Series : GE1FH

SET~3

रोल नं.
Roll No.

प्रश्न-पत्र कोड
Q.P. Code 30/1/3

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***

• • •

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।* $20 \times 1 = 20$

1. यदि किन्हीं आँकड़ों के माध्यक तथा माध्य क्रमश: 9·6 तथा 10·5 हैं, तो इन आँकड़ों का बहुलक क्या है ?

(A) 7·8

(B) 12·3

(C) 8·4

(D) 7

• • •

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. What is the mode of a data if median and mean of the same data are 9·6 and 10·5, respectively ?

(A) 7·8

(B) 12·3

(C) 8·4

(D) 7

• • •

2. $(\tan A \operatorname{cosec} A)^2 - (\sin A \sec A)^2$ का मान है :

(A) 0

(B) 1

(C) -1

(D) 2

3. एक पतंग भूमि से 150 m की ऊँचाई पर उड़ रही है। यह जिस डोरी से जुड़ी है वह भूमि की क्षैतिज दिशा से $30°$ का कोण बनाती है। डोरी की लंबाई है :

(A) $100\sqrt{3}$ m

(B) 300 m

(C) $150\sqrt{2}$ m

(D) $150\sqrt{3}$ m

4. 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

5. यदि θ न्यूनकोण है तथा $7 + 4 \sin \theta = 9$ है, तो θ का मान है :

(A) $90°$

(B) $30°$

(C) $45°$

(D) $60°$

• • •

2. The value of $(\tan A \operatorname{cosec} A)^2 - (\sin A \sec A)^2$ is :

(A) 0

(B) 1

(C) –1

(D) 2

3. A kite is flying at a height of 150 m from the ground. It is attached to a string inclined at an angle of 30° to the horizontal. The length of the string is :

(A) $100\sqrt{3}$ m

(B) 300 m

(C) $150\sqrt{2}$ m

(D) $150\sqrt{3}$ m

4. 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

5. If θ is an acute angle and $7 + 4 \sin \theta = 9$, then the value of θ is :

(A) 90°

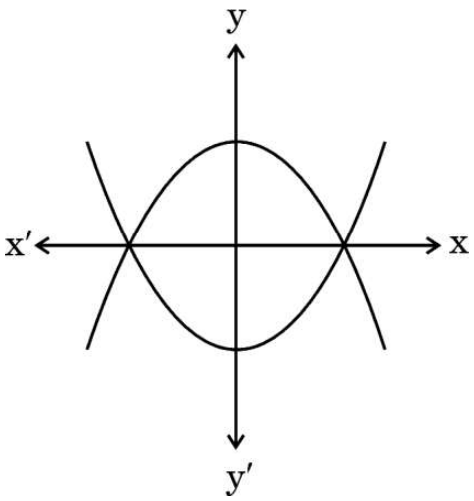
(B) 30°

(C) 45°

(D) 60°

• • •

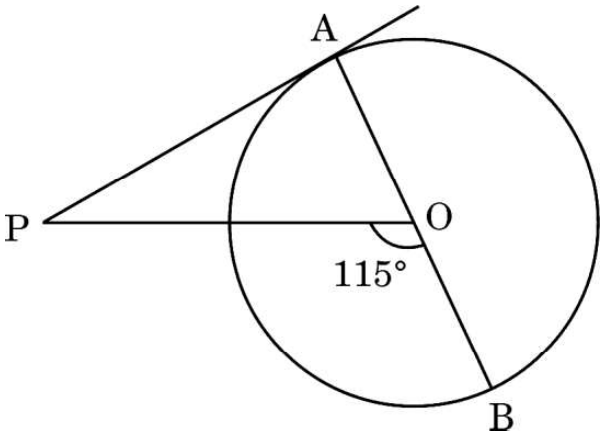
6. नीचे दिए गए ग्राफ में, दो बहुपदों को दिखाया गया है। इन दोनों बहुपदों के भिन्न शून्यकों की संख्या है :



(A) 3 (B) 5

(C) 2 (D) 4

7. 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°

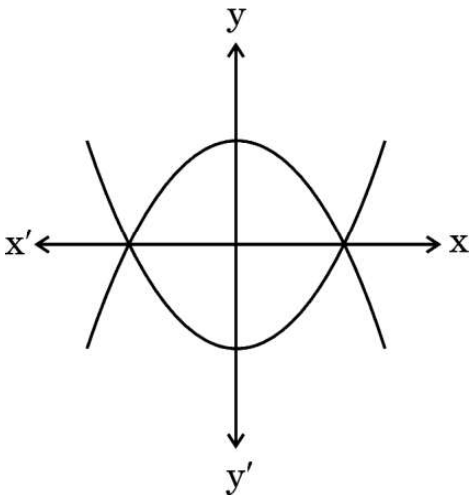
8. 20 cm लंबे तार के एक टुकड़े को $\frac{60}{\pi}$ cm त्रिज्या वाले वृत्त की एक चाप के रूप में मोड़ा गया। इस वृत्त के केन्द्र पर चाप द्वारा अंतरित कोण है :

(A) 30° (B) 60°

(C) 90° (D) 50°

• • •

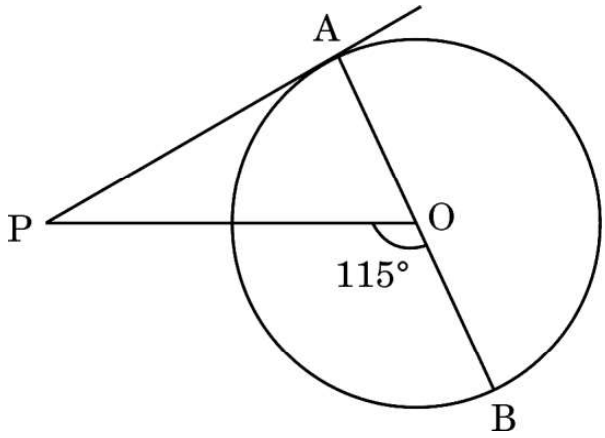
6. Two polynomials are shown in the graph below. The number of distinct zeroes of both the polynomials is :



(A) 3 (B) 5

(C) 2 (D) 4

7. 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°

8. 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°

• • •

9. 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

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

(A) 1·4142387954012 ....

