Series : EGFH2

SET~2

रोल नं.
Roll No.

प्रश्न-पत्र कोड
Q.P. Code 30/2/2

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

नोट

(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.

#

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. वह द्विघात समीकरण जिसके मूलों का योगफल तथा गुणनफल क्रमश: 'a' तथा '$\frac{1}{a}$' हैं, है :

(A) $ax^2 - ax + 1 = 0$ (B) $ax^2 - a^2x + 1 = 0$

(C) $ax^2 + ax + 1 = 0$ (D) $ax^2 + a^2x - 1 = 0$

2. समांतर श्रेढ़ी 7, 11, 15, 19, ..., 147 का अंतिम पद से (प्रथम पद की ओर) 9वाँ पद है :

(A) 135 (B) 125

(C) 115 (D) 39

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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. The quadratic equation whose sum and product of roots are 'a' and '$\frac{1}{a}$', respectively is :

(A) $ax^2 - ax + 1 = 0$ (B) $ax^2 - a^2x + 1 = 0$

(C) $ax^2 + ax + 1 = 0$ (D) $ax^2 + a^2x - 1 = 0$

2. The 9^{th} term from the end (towards first term) of the AP 7, 11, 15, 19, ..., 147 is :

(A) 135 (B) 125

(C) 115 (D) 39

• • •

3. बिंदुओं (0, 0), (2, 0) तथा (0, 2) शीर्षों वाले त्रिभुज का परिमाप है :

(A) 4 इकाई (B) 6 इकाई

(C) $6\sqrt{2}$ इकाई (D) $(4 + 2\sqrt{2})$ इकाई

4. समीकरण $x - y = 0$ द्वारा निरूपित सरल रेखा

(A) x-अक्ष के समांतर है

(B) y-अक्ष के समांतर है

(C) मूल-बिंदु से गुज़रता है

(D) बिंदु (3, 2) से गुज़रता है

5. यदि बहुपद $p(x) = x^2 - x - (2 + 2k)$ का एक शून्यक -4 है, तो k का मान है :

(A) 3 (B) 9

(C) 6 (D) -9

6. 40, 110 और 360 का म.स. (HCF) है :

(A) 40 (B) 110

(C) 360 (D) 10

7. यदि एक बड़े वृत्ताकार पिज़्ज़ा को पाँच बराबर त्रिज्यखण्डों में विभाजित किया जाए, तो प्रत्येक त्रिज्यखण्ड का केंद्रीय कोण होगा :

(A) 60°

(B) 90°

(C) 45°

(D) 72°

8. वह छोटी-से-छोटी संख्या जो एक पूर्ण वर्ग संख्या है और 16, 20 तथा 50 प्रत्येक से भाज्य है, है :

(A) 1200

(B) 100

(C) 3600

(D) 2400

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3. The perimeter of the triangle formed by the vertices (0, 0), (2, 0) and (0, 2) is :

(A) 4 units (B) 6 units

(C) $6\sqrt{2}$ units (D) $(4 + 2\sqrt{2})$ units

4. The line represented by the equation $x - y = 0$ is :

(A) parallel to x-axis

(B) parallel to y-axis

(C) passing through the origin

(D) passing through the point (3, 2)

5. If -4 is a zero of the polynomial $p(x) = x^2 - x - (2 + 2k)$, then the value of k is :

(A) 3 (B) 9

(C) 6 (D) -9

6. The HCF of 40, 110 and 360 is :

(A) 40 (B) 110

(C) 360 (D) 10

7. If a large circular pizza is divided into 5 equal sectors, then the central angle of each sector will be :

(A) 60°

(B) 90°

(C) 45°

(D) 72°

8. The least number which is a perfect square and is divisible by each of 16, 20 and 50, is :

(A) 1200

(B) 100

(C) 3600

(D) 2400

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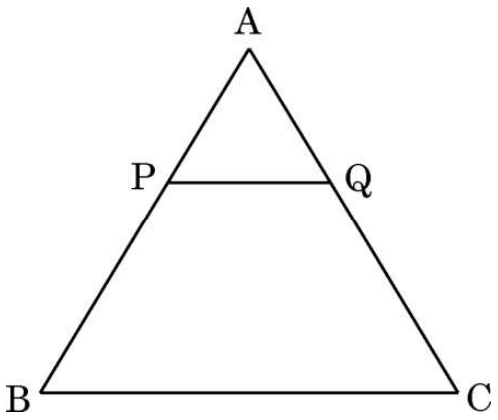
9. दी गई आकृति में, PQ || BC है। यदि $\frac{AP}{PB} = \frac{4}{13}$ तथा AC = 20·4 cm है, तो AQ की लंबाई है :



(A) 2·8 cm (B) 5·8 cm

(C) 3·8 cm (D) 4·8 cm

10. वृत्त के एक व्यास के दो छोरों के निर्देशांक (5, – 2) तथा (5, 2) हैं। वृत्त की त्रिज्या की लंबाई है :

(A) ± 2 (B) ± 4

(C) 4 (D) 2

11. यदि $\sin(\alpha + \beta) = 1$ है, तो $\sin\left(\frac{\alpha + \beta}{2}\right)$ का मान है :

