}{r_2}\right)^2 \times \left(\frac{h_1}{h_2}\right)$ $= 3 \times \left(\frac{3}{4}\right)^2 \times \left(\frac{2}{3}\right)$ $= \frac{9}{8}$ Hence, required ratio is 9:8	**1** **1** **1**

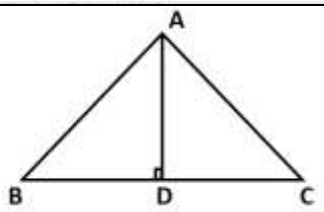
27.	Three sets of Physics, Chemistry and Mathematics books have to be stacked in such a way that all the books are stored subject-wise and the height of each stack is the same. The number of Physics books is 144, the number of Chemistry books is 180 and the number of Mathematics books is 192. Assuming that the books are of same thickness, determine the number of stacks of Physics, Chemistry and Mathematics books.	
Sol.	$144 = 2^4 \times 3^2$ $180 = 2^2 \times 3^2 \times 5$ $192 = 2^6 \times 3$ HCF $= 2^2 \times 3 = 12$ Number of stacks of Physics Books $= \frac{144}{12} = 12$ Number of stacks of Chemistry Books $= \frac{180}{12} = 15$ Number of stacks of Mathematics Books $= \frac{192}{12} = 16$	**1½** ½ **1**
28	Two dice are thrown at the same time. Determine the probability that the difference of the numbers on the two dice is 2.	
Sol.	Total outcomes = 36 Number of Outcomes with difference of the numbers on the two dice is 2 = 8 (1,3) (3,1) (4,2) (2,4) (5,3) (3,5) (4,6) (6,4) P (difference of the numbers on the two dice is 2) $= \frac{8}{36}$ or $\frac{2}{9}$	**1** **1** **1**
29 (a)	Prove that : $\frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta} = 1 + \sec\theta \operatorname{cosec}\theta$	
Sol.	LHS $= \frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta}$ $= \frac{\frac{\sin\theta}{\cos\theta}}{1-\frac{\cos\theta}{\sin\theta}} + \frac{\frac{\cos\theta}{\sin\theta}}{1-\frac{\sin\theta}{\cos\theta}}$ $= \frac{\sin^2\theta}{\cos\theta(\sin\theta-\cos\theta)} - \frac{\cos^2\theta}{\sin\theta(\sin\theta-\cos\theta)}$ $= \frac{1}{(\sin\theta-\cos\theta)}\left[\frac{\sin^3\theta-\cos^3\theta}{\sin\theta\cos\theta}\right]$ $= \frac{(\sin\theta-\cos\theta)(\sin^2\theta+\sin\theta\cos\theta+\cos^2\theta)}{(\sin\theta-\cos\theta)\sin\theta\cos\theta}$ $= \frac{(1+\sin\theta\cos\theta)}{\sin\theta\cos\theta}$ $= 1+\sec\theta\operatorname{cosec}\theta$ = RHS	½ **1** ½ ½ ½
	OR	
29 (b)	Prove that : $\frac{\sin A+\cos A}{\sin A-\cos A} + \frac{\sin A-\cos A}{\sin A+\cos A} = \frac{2}{2\sin^2 A-1}$	
Sol.	LHS $= \frac{\sin A+\cos A}{\sin A-\cos A} + \frac{\sin A-\cos A}{\sin A+\cos A}$	

	$= \frac{(\sin A + \cos A)^2 + (\sin A - \cos A)^2}{(\sin A - \cos A)(\sin A + \cos A)}$ $= \frac{\sin^2 A + \cos^2 A + 2 \sin A \cos A + \sin^2 A + \cos^2 A - 2 \sin A \cos A}{\sin^2 A - \cos^2 A}$ $= \frac{1+1}{\sin^2 A - (1 - \sin^2 A)}$ $= \frac{2}{2\sin^2 A - 1}$ = RHS	**1** **1** ½ ½
30 (a)	In the given figure, O is the centre of the circle and BCD is tangent to it at C. Prove that $\angle BAC + \angle ACD = 90°$.  	
Sol.	In Δ OAC, OA = OC $\Rightarrow \angle$ OCA = $\angle$ OAC Now, $\angle$ OCD = 90° $\Rightarrow \angle$ OCA + $\angle$ ACD = 90° $\Rightarrow \angle$ OAC + $\angle$ ACD = 90° or $\angle$ BAC + $\angle$ ACD = 90°	**1** **1** ½ ½
	OR	
30 (b)	Prove that opposite sides of a quadrilateral circumscribing a circle subtend supplementary angles at the centre of the circle.	
Sol.	 Correct Figure Δ OAP $\cong \Delta$ OAS $\therefore \angle 1 = \angle 2$ Similarly, $\angle 3 = \angle 4$, $\angle 5 = \angle 6$, $\angle 7 = \angle 8$ Also, $\angle 1 + \angle 2 + \angle 3 + \angle 4 + \angle 5 + \angle 6 + \angle 7 + \angle 8 = 360°$	½ **1** ½