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

(C) π

(D) 1·857142

11. बहुपद $p(x) = 5x - 7x^2 + 3$ के शून्यकों का योगफल है :

(A) $\frac{-7}{5}$ (B) $\frac{7}{5}$

(C) $\frac{5}{7}$ (D) $\frac{-5}{7}$

12. 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) $2a + b = 0$

• • •

9. 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

10. 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

11. The sum of the zeroes of the polynomial $p(x) = 5x - 7x^2 + 3$ is :

(A) $\frac{-7}{5}$ (B) $\frac{7}{5}$

(C) $\frac{5}{7}$ (D) $\frac{-5}{7}$

12. 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

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13. यदि एक वृत्त के त्रिज्यखण्ड का क्षेत्रफल 40π वर्ग इकाई है तथा केंद्र पर बना कोण $72°$ है, तो वृत्त की त्रिज्या है :

(A) 200 इकाई

(B) 100 इकाई

(C) 20 इकाई

(D) $10\sqrt{2}$ इकाई

14. किसी वृत्त के व्यास के छोरों पर खींची गई स्पर्श-रेखाएँ सदैव परस्पर :

(A) समांतर होती हैं

(B) लंबवत होती हैं

(C) समान होती हैं

(D) प्रतिच्छेदी होती हैं

15. यदि $(-1)^n + (-1)^8 = 0$ है, तो n :

(A) कोई धन पूर्णांक है

(B) कोई ऋण पूर्णांक है

(C) कोई विषम संख्या है

(D) कोई सम संख्या है

16. एक वृत्त के व्यास के दो छोरों के निर्देशांक (2, 4) तथा (– 3, – 1) हैं। इसकी त्रिज्या की लंबाई है :

(A) $\frac{5\sqrt{2}}{2}$ इकाई (B) $5\sqrt{2}$ इकाई

(C) $3\sqrt{2}$ इकाई (D) $\pm \frac{5\sqrt{2}}{2}$ इकाई

17. एक समांतर श्रेढ़ी का 11वाँ तथा 13वाँ पद क्रमश: 39 तथा 45 है। इस समांतर श्रेढ़ी का सार्व अंतर क्या है ?

(A) 42 (B) 21

(C) 6 (D) 3

• • •

13. If a sector of a circle has an area of 40π sq. units and a central angle of $72°$, the radius of the circle is :

(A) 200 units

(B) 100 units

(C) 20 units

(D) $10\sqrt{2}$ units

14. The tangents drawn at the extremities of the diameter of a circle are always :

(A) parallel

(B) perpendicular

(C) equal

(D) intersecting

15. If $(-1)^n + (-1)^8 = 0$, then n is :

(A) any positive integer

(B) any negative integer

(C) any odd number

(D) any even number

16. The end points of a diameter of circle are (2, 4) and (– 3, – 1). The length of its radius is :

(A) $\frac{5\sqrt{2}}{2}$ units (B) $5\sqrt{2}$ units

(C) $3\sqrt{2}$ units (D) $\pm \frac{5\sqrt{2}}{2}$ units

17. The 11^{th} and 13^{th} term of an AP are 39 and 45, respectively. What is the common difference of the AP ?

(A) 42 (B) 21

(C) 6 (D) 3

• • •

18. 52 पत्तों की ताश की गड्डी में से यादृच्छया एक पत्ता निकाला गया। निकाले गए पत्ते के एक हुकुम का पत्ता या एक बादशाह होने की प्रायिकता है :

(A) $\frac{1}{13}$

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

(C) $\frac{4}{13}$

(D) $\frac{9}{13}$

*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)* : 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।

• • •

18. A card is drawn at random from a pack of 52 cards. What is the probability that the card drawn is a spade or a king ?

(A) $\frac{1}{13}$

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

(C) $\frac{4}{13}$

(D) $\frac{9}{13}$

*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) :* 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.

• • •

20. *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।

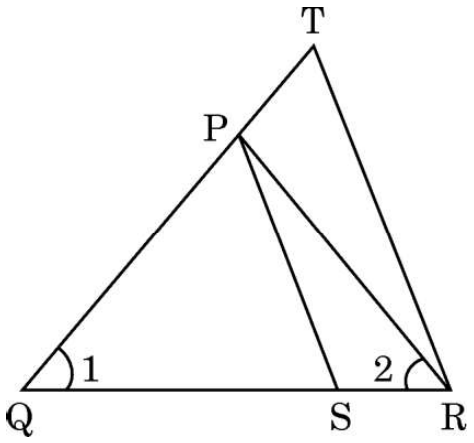
खण्ड ख

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

21. (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 $\Delta PQS \sim \Delta TQR$.



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

अथवा

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

• • •

20. *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 $3\pi r^2$.

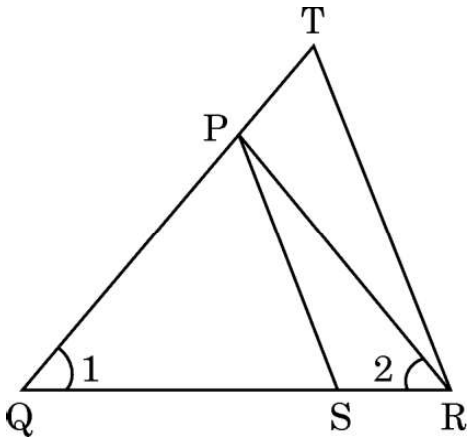
SECTION B

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

21. (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 $\Delta PQS \sim \Delta TQR$.



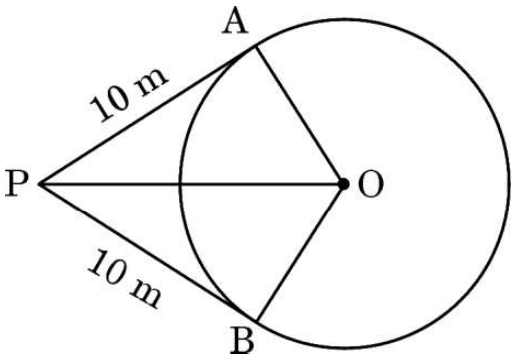
22. (a) If $x \cos 60° + y \cos 0° + \sin 30° - \cot 45° = 5$, then find the value of $x + 2y$.