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

(C) 0 (D) 1

12. यदि $1080 = 2^p \times 3^q \times 5$ है, तो (p – q) बराबर है :

(A) 6 (B) –1

(C) 1 (D) 0

13. यदि 52 पत्तों की ताश की गड्डी में से सभी लाल रंग के तस्वीर वाले पत्ते निकाल दिए जाएँ, तो शेष पत्तों में से यादृच्छया एक काले रंग का गुलाम का पत्ता निकालने की प्रायिकता है :

(A) $\frac{2}{46}$ (B) $\frac{2}{52}$

(C) $\frac{4}{48}$ (D) $\frac{2}{23}$

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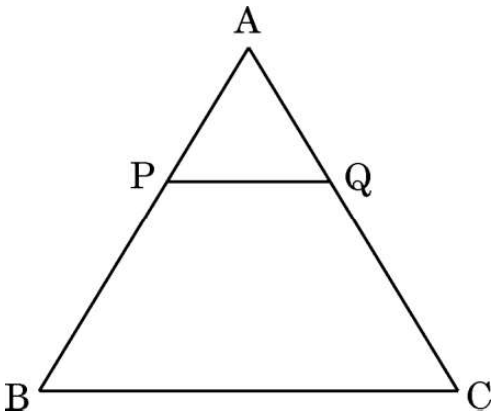
9. In the given figure, PQ || BC. If $\frac{AP}{PB} = \frac{4}{13}$ and AC = 20·4 cm, then the length of AQ is :



(A) 2·8 cm (B) 5·8 cm

(C) 3·8 cm (D) 4·8 cm

10. The coordinates of the end points of a diameter of a circle are (5, – 2) and (5, 2). The length of the radius of the circle is :

(A) ± 2 (B) ± 4

(C) 4 (D) 2

11. If $\sin(\alpha + \beta) = 1$, then the value of $\sin\left(\frac{\alpha + \beta}{2}\right)$ is :

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

(C) 0 (D) 1

12. If $1080 = 2^p \times 3^q \times 5$, then (p – q) is equal to :

(A) 6 (B) –1

(C) 1 (D) 0

13. If all the red face cards are removed from the deck of 52 playing cards, then the probability of getting a black jack from the remaining cards is :

(A) $\frac{2}{46}$ (B) $\frac{2}{52}$

(C) $\frac{4}{48}$ (D) $\frac{2}{23}$

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14. x-अक्ष के नीचे तथा 3 इकाई की दूरी पर x-अक्ष के समांतर एक रेखा का समीकरण है :

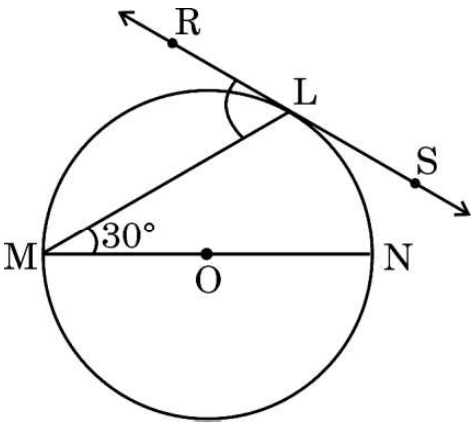
(A) $x = 3$

(B) $x = -3$

(C) $y = -3$

(D) $y = 3$

15. दी गई आकृति में, RS वृत्त के बिंदु L पर स्पर्श-रेखा है तथा MN वृत्त का व्यास है । यदि $\angle NML = 30°$ है, तो $\angle RLM$ है :



(A) 30° (B) 60°

(C) 90° (D) 120°

16. एक क्रिकेट मैच में, एक बल्लेबाज खेली गई 42 गेंदों में से 7 बार बाउंड्री हिट करता है । उसकी बाउंड्री हिट **न** करने की प्रायिकता है :

(A) $\frac{1}{7}$

(B) $\frac{2}{7}$

(C) $\frac{5}{6}$

(D) $\frac{1}{6}$

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14. The equation of a line parallel to the x-axis and at a distance of 3 units below x-axis is :

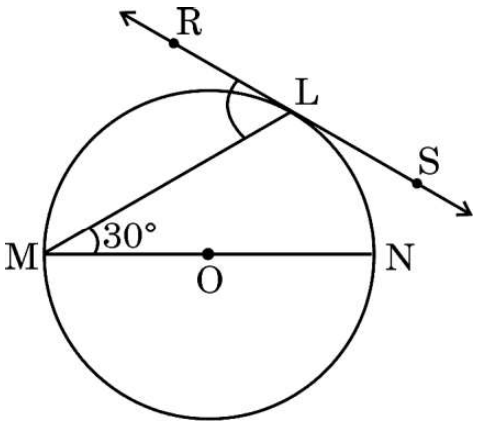
(A) $x = 3$

(B) $x = -3$

(C) $y = -3$

(D) $y = 3$

15. In the given figure, RS is the tangent to the circle at the point L and MN is the diameter. If $\angle NML = 30°$, then $\angle RLM$ is :



(A) 30° (B) 60°

(C) 90° (D) 120°

16. In a cricket match, a batsman hits the boundary 7 times out of the 42 balls he plays. The probability of his ***not*** hitting a boundary is :

(A) $\frac{1}{7}$

(B) $\frac{2}{7}$

(C) $\frac{5}{6}$

(D) $\frac{1}{6}$

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17. निम्नलिखित में से कौन-सा कथन ***ग़लत*** है ?