	$\Rightarrow 2(\angle 1 + \angle 4 + \angle 5 + \angle 8) = 360°$ $\Rightarrow \angle AOB + \angle COD = 180°$ Similarly, $\angle BOC + \angle AOD = 180°$	½ ½
31.	Find the ratio in which the y-axis divides the line segment joining the points $(5, -6)$ and $(-1, -4)$. Also find the point of intersection.	
Sol.	 Let the ratio be k:1 and point on y- axis be P(0, y) $0 = \frac{-k+5}{k+1}$ $k = 5$ Hence, ratio is 5:1 $y = \frac{-4(5)-6}{5+1} = \frac{-26}{6} = \frac{-13}{3}$ Coordinates of point of intersection are $P\left(0, -\frac{13}{3}\right)$	½ **1** ½ ½ ½
	SECTION D This section has **4** Long Answer (LA) type questions carrying **5** marks each.	
32 (a)	The diagonal BD of a parallelogram ABCD intersects the line segment AE at the point F, where E is any point on the side BC. Prove that $DF \times EF = FB \times FA$.	
Sol.	 Correct figure In Δ ADF and Δ EBF, $\angle DFA = \angle EFB$ $\angle ADF = \angle FBE$ $\therefore \Delta ADF \sim \Delta EBF$ $\therefore \frac{DF}{FB} = \frac{FA}{EF}$ $\Rightarrow DF \times EF = FB \times FA$	**1** **2** **1** **1**
	OR	

32 (b) In ΔABC, if $AD \perp BC$ and $AD^2 = BD \times DC$, then prove that $\angle BAC = 90°$.

Sol.



Correct figure **1**

$AD^2 = BD \times DC$

$\frac{AD}{DC} = \frac{BD}{AD}$ **1**

Also, $\angle ADB = \angle ADC$

$\therefore \Delta DBA \sim \Delta DAC$ **1**

$\angle DBA = \angle DAC$

$\angle BAD = \angle DCA$ **1**

Adding both

$\angle DBA + \angle DCA = \angle DAC + \angle BAD$

$\therefore \quad \angle BAC = 90°$ **1**

33. The following frequency distribution gives the monthly consumption of electricity of 68 consumers of a locality. Find the mean and mode of the data :

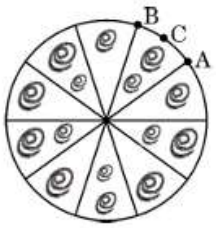
Monthly Consumption (in units)	*Number of Consumers*
65 – 85	4
85 – 105	5
105 – 125	13
125 – 145	20
145 – 165	14
165 – 185	8
185 – 205	4

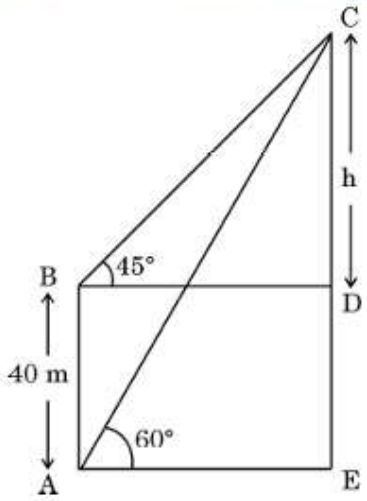
Sol.

Monthly Consumption (in units)	f_i	x_i	$u_i = \frac{x_i - 135}{h}$	$f_i u_i$
65-85	4	75	-3	-12
85-105	5	95	-2	-10
105-125	13	115	-1	-13
125-145	20	135=a	0	0
145-165	14	155	1	14
165-185	8	175	2	16
185-205	4	195	3	12
Total	68			7

Correct Table **1½**

	Mean = $135 + \frac{7}{68} \times 20$ = 137.06 Modal Class is 125-145 Mode = $125 + \left(\frac{20-13}{40-13-14}\right) \times 20$ = 135.77 Hence, Mean = 137.06 units and Mode = 135.77 units	**1** ½ ½ **1** ½
34.	Vijay invested certain amounts of money in two schemes A and B, which offer interest at the rate of 8% per annum and 9% per annum, respectively. He received ₹ 1,860 as the total annual interest. However, had he interchanged the amounts of investments in the two schemes, he would have received ₹ 20 more as annual interest. How much money did he invest in each scheme ?	
Sol.	Let Vijay invested ₹ x at 8% rate of interest & ₹ y at 9% rate of interest ATQ, $\frac{8x}{100} + \frac{9y}{100} = 1860$ or $8x + 9y = 186000$ ……..(i) $\frac{9x}{100} + \frac{8y}{100} = 1880$ or $9x + 8y = 188000$ ……..(ii) On solving (i) and (ii), we get x = 12000 y = 10000 Hence, money invested in scheme A is ₹ 12000 and scheme B is ₹ 10000.	**1½** **1½** **1** **1**
35 (a)	A two-digit number is such that the product of its digits is 12. When 36 is added to this number, the digits interchange their places. Find the number.	
Sol.	Let unit digit be y and ten's digit = x hence, the two digit number = 10x + y, ATQ $xy = 12$ ….. (i) $10x + y + 36 = 10y + x$ $x - y + 4 = 0$ ……. (ii) From (i) and (ii) $x^2 + 4x - 12 = 0$ $(x + 6)(x - 2) = 0$ Hence, $x = 2$ and $y = 6$ ∴ Number = 26	½ ½ **1** **1** ½ ½ ½ ½
	OR	