OR

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

• • •

23. 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।



24. बहुपद $p(x) = x^2 + \frac{4}{3}x - \frac{4}{3}$ के शून्यक ज्ञात कीजिए।

25. एक त्रिभुज ABC, जिसके शीर्ष A(9, – 2), B(– 3, 7) तथा C(–1, 10) हैं, के शीर्ष B से खींची गई माध्यिका की लंबाई 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. सिद्ध कीजिए कि $\sqrt{5}$ एक अपरिमेय संख्या है।

27. दो पासों को एक साथ उछाला गया। निम्नलिखित के प्राप्त होने की प्रायिकता ज्ञात कीजिए :

(i) एक पासे पर 2 का गुणज तथा दूसरे पर 3 का गुणज।

(ii) दोनों पासों के शीर्ष पर आने वाली दोनों संख्याओं का गुणनफल एक पूर्ण वर्ग संख्या होना।

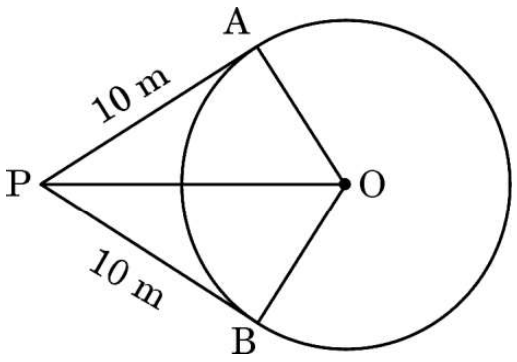
28. (क) सिद्ध कीजिए कि : $\frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta} = 1 + \sec\theta\,\text{cosec}\,\theta$

अथवा

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

• • •

23. 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.



24. Find the zeroes of the polynomial $p(x) = x^2 + \frac{4}{3}x - \frac{4}{3}$.

25. Find the length of the median through the vertex B of ΔABC with vertices A(9, – 2), B(– 3, 7) and C(–1, 10).

SECTION C

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

26. Prove that $\sqrt{5}$ is an irrational number.

27. Two dice are rolled together. Find the probability of getting :

(i) a multiple of 2 on one and a multiple of 3 on the other die.

(ii) the product of two numbers on the top of the two dice is a perfect square number.

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

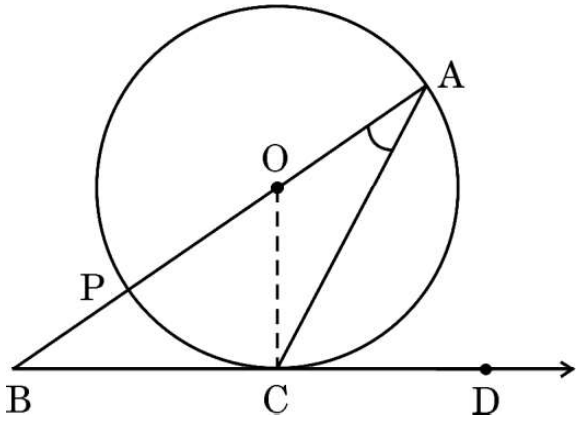
OR

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

• • •

29. एक कमरा बेलन के आकार का है जिसके ऊपर एक अर्धगोलाकार गुंबद अध्यारोपित है। अर्धगोले के आधार की त्रिज्या, बेलनाकार भाग की ऊँचाई की आधी है। यदि इस कमरे में $\frac{1408}{21}$ m^3 वायु है, तो बेलनाकार भाग की ऊँचाई ज्ञात कीजिए। ($\pi = \frac{22}{7}$ प्रयोग कीजिए)

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 समकोण त्रिभुज का परिमाप 60 cm है तथा इसके कर्ण की लंबाई 25 cm है। त्रिभुज की अन्य दो भुजाओं की लंबाइयाँ ज्ञात कीजिए।

अथवा

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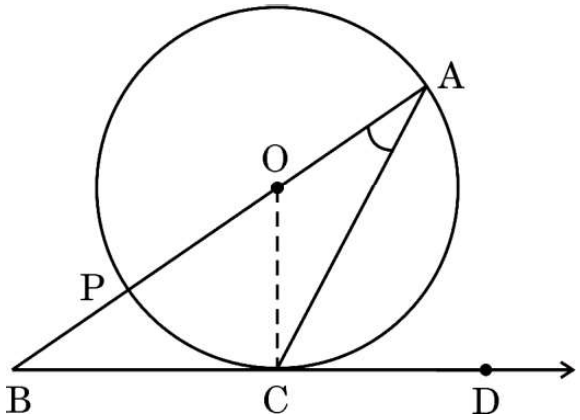
29. A room is in the form of a cylinder surmounted by a hemispherical dome. The base radius of the hemisphere is half of the height of the cylindrical part. If the room contains $\frac{1408}{21}\,m^3$ of air, find the height of the cylindrical part. (Use $\pi = \frac{22}{7}$).

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 perimeter of a right triangle is 60 cm and its hypotenuse is 25 cm. Find the lengths of other two sides of the triangle.

OR

• • •

(ख) एक रेलगाड़ी 480 km की दूरी एकसमान चाल से तय करती है। यदि इसकी चाल 8 km/h कम होती, तो इसे वही दूरी तय करने में 3 घंटे अधिक लगते। रेलगाड़ी की चाल ज्ञात कीजिए।

33. एक थैले में कुछ लाल तथा कुछ नीली गेंदें हैं। लाल गेंदों की संख्या के दस प्रतिशत तथा नीली गेंदों की संख्या के बीस प्रतिशत को जोड़ने पर योगफल 24 आता है। यदि लाल गेंदों की संख्या का तिगुना, नीली गेंदों की संख्या से 20 अधिक है, तो लाल तथा नीली गेंदों की संख्या ज्ञात कीजिए।

34. एक पौधे के 40 पत्तों की लंबाई, मिलिमीटर तक सही मापी गई तथा प्राप्त आँकड़ों को निम्नलिखित सारणी में दर्शाया गया :

लंबाई (mm में)	*पत्तों की संख्या*
118 – 126	3
127 – 135	5
136 – 144	9
145 – 153	12
154 – 162	5
163 – 171	4
172 – 180	2

पत्तों की माध्यक लंबाई ज्ञात कीजिए।

35. (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 $\angle BAC = 90°$.