(A) दो सर्वांगसम आकृतियाँ सदैव समरूप होती हैं।

(B) समान क्षेत्रफल का एक वर्ग तथा एक समचतुर्भुज सदैव समरूप होते हैं।

(C) दो समबाहु त्रिभुज सदैव समरूप होते हैं।

(D) दो समरूप त्रिभुजों का सर्वांगसम होना आवश्यक नहीं है।

18. यदि $\sin 30° \tan 45° = \frac{\sec 60°}{k}$ है, तो k का मान है :

(A) 4

(B) 3

(C) 2

(D) 1

*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)* : रैखिक समीकरण युग्म $px + 3y + 59 = 0$ तथा $2x + 6y + 118 = 0$ के अपरिमित रूप से अनेक हल होंगे, यदि $p = 1$ है।

तर्क (R) : यदि रैखिक समीकरण युग्म $px + 3y + 19 = 0$ तथा $2x + 6y + 157 = 0$ का एक अद्वितीय हल है, तो $p \neq 1$ है।

20. *अभिकथन (A)* : समांतर श्रेढ़ी : 5, 1, – 3, – 7, ... का सार्व अंतर 4 है।

तर्क (R) : समांतर श्रेढ़ी : $a_1, a_2, a_3, ..., a_n$ का सार्व अंतर $d = a_n - a_{n-1}$ द्वारा प्राप्त किया जाता है।

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17. Which of the following statements is ***incorrect*** ?

(A) Two congruent figures are always similar.

(B) A square and a rhombus of the same area are always similar.

(C) Two equilateral triangles are always similar.

(D) Two similar triangles need not be congruent.

18. If $\sin 30° \tan 45° = \frac{\sec 60°}{k}$, then the value of k is :

(A) 4

(B) 3

(C) 2

(D) 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 pair of linear equations $px + 3y + 59 = 0$ and $2x + 6y + 118 = 0$ will have infinitely many solutions if $p = 1$.

Reason (R): If the pair of linear equations $px + 3y + 19 = 0$ and $2x + 6y + 157 = 0$ has a unique solution, then $p \neq 1$.

20. *Assertion (A) :* Common difference of the AP : 5, 1, – 3, – 7, … is 4.

Reason (R): Common difference of the AP : $a_1, a_2, a_3, \ldots, a_n$ is obtained by $d = a_n - a_{n-1}$.

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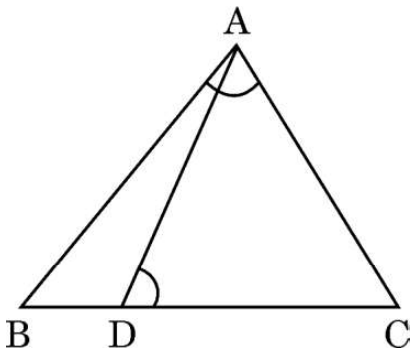
खण्ड ख

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

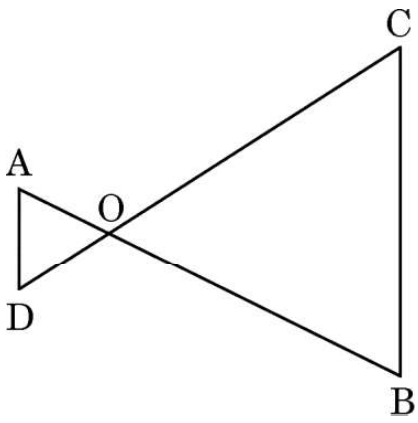
21. वह द्विघात बहुपद ज्ञात कीजिए जिसके शून्यक 2 तथा $-\frac{7}{5}$ हैं।

22. (क) दी गई आकृति में, ΔABC की भुजा BC पर बिंदु D इस प्रकार है कि $\angle ADC = \angle BAC$ है। दर्शाइए कि $CA^2 = CD \cdot CB$.



अथवा

(ख) दी गई आकृति में, $OA \cdot OB = OC \cdot OD$ है। तो दर्शाइए कि $\angle A = \angle C$ तथा $\angle B = \angle D$ है।



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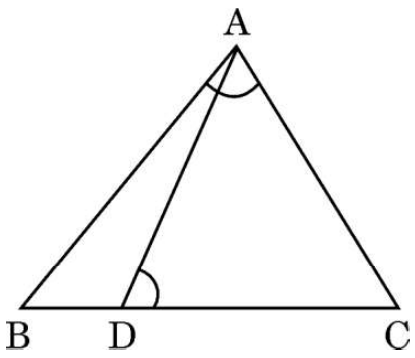
SECTION B

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

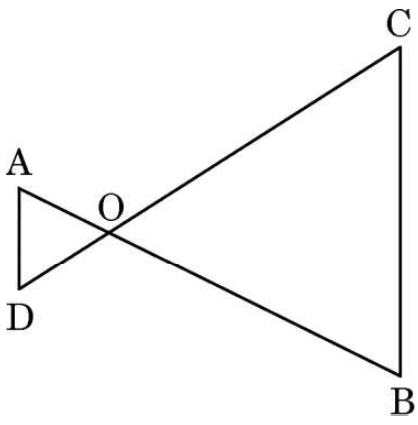
21. Find a quadratic polynomial whose zeroes are 2 and $-\frac{7}{5}$.