35 (b)	A student scored a total of 32 marks in class tests in Mathematics and Science. Had he scored 2 marks less in Science and 4 marks more in Mathematics, the product of his marks would have been 253. Find his marks in the two subjects.	
Sol.	Let marks scored in Mathematics be x and marks scored in Science be y ATQ, $x + y = 32$ …… (i) $and\ (x + 4)(y - 2) = 253$ ….. (ii) from (i) and (ii) $x^2 - 26x + 133 = 0$ $(x - 19)(x - 7) = 0$ $x = 19, 7$ $x = 19 \Longrightarrow y = 13$ $x = 7 \Longrightarrow y = 25$ Hence, marks in Mathematics and Science are 19, 13 or 7, 25	**1** **1** **1** **1** ½ ½
	SECTION E This section has **3** case study based carrying **4** marks each.	
36.	**Case Study – 1** A brooch is a decorative piece often worn on clothing like jackets, blouses or dresses to add elegance. Made from precious metals and decorated with gemstones, brooches come in many shapes and designs.  One such brooch is made with silver wire in the form of a circle with diameter 35 mm. The wire is also used in making 5 diameters which divide the circle into 10 equal sectors as shown in the figure.  Based on the above given information, answer the following questions : (i) Find the central angle of each sector. (ii) Find the length of the arc ACB. (iii) (a) Find the area of each sector of the brooch. **OR** (iii) (b) Find the total length of the silver wire used.	
Sol.	(i) central angle = $\frac{360^0}{10}$ = 36°	**1**

	(ii) length of arc ACB = $\frac{1}{10} \times 2 \times \frac{22}{7} \times \frac{35}{2}$ = 11mm	**1**
	(iii)(a) Area of each sector of the brooch = $\frac{1}{10} \times \frac{22}{7} \times \frac{35}{2} \times \frac{35}{2}$	**1**
	$= \frac{385}{4}$ mm^2 or 96.25 mm^2	**1**
	OR	
	(iii) (b) length of silver wire used = $2 \times \frac{22}{7} \times \frac{35}{2} + 5 \times 35$	**1**
	= 285 mm	**1**
37.	**Case Study – 2** Amrita stood near the base of a lighthouse, gazing up at its towering height. She measured the angle of elevation to the top and found it to be 60°. Then, she climbed a nearby observation deck, 40 metres higher than her original position and noticed the angle of elevation to the top of lighthouse to be 45°.   Based on the above given information, answer the following questions : (i) **If CD is h metres, find the distance BD in terms of 'h'.** (ii) **Find distance BC in terms of 'h'.** (iii) (a) Find the height CE of the lighthouse [Use $\sqrt{3}$ = 1·73] **OR** (iii) (b) Find distance AE, if AC = 100 m.	
Sol.	(i) $\frac{h}{BD} = \tan 45° = 1$	½
	$\Rightarrow$BD = h m	½
	(ii) $\frac{h}{BC} = \sin 45° = \frac{1}{\sqrt{2}}$	½
	$\Rightarrow$BC = $\sqrt{2}$h m	½

	(iii)(a) $\tan 60° = \frac{EC}{AE}$ $\Rightarrow \sqrt{3} = \frac{h+40}{h}$ $\Rightarrow$ $h = 20(\sqrt{3}+1) = 20 \times 2.73 = 54.6$ m $\therefore$ CE = 54.6 + 40 = 94.6 m **OR** (iii)(b) $\cos 60° = \frac{AE}{AC}$ $\Rightarrow \frac{1}{2} = \frac{AE}{100}$ $\therefore$ AE = 50 m	**1** ½ ½ **1** **1**
38.	**Case Study – 3** A school is organizing a charity run to raise funds for a local hospital. The run is planned as a series of rounds around a track, with each round being 300 metres. To make the event more challenging and engaging, the organizers decide to increase the distance of each subsequent round by 50 metres. For example, the second round will be 350 metres, the third round will be 400 metres and so on. The total number of rounds planned is 10.  Based on the information given above, answer the following questions : (i) Write the fourth, fifth and sixth term of the Arithmetic Progression so formed. (ii) Determine the distance of the 8^{th} round. (iii) (a) Find the total distance run after completing all 10 rounds. **OR** (iii) (b) If a runner completes only the first 6 rounds, what is the total distance run by the runner ?	
Sol.	A.P formed is 300, 350, 400…… (i) $a_4 = 450$ $a_5 = 500$ $a_6 = 550$ (ii) $a_8 = 300 + 7 \times 50$ $= 650$ m	**1** ½ ½

	(iii) (a) $S_{10} = \frac{10}{2} \times (2 \times 300 + 9 \times 50)$ $= 5250$ m **OR** (iii) (b) $S_6 = \frac{6}{2} \times (2 \times 300 + 5 \times 50)$ $= 2250$ m	**1** **1** **1** **1**