• • •

(b) A train travels a distance of 480 km at a uniform speed. If the speed had been 8 km/h less, then it would have taken 3 hours more to cover the same distance. Find the speed of the train.

33. A bag contains some red and blue balls. Ten percent of the red balls, when added to twenty percent of the blue balls, give a total of 24. If three times the number of red balls exceeds the number of blue balls by 20, find the number of red and blue balls.

34. The lengths of 40 leaves of a plant are measured correct to the nearest millimetre, and the data obtained is represented in the following table :

Length (in mm)	*Number of Leaves*
118 – 126	3
127 – 135	5
136 – 144	9
145 – 153	12
154 – 162	5
163 – 171	4
172 – 180	2

Find the median length of the leaves.

35. (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 $\angle BAC = 90°$.

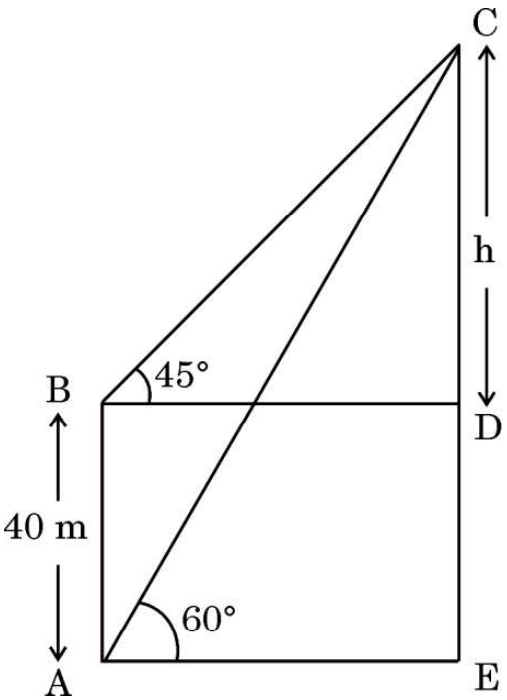
• • •

खण्ड ङ

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

प्रकरण अध्ययन – 1

36. 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*

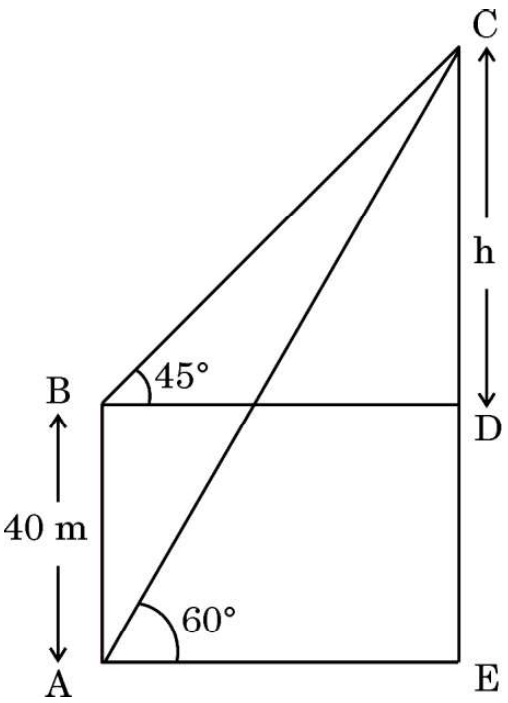
• • •

SECTION E

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

Case Study – 1

36. 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*

• • •

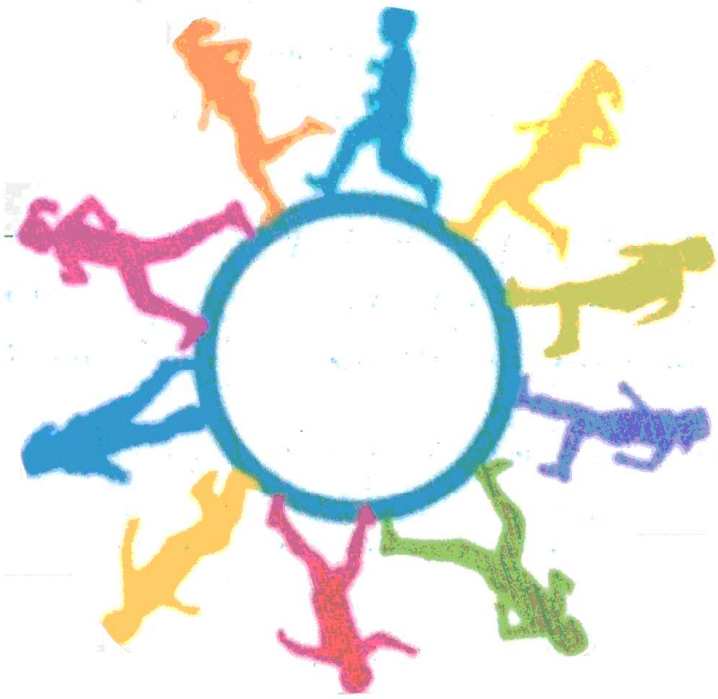
(iii) (क) लाइटहाउस की ऊँचाई CE ज्ञात कीजिए। [$\sqrt{3}$ = 1·73 प्रयोग कीजिए] *2*