22. (a) In the given figure, D is a point on the side BC of Δ ABC such that ∠ ADC = ∠ BAC. Show that CA^2 = CD . CB.



OR

(b) In the given figure, OA . OB = OC . OD. Show that ∠ A = ∠ C and ∠ B = ∠ D.



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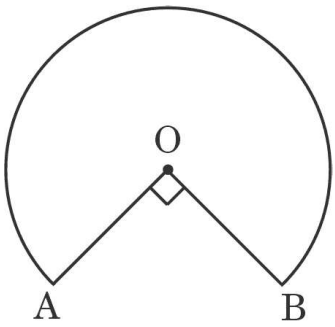
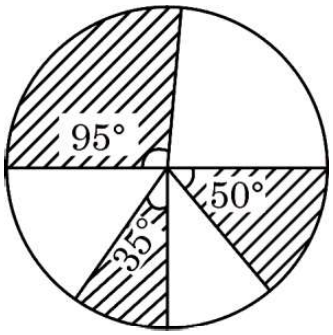
23. (क) दी गई आकृति में, एक टेबल के ऊपर का भाग दर्शाया गया है जो एक वृत्त के त्रिज्यखण्ड के आकार का है, जहाँ वृत्त का केंद्र O तथा $\angle AOB = 90°$ है। यदि $AO = OB = 42$ cm है, तो टेबल के इस ऊपरी भाग का परिमाप ज्ञात कीजिए।

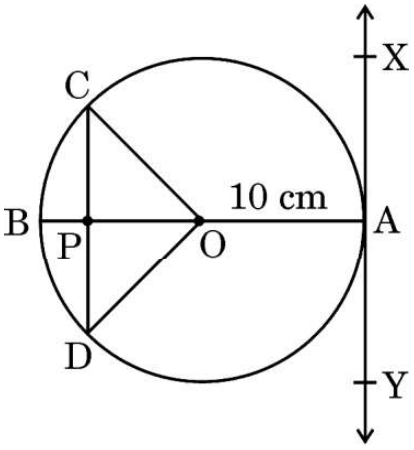


अथवा

(ख) दी गई आकृति में, 5 cm त्रिज्या वाले वृत्त के तीन त्रिज्यखण्डों को छायांकित किया गया है, जो केंद्र पर 35°, 50° तथा 95° के कोण बना रहे हैं। छायांकित क्षेत्र का क्षेत्रफल ज्ञात कीजिए। [$\pi = \frac{22}{7}$ प्रयोग कीजिए]



24. 10 cm त्रिज्या वाले एक वृत्त के एक व्यास AB के बिंदु A पर XAY एक स्पर्श-रेखा खींची गई है। बिंदु A से 16 cm की दूरी पर XY के समांतर जीवा CD की लंबाई ज्ञात कीजिए।



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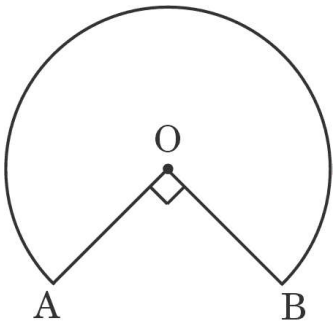
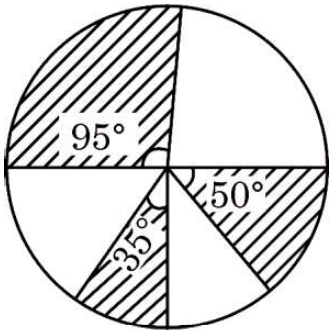
23. (a) In the given figure, the shape of the top of a table is that of a sector of a circle with centre O and $\angle AOB = 90°$. If AO = OB = 42 cm, then find the perimeter of the top of the table.

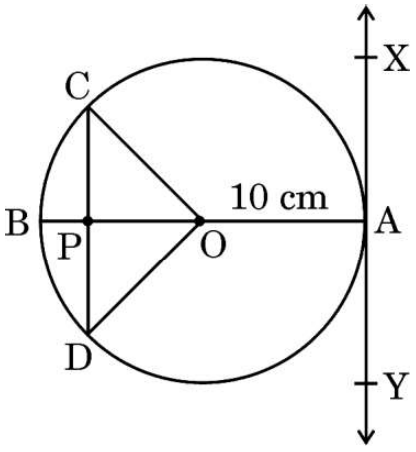


OR

(b) In the given figure, three sectors of a circle of radius 5 cm, making angles 35°, 50° and 95° at the centre are shaded. Find the area of the shaded region. [Use $\pi = \frac{22}{7}$]



24. At point A on the diameter AB of a circle of radius 10 cm, tangent XAY is drawn to the circle. Find the length of the chord CD parallel to XY at a distance of 16 cm from A.



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25. यदि $\tan A = \sqrt{3}$ है; जहाँ A एक न्यून कोण है, तो $\frac{\sin^2 A}{1 + \cos^2 A}$ का 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. (क) यदि $\tan \theta + \sin \theta = m$ तथा $\tan \theta - \sin \theta = n$ है, तो सिद्ध कीजिए कि $m^2 - n^2 = 4\sqrt{mn}$.

अथवा

(ख) सिद्ध कीजिए कि : $\frac{\cot A - 1}{2 - \sec^2 A} = \frac{\cot A}{1 + \tan A}$

27. यदि बिंदुओं A(10, – 6) तथा B(k, 4) को मिलाने वाले रेखाखण्ड का मध्य-बिंदु (a, b) है तथा $a - 2b = 18$ है, तो k का मान ज्ञात कीजिए।

28. ₹ 2,000 की धनराशि साधारण ब्याज की 7% वार्षिक दर पर निवेश की गई। पहले, दूसरे और तीसरे वर्ष के अंत में ब्याज की गणना कीजिए। क्या यह ब्याज की राशियाँ एक समांतर श्रेढ़ी निर्मित करती हैं ? यदि हाँ, तो 27वें वर्ष के अन्त की ब्याज की राशि ज्ञात कीजिए।

29. सिद्ध कीजिए कि $\sqrt{3}$ एक अपरिमेय संख्या है।

30. एक घड़ी की घंटे वाली सुई की लंबाई 10 cm है। प्रात: 5 a.m. से 8 a.m. के बीच घड़ी की घंटे वाली सुई द्वारा रचित लघु त्रिज्यखण्ड का क्षेत्रफल ज्ञात कीजिए। दीर्घ त्रिज्यखण्ड का क्षेत्रफल भी ज्ञात कीजिए।

31. (क) सिद्ध कीजिए कि किसी वृत्त के परिगत समांतर चतुर्भुज एक समचतुर्भुज होता है।

अथवा

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25. If $\tan A = \sqrt{3}$; where A is an acute angle, then find the value of $\frac{\sin^2 A}{1 + \cos^2 A}$.

SECTION C

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

26. (a) If $\tan \theta + \sin \theta = m$ and $\tan \theta - \sin \theta = n$, then prove that $m^2 - n^2 = 4\sqrt{mn}$.

OR

(b) Prove that : $\frac{\cot A - 1}{2 - \sec^2 A} = \frac{\cot A}{1 + \tan A}$

27. If (a, b) is the mid-point of the line segment joining the points A(10, – 6) and B(k, 4) and a – 2b = 18, then find the value of k.

28. A sum of ₹ 2,000 is invested at 7% per annum simple interest. Calculate the interests at the end of 1^{st}, 2^{nd} and 3^{rd} year. Do these interests form an AP ? If so, find the interest at the end of the 27^{th} year.

29. Prove that $\sqrt{3}$ is an irrational number.

30. The length of the hour hand of a clock is 10 cm. Find the area of the minor sector swept by the hour hand of the clock between 5 a.m. to 8 a.m. Also, find the area of the major sector.

31. (a) Prove that the parallelogram circumscribing a circle is a rhombus.

OR

• • •

(ख) सिद्ध कीजिए कि किसी बाह्य बिंदु से किसी वृत्त पर खींची गई दो स्पर्श-रेखाओं के बीच का कोण, स्पर्श बिंदुओं को मिलाने वाले रेखाखण्ड द्वारा केंद्र पर अंतरित कोण का संपूरक होता है।

खण्ड घ

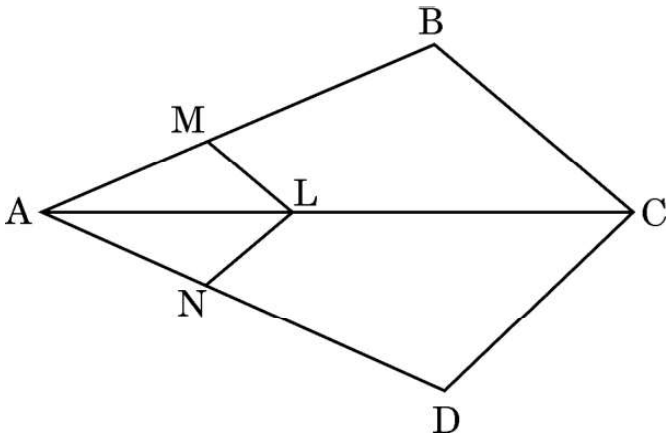
*इस खण्ड में **4** दीर्घ-उत्तरीय (LA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक के 5 अंक हैं।* *4×5=20*

32. (क) दो वर्गों के क्षेत्रफलों का योगफल $52\ cm^2$ है तथा उनके परिमापों का अन्तर 8 cm है। दोनों वर्गों की भुजाओं की लंबाइयाँ ज्ञात कीजिए।