अथवा

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

प्रकरण अध्ययन – 2

37. 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*

• • •

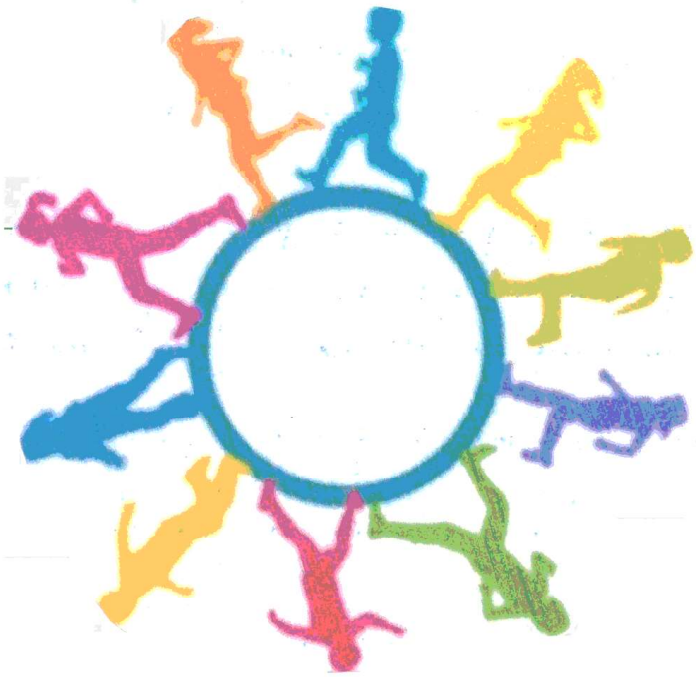
(iii) (a) Find the height CE of the lighthouse [Use $\sqrt{3}$ = 1·73] *2*

OR

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

Case Study – 2

37. 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*

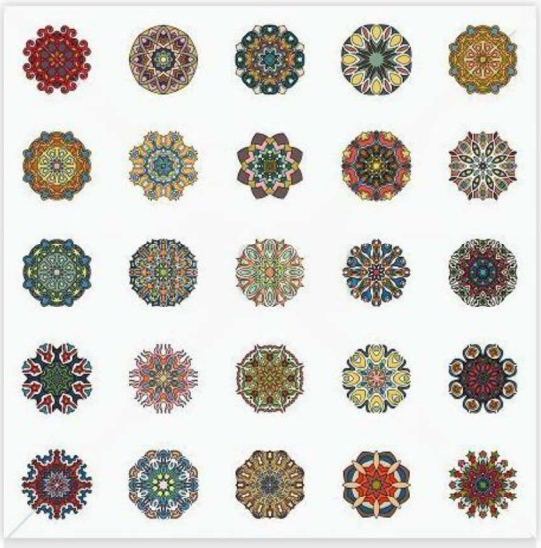
OR

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

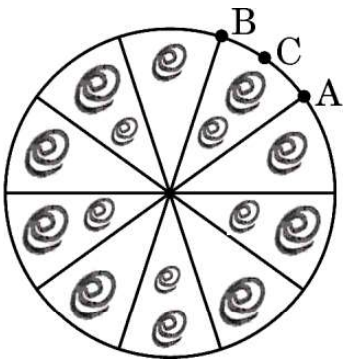
• • •

प्रकरण अध्ययन – 3

38. 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*

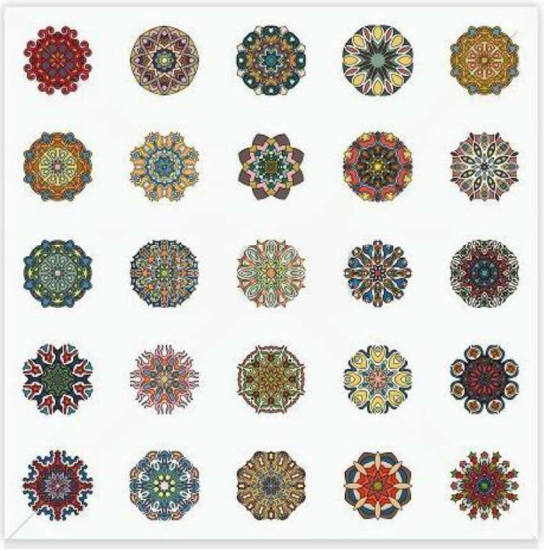
अथवा

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

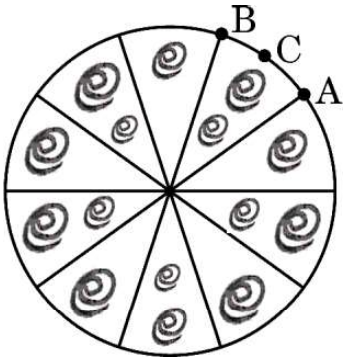
• • •

Case Study – 3

38. 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*

Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2025
MATHEMATICS (Standard) (Q.P. CODE 30/1/3)

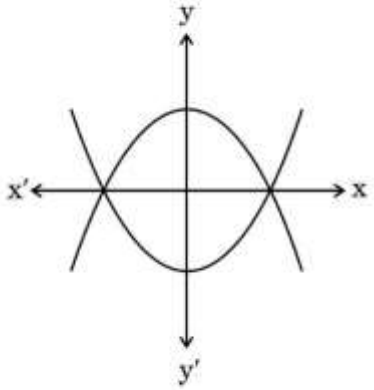
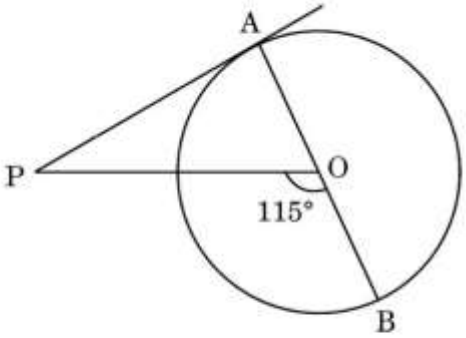
General Instructions: -

1.	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully.
2.	**"Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, Evaluation done and several other aspects. 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: 30/1/3)

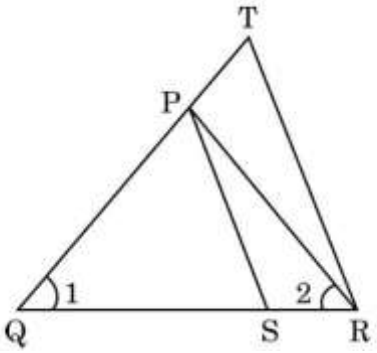
Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Marks
	SECTION A This section has 20 Multiple Choice Questions (MCQs) carrying 1 mark each.	
1.	What is the mode of a data if median and mean of the same data are 9·6 and 10·5, respectively ? (A) 7·8 (B) 12·3 (C) 8·4 (D) 7	
Sol.	(A) 7.8	**1**
2.	The value of $(\tan A \operatorname{cosec} A)^2 - (\sin A \sec A)^2$ is : (A) 0 (B) 1 (C) –1 (D) 2	
Sol.	(B) 1	**1**
3.	A kite is flying at a height of 150 m from the ground. It is attached to a string inclined at an angle of 30° to the horizontal. The length of the string is : (A) $100\sqrt{3}$ m (B) 300 m (C) $150\sqrt{2}$ m (D) $150\sqrt{3}$ m	
Sol.	(B) 300 m	**1**
4.	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**

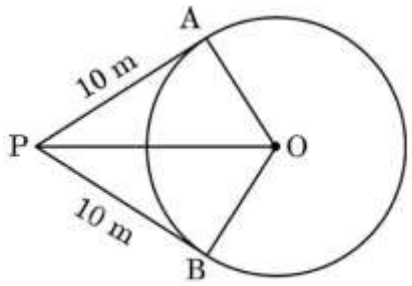
5.	If θ is an acute angle and $7 + 4 \sin \theta = 9$, then the value of θ is : (A) $90°$ (B) $30°$ (C) $45°$ (D) $60°$	
Sol.	(B) 30^0	**1**
6.	Two polynomials are shown in the graph below. The number of distinct zeroes of both the polynomials is :  (A) 3 (B) 5 (C) 2 (D) 4	
Sol.	(C) 2	**1**
7.	In the 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**

8.	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**
9.	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**
10.	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**
11.	The sum of the zeroes of the polynomial $p(x) = 5x - 7x^2 + 3$ is : (A) $\frac{-7}{5}$ (B) $\frac{7}{5}$ (C) $\frac{5}{7}$ (D) $\frac{-5}{7}$	
Sol.	(C) $\frac{5}{7}$	**1**
12.	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**

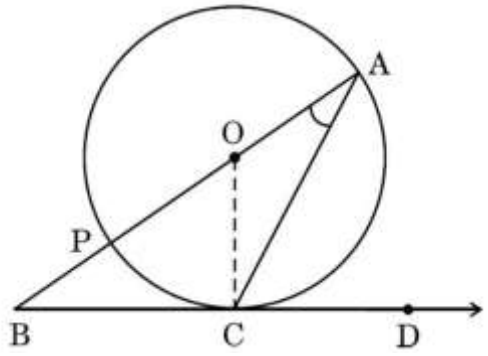
13.	If a sector of a circle has an area of 40π sq. units and a central angle of $72°$, the radius of the circle is : (A) 200 units (B) 100 units (C) 20 units (D) $10\sqrt{2}$ units	
Sol.	(D) $10\sqrt{2}$ units	**1**
14.	The tangents drawn at the extremities of the diameter of a circle are always : (A) parallel (B) perpendicular (C) equal (D) intersecting	
Sol.	(A) parallel	**1**
15.	If $(-1)^n + (-1)^8 = 0$, then n is : (A) any positive integer (B) any negative integer (C) any odd number (D) any even number	
Sol.	(C) any odd number	**1**
16.	The end points of a diameter of circle are (2, 4) and (– 3, – 1). The length of its radius is : (A) $\frac{5\sqrt{2}}{2}$ units (B) $5\sqrt{2}$ units (C) $3\sqrt{2}$ units (D) $\pm\frac{5\sqrt{2}}{2}$ units	
Sol.	(A) $\frac{5\sqrt{2}}{2}$ units	**1**
17.	The 11^{th} and 13^{th} term of an AP are 39 and 45, respectively. What is the common difference of the AP ? (A) 42 (B) 21 (C) 6 (D) 3	
Sol.	(D) 3	**1**

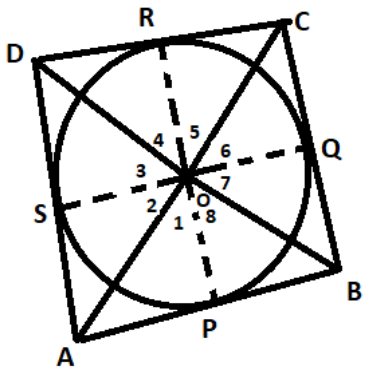
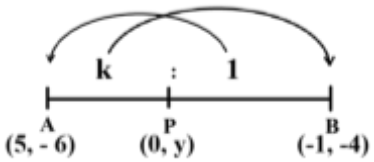
18.	A card is drawn at random from a pack of 52 cards. What is the probability that the card drawn is a spade or a king ? (A) $\frac{1}{13}$ (B) $\frac{2}{13}$ (C) $\frac{4}{13}$ (D) $\frac{9}{13}$	
Sol.	(C) $\frac{4}{13}$	**1**
	Questions number ***19*** *and* ***20*** *are Assertion and Reason based 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) :* 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**
20.	*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**
	SECTION B This section has **5** Very Short Answer (VSA) type questions carrying **2** marks each.	
21 (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).	
Sol.	$\frac{6}{PQ} = \frac{4}{QR} = \frac{8}{6}$ $\Rightarrow PQ = \frac{9}{2}$ cm or 4.5 cm	½ ½

	and QR = 3 cm ∴ PQ + QR = 7.5cm	½ ½
	OR	
21 (b)	In the given figure, $\frac{QR}{QS} = \frac{QT}{PR}$ and $\angle 1 = \angle 2$, show that $\Delta PQS \sim \Delta TQR$.  	
Sol.	In Δ PQR, $\angle 1 = \angle 2$ ∴ PR = PQ $\therefore \frac{QR}{QS} = \frac{QT}{PR} \Rightarrow \frac{QR}{QS} = \frac{QT}{PQ}$ Also, $\angle 1 = \angle 1$ ∴ Δ PQS ~ Δ TQR	½ ½ ½ ½
22 (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	
22 (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