अथवा

(ख) एक व्यक्ति ऊपर की दिशा में 150 km की दूरी तय करने में, वही दूरी नीचे की दिशा में वापस आने से $2\frac{1}{2}$ घंटे अधिक लगाता है। यदि वह नीचे आने में ऊपर जाने से 10 km/h अधिक गति से आता है, तो प्रत्येक दिशा में उसकी गति की दर ज्ञात कीजिए।

33. यदि किसी त्रिभुज की एक भुजा के समांतर अन्य दो भुजाओं को भिन्न-भिन्न बिंदुओं पर प्रतिच्छेद करने के लिए एक रेखा खींची जाए, तो सिद्ध कीजिए कि ये अन्य दो भुजाएँ एक ही अनुपात में विभाजित हो जाती हैं। अत: दी गई आकृति में, सिद्ध कीजिए कि $\frac{AM}{MB} = \frac{AN}{ND}$, जहाँ LM || CB तथा LN || CD है।



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(b) Prove that the angle between the two tangents drawn from an external point to a circle is supplementary to the angle subtended by the line-segment joining the points of contact at the centre.

SECTION D

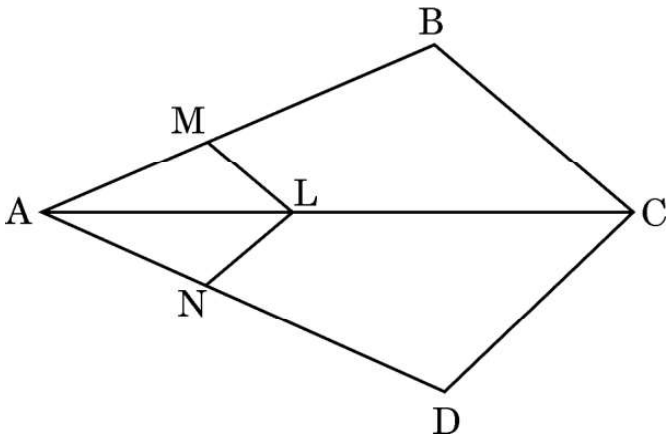
*This section has **4** Long Answer (LA) type questions carrying **5** marks each.* $4\times5=20$

32. (a) The sum of the areas of two squares is 52 cm^2 and difference of their perimeters is 8 cm. Find the lengths of the sides of the two squares.

OR

(b) The time taken by a person to travel an upward distance of 150 km was $2\frac{1}{2}$ hours more than the time taken in the downward return journey. If he returned at a speed of 10 km/h more than the speed while going up, find the speeds in each direction.

33. Prove that a line drawn parallel to one side of a triangle to intersect the other two sides in distinct points divides the other two sides in the same ratio. Hence, in the figure given below, prove that $\frac{AM}{MB} = \frac{AN}{ND}$ where LM || CB and LN || CD.



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34. निम्नलिखित आँकड़ों का माध्य तथा माध्यक ज्ञात कीजिए :

वर्ग	*बारंबारता*
5 – 15	2
15 – 25	3
25 – 35	5
35 – 45	7
45 – 55	4
55 – 65	2
65 – 75	2

35. (क) भूमि के एक बिंदु A से आकाश में उड़ रहे हेलीकॉप्टर का उन्नयन कोण 45° है। 15 सेकंड की उड़ान के बाद, हेलीकॉप्टर का उन्नयन कोण 30° हो जाता है। यदि हेलीकॉप्टर 2000 m की स्थिर ऊँचाई पर उड़ रहा है, तो हेलीकॉप्टर की चाल ज्ञात कीजिए।

($\sqrt{3}$ = 1·732 लीजिए)

अथवा

(ख) 1·5 m लंबी एक लड़की 30 m ऊँची एक मीनार से कुछ दूरी पर खड़ी है। जब यह लड़की मीनार की ओर चलती है, तो मीनार के शिखर का इसकी आँख पर बना उन्नयन कोण 30° से बढ़कर 60° हो जाता है। उसके द्वारा मीनार की ओर चली गई दूरी ज्ञात कीजिए।

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34. Find the mean and median for the following data :

Classes	*Frequency*
5 – 15	2
15 – 25	3
25 – 35	5
35 – 45	7
45 – 55	4
55 – 65	2
65 – 75	2

35. (a) The angle of elevation of an airborne helicopter from a point A on the ground is 45°. After a flight of 15 seconds, the angle of elevation of the helicopter changes to 30°. If the helicopter is flying at a constant height of 2000 m, find the speed of the helicopter. (Take $\sqrt{3}$ = 1·732)

OR

(b) A girl 1·5 m tall is standing at some distance from a 30 m high tower. The angle of elevation from her eye to the top of the tower increases from 30° to 60° as she walks towards the tower. Find the distance she walked towards the tower.