23.	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
24.	Find the zeroes of the polynomial $p(x) = x^2 + \frac{4}{3}x - \frac{4}{3}$.	
Sol.	$\frac{1}{3}(3x^2 + 4x - 4)$ $= \frac{1}{3}(3x^2 + 6x - 2x - 4)$ $= \frac{1}{3}(3x - 2)(x + 2)$ Zeroes are $\frac{2}{3}$, – 2	½ ½ ½ ½
25.	Find the length of the median through the vertex B of Δ ABC with vertices A(9, – 2), B(– 3, 7) and C(–1, 10).	
Sol.	Mid point of AC = (4,4) Length of median from B to AC = $\sqrt{(4+3)^2 + (4-7)^2}$ $= \sqrt{58}$ Hence the length of median is $\sqrt{58}$ units	**1** ½ ½
	SECTION C This section has **6** Short Answer (SA) type questions carrying **3** marks each.	
26.	Prove that $\sqrt{5}$ is an irrational number.	
Sol.	Let $\sqrt{5}$ be a rational number. $\therefore \sqrt{5} = \frac{p}{q}$, where q $\neq$ 0 and let p & q are co-primes. $5q^2 = p^2 \Rightarrow p^2$ is divisible by 5 $\Rightarrow$ p is divisible by 5----- (i) $\Rightarrow$let p = 5a, where 'a' is some integer $25a^2 = 5q^2 \Rightarrow q^2 = 5a^2 \Rightarrow q^2$ is divisible by 5. $\Rightarrow$ q is divisible by 5. ----- (ii)	½ 1 1

	(i) and (ii) leads to contradiction as p and q are coprimes. $\therefore$ $\sqrt{5}$ is an irrational number	½
27.	Two dice are rolled together. Find the probability of getting : (i) a multiple of 2 on one and a multiple of 3 on the other die. (ii) the product of two numbers on the top of the two dice is a perfect square number.	
Sol.	Total outcomes = 36 (i) (2, 3), (2, 6), (3, 2), (3, 4), (3, 6), (4, 3), (4, 6), (6, 2), (6, 3), (6, 4), (6, 6) Number of outcomes having multiple of 2 on one die and a multiple of 3 on other die = 11 Hence, P(E) = $\frac{11}{36}$ (ii) (1, 1), (2, 2), (3, 3), (1, 4), (4, 1), (4, 4), (5, 5), (6, 6) Number of outcomes having product of two numbers on the top of the dice is a perfect square number = 8 P(E) = $\frac{8}{36}$ or $\frac{2}{9}$	**1** ½ ½ ½ ½
28 (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 θ cosec θ = RHS	½ **1** ½ ½ ½
	OR	
28.(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 = $\frac{\sin A+\cos A}{\sin A-\cos A} + \frac{\sin A-\cos A}{\sin A+\cos A}$ = $\frac{(\sin A+\cos A)^2+(\sin A-\cos A)^2}{(\sin A-\cos A)(\sin A+\cos A)}$ = $\frac{\sin^2A+\cos^2A+2\sin A\cos A+\sin^2A+\cos^2A-2\sin A\cos A}{\sin^2A-\cos^2A}$ = $\frac{1+1}{\sin^2A-(1-\sin^2A)}$ = $\frac{2}{2\sin^2A-1}$ = RHS	**1** **1** ½ ½

29.	A room is in the form of a cylinder surmounted by a hemispherical dome. The base radius of the hemisphere is half of the height of the cylindrical part. If the room contains $\frac{1408}{21}$ m^3 of air, find the height of the cylindrical part. (Use $\pi = \frac{22}{7}$).	
Sol.	Let r is the radius of hemisphere and cylinder and h is the height of cylinder h = 2r Volume of air in room $= \frac{2}{3}\pi r^3 + \pi r^2 h$ $\frac{1408}{21} = \frac{2}{3}\pi r^3 + \pi r^2(2r)$ $\frac{1408}{21} = \frac{8}{3} \times \frac{22}{7} \times r^3$ $r^3 = 8$ $\therefore$ r = 2 m and h = 4 m	½ ½ **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	½
	Δ OAP $\cong \Delta$ OAS	**1**
	$\therefore \angle 1 = \angle 2$	
	Similarly, $\angle 3 = \angle 4$, $\angle 5 = \angle 6$, $\angle 7 = \angle 8$	½
	Also, $\angle 1 + \angle 2 + \angle 3 + \angle 4 + \angle 5 + \angle 6 + \angle 7 + \angle 8 = 360°$	
	$\Rightarrow 2 (\angle 1 + \angle 4 + \angle 5 + \angle 8) = 360°$	½
	$\Rightarrow \angle$ AOB + $\angle$ COD = 180°	½
	Similarly, $\angle$ BOC + $\angle$ AOD = 180°	
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)	½
	$0 = \frac{-k+5}{k+1}$	
	k = 5	**1**
	Hence, ratio is 5:1	½
	$y = \frac{-4(5)-6}{5+1} = \frac{-26}{6} = \frac{-13}{3}$	½
	Coordinates of point of intersection are $P\left(0, -\frac{13}{3}\right)$	½

	SECTION D This section has **4** Long Answer (LA) type questions carrying **5** marks each.	
32 (a)	The perimeter of a right triangle is 60 cm and its hypotenuse is 25 cm. Find the lengths of other two sides of the triangle.	
Sol.	Let the other two sides be x cm and y cm ATQ $x + y + 25 = 60$ $y = 35 - x$ Now, $x^2 + y^2 = (25)^2$ $x^2 + (35 - x)^2 = 625$ $x^2 - 35x + 300 = 0$ $(x - 20)(x - 15) = 0$ $\Rightarrow x = 20, 15$ $x = 20 \Rightarrow y = 15$ $x = 15 \Rightarrow y = 20$ Hence sides are 15 cm and 20 cm.	**1** ½ **1** **1** **1** ½
	OR	
32 (b)	A train travels a distance of 480 km at a uniform speed. If the speed had been 8 km/h less, then it would have taken 3 hours more to cover the same distance. Find the speed of the train.	
Sol.	Let the speed of train be x km/h Reduced speed of train = (x – 8) km/h ATQ $\frac{480}{x-8} - \frac{480}{x} = 3$ $x^2 - 8x - 1280 = 0$ $(x - 40)(x + 32) = 0$ $\Rightarrow x = 40$ $\therefore$ Speed of train = 40 km/h	½ **1½** **1½** **1** ½
33.	A bag contains some red and blue balls. Ten percent of the red balls, when added to twenty percent of the blue balls, give a total of 24. If three times the number of red balls exceeds the number of blue balls by 20, find the number of red and blue balls.	
Sol.	Let number of red balls be x & number of blue balls be y A.T.Q. $\frac{10x}{100} + \frac{20y}{100} = 24$ or $x + 2y = 240$ …..(i) Also, $3x - y = 20$ ……(ii) Solving (i) and (ii) , we get $x = 40, y = 100$ $\therefore$ Number of red balls = 40 and Number of blue balls = 100	**1½** **1½** **1+1**