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खण्ड ङ

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

प्रकरण अध्ययन – 1

36. राहुल अपनी क्रिकेट टीम के लिए भाग्यशाली (लकी चार्म) है। उसके पास एक जार में कार्ड हैं जिन पर 10 से 74 तक की संख्याएँ अंकित हैं। हर मैच से पहले, वह इस जार में से एक कार्ड निकालता है। यदि निकाले गए कार्ड पर एक सम संख्या अंकित है, तो टीम जीत जाती है। यदि अंकित संख्या सम है तथा 5 से भाज्य है, तो टीम एक बड़े अंतर से जीतती है। यदि यह संख्या 30 से कम एक विषम संख्या है, तो टीम कम अंतर से जीतती है और यदि यह संख्या 50 तथा 74 के बीच की अभाज्य संख्या है, तो टीम हारती है।

यदि आज राहुल एक कार्ड निकालता है, तो निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) राहुल द्वारा निकाले गए कार्ड पर एक सम संख्या आने की प्रायिकता क्या है ? *1*

(ii) राहुल द्वारा निकाले गए कार्ड पर 30 से कम एक विषम संख्या आने की प्रायिकता क्या है ? *1*

(iii) (क) राहुल द्वारा निकाले गए कार्ड पर 50 और 74 के बीच की एक अभाज्य संख्या आने की प्रायिकता क्या है ? *2*

अथवा

(ख) राहुल द्वारा निकाले गए 5 से भाज्य एक सम संख्या वाला कार्ड आने की प्रायिकता क्या है ? *2*

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SECTION E

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

Case Study – 1

36. Rahul is a lucky charm for his cricket team. He has a jar of cards with numbers from 10 to 74. Before each match, he draws a card from the jar. If the card bears an even number, the team wins. If the number is even and divisible by 5, they win by a big margin. If the number is an odd number less than 30, they win by a small margin. And if the number is a prime number between 50 and 74, they lose.

Answer the following questions if Rahul draws a card today :

(i) What is the probability that Rahul draws a card with an even number ? *1*

(ii) What is the probability that Rahul draws a card with an odd number less than 30 ? *1*

(iii) (a) What is the probability that Rahul draws a card with a prime number between 50 and 74 ? *2*

OR

(b) What is the probability that Rahul draws a card with an even number divisible by 5 ? *2*

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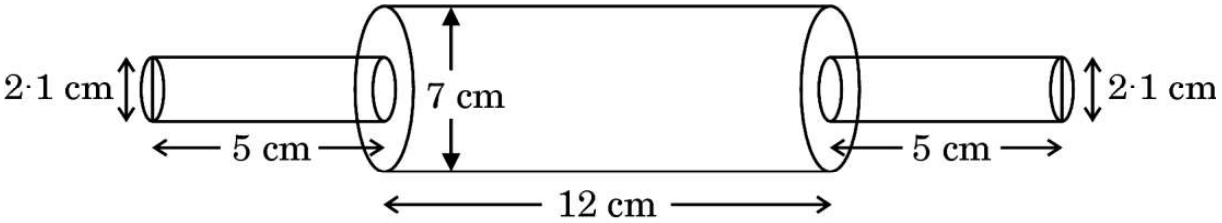
प्रकरण अध्ययन – 2

37. एक कुशल बढ़ई ने एक स्थानीय बेकर के लिए एक विशेष रोलिंग पिन तैयार करने का फैसला किया। वह ध्यान से लकड़ी के तीन बेलनाकार टुकड़ों को उत्तम टूल बनाने के लिए इस प्रकार जोड़ता है कि सिरों पर दो छोटे और बीच में एक बड़ा टुकड़ा रहता है। बेकर को यह रोलिंग पिन बहुत अच्छा लगा क्योंकि इससे आटे से ब्रेड तथा पेस्ट्रियों के लिए गुँधा आटा अच्छे प्रकार से बनाया जा सकता था।



बड़े बेलनाकार भाग (टुकड़े) की लम्बाई 12 cm तथा व्यास 7 cm है जबकि प्रत्येक छोटे बेलनाकार भाग की लंबाई 5 cm तथा व्यास 2·1 cm है।

उपर्युक्त सूचना के आधार पर, निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) बड़े बेलनाकार भाग का आयतन ज्ञात कीजिए। *1*

(ii) बड़े बेलनाकार भाग का वक्र पृष्ठीय क्षेत्रफल ज्ञात कीजिए। *1*

(iii) (क) बड़े बेलनाकार भाग के आयतन का दोनों छोटे बेलनाकार भागों के कुल आयतन से अनुपात ज्ञात कीजिए। *2*

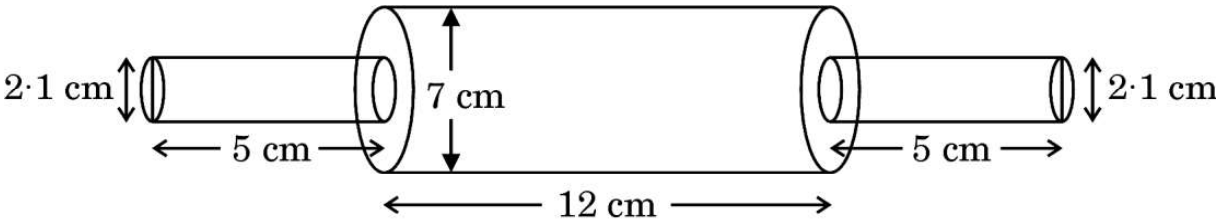
अथवा

(ख) दो एक जैसे छोटे बेलनाकार भागों के वक्र पृष्ठीय क्षेत्रफलों का योगफल ज्ञात कीजिए। *2*

• • •

Case Study – 2

37. A skilled carpenter decided to craft a special rolling pin for the local baker. He carefully joined three cylindrical pieces of wood – two small ones on the ends and one larger in the centre to create a perfect tool. The baker loved the rolling pin, as it rolled out the smoothest dough for breads and pastries.