34. The lengths of 40 leaves of a plant are measured correct to the nearest millimetre, and the data obtained is represented in the following table :

Length (in mm)	*Number of Leaves*
118 – 126	3
127 – 135	5
136 – 144	9
145 – 153	12
154 – 162	5
163 – 171	4
172 – 180	2

Find the median length of the leaves.

Sol.

Length (mm)	f_i	*cf*
117.5 – 126.5	3	3
126.5 – 135.5	5	8
135.5 – 144.5	9	17
144.5 – 153.5	12	29
153.5 – 162.5	5	34
162.5 – 171.5	4	38
171.5 – 180.5	2	40

Correct Table **2**

Median class = 144.5 – 153.5 **1**

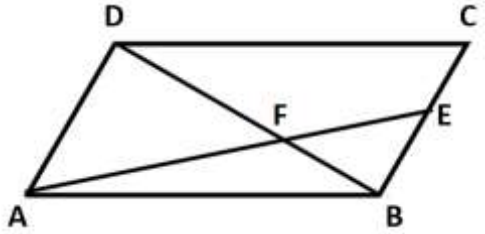
Median = $144.5 + \frac{20-17}{12} \times 9$ **1½**

= 146.75 **½**

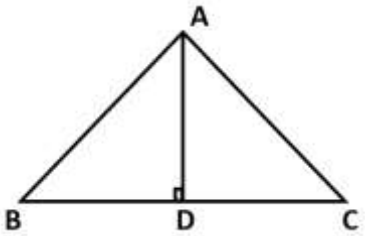
Hence, median length is 146.75 mm

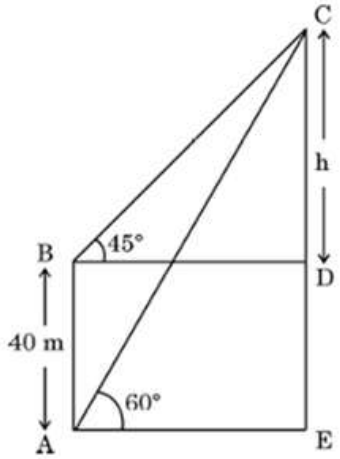
35 (a) The diagonal BD of a parallelogram ABCD intersects the line segment AE at the point F, where E is any point on the side BC. Prove that DF × EF = FB × FA.

Sol.



Correct figure **1**

	In Δ ADF and Δ EBF, ∠ DFA = ∠ EFB ∠ ADF = ∠ FBE ∴ Δ ADF ~ Δ EBF $\therefore \frac{DF}{FB} = \frac{FA}{EF}$ ⇒ DF ×EF = FB ×FA	**2** **1** **1**
	OR	
35 (b)	In Δ ABC, if AD ⊥ BC and $AD^2 = BD \times DC$, then prove that ∠ BAC = 90°.	
Sol.	 Correct figure $AD^2 = BD \times DC$ $\frac{AD}{DC} = \frac{BD}{AD}$ Also, ∠ ADB = ∠ ADC ∴ Δ DBA ~ Δ DAC ∠ DBA = ∠ DAC ∠ BAD = ∠ DCA Adding both ∠ DBA + ∠ DCA = ∠ DAC + ∠ BAD ∴ ∠ BAC = 90°	**1** **1** **1** **1** **1**

	SECTION E This section has **3** case study based carrying **4** marks each.	
36.	**Case Study – 1** 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) $\frac{h}{BD} = \tan 45° = 1$ BD = h m (ii) $\frac{h}{BC} = \sin 45° = \frac{1}{\sqrt{2}}$ BC = $\sqrt{2}$h m (iii)(a) $\tan 60° = \frac{EC}{AE}$ $\sqrt{3} = \frac{h+40}{h}$ h = $20\,(\sqrt{3}+1) = 20 \times 2.73 = 54.6\,m$ CE = 54.6 + 40 = 94.6 m OR (iii)(b) $\cos 60° = \frac{AE}{AC}$ $\frac{1}{2} = \frac{AE}{100}$ AE = 50 m	½ ½ ½ ½ **1** ½ ½ **1** **1**

37.

Case Study – 2

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) $a_4 = 450$

$a_5 = 500$ **1**

$a_6 = 550$

(ii) $a_8 = 300 + 7 \times 50$ ½

$= 650$ m ½

(iii) (a) $S_{10} = \frac{10}{2} \times (2 \times 300 + 9 \times 50)$ **1**

$= 5250$ m **1**

OR

(iii) (b) $S_6 = \frac{6}{2} \times (2 \times 300 + 5 \times 50)$ **1**

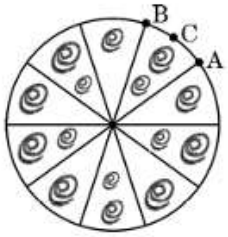
$= 2250$ m **1**

38.

Case Study – 3

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 = $\frac{1}{10} \times 2 \times \frac{22}{7} \times \frac{35}{2} = 11\text{mm}$ **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**

$= \frac{385}{4}\ \text{mm}^2$ or $96.25\ \text{mm}^2$ **1**

OR

(iii) (b) length of silver wire used = $2 \times \frac{22}{7} \times \frac{35}{2} + 5 \times 35$ **1**

$= 285\ \text{mm}$ **1**