The length of the bigger cylindrical part is 12 cm and diameter is 7 cm and the length of each smaller cylindrical part is 5 cm and diameter is 2·1 cm.

Based on the above information, answer the following questions :

(i) Find the volume of the bigger cylindrical part. *1*

(ii) Find the curved surface area of the bigger cylindrical part. *1*

(iii) (a) Find the ratio of the volume of the bigger cylindrical part to the total volume of the two smaller (identical) cylindrical parts. *2*

OR

(b) Find the sum of the curved surface areas of the two identical smaller cylindrical parts. *2*

• • •

प्रकरण अध्ययन – 3

38. एक स्कूल अपने विद्यार्थियों की प्रतिभा दर्शाने के लिए एक भव्य सांस्कृतिक कार्यक्रम का आयोजन कर रहा है। अतिथियों की सुविधा के लिए, स्कूल ने स्थानीय सप्लायर से कुर्सियाँ और मेजें किराए पर लेने की योजना बनाई। स्कूल को ज्ञात हुआ कि प्रत्येक कुर्सी का किराया ₹ 50 तथा प्रत्येक मेज का किराया ₹ 200 है। स्कूल ने कुर्सियों तथा मेजों के किराए पर कुल ₹ 30,000 खर्च किए। साथ ही, किराए पर ली गई मदों (कुर्सियों और मेजों) की कुल संख्या 300 है।

यदि स्कूल ने 'x' कुर्सियाँ तथा 'y' मेजें किराए पर लीं, तो निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) दी गई सूचनाओं को निरूपित करने के लिए रैखिक समीकरण युग्म लिखिए। *1*

(ii) (क) स्कूल द्वारा किराए पर ली गई कुर्सियों तथा मेजों की संख्या ज्ञात कीजिए। *2*

अथवा

(ख) यदि स्कूल 300 मदों (कुर्सियों और मेजों) पर कुल ₹ 27,000 खर्च करना चाहता है, तो किराए पर ली जा सकने वाली कुर्सियों तथा मेजों की संख्या ज्ञात कीजिए। *2*

(iii) यदि कुर्सियाँ किराए पर न ली जाएँ, तो ₹ 30,000 में किराए पर अधिकतम कितनी मेजें ली जा सकती हैं ? *1*

• • •

Case Study – 3

38. A school is organizing a grand cultural event to show the talent of its students. To accommodate the guests, the school plans to rent chairs and tables from a local supplier. It finds that rent for each chair is ₹ 50 and for each table is ₹ 200. The school spends ₹ 30,000 for renting the chairs and tables. Also, the total number of items (chairs and tables) rented are 300.

If the school rents 'x' chairs and 'y' tables, answer the following questions :

(i) Write down the pair of linear equations representing the given information. *1*

(ii) (a) Find the number of chairs and number of tables rented by the school. *2*

OR

(b) If the school wants to spend a maximum of ₹ 27,000 on 300 items (tables and chairs), then find the number of chairs and tables it can rent. *2*

(iii) What is maximum number of tables that can be rented in ₹ 30,000 if no chairs are rented ? *1*

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

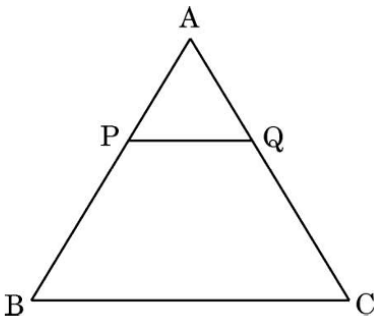
General Instructions: -

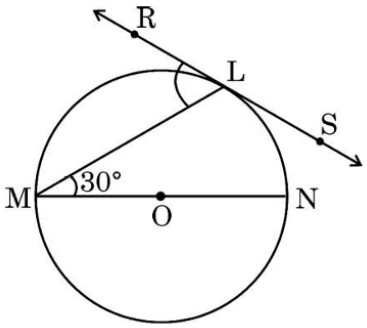
1.	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested 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 the competency-based questions, please try to understand given answer and even if reply is not from Marking Scheme but correct competency is enumerated by the candidate, due marks should be awarded.**
4.	The Marking scheme carries only suggested value points for the answers. These are in the nature of Guidelines only and do not constitute the complete answer. The students can have their own expression and if the expression is correct, the due marks should be awarded accordingly.
5.	The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. If there is any variation, the same should be zero after deliberation and discussion. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.
6.	Evaluators will mark (✓) wherever answer is correct. For wrong answer CROSS 'X" be marked. Evaluators will not put right (✓) while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing.**
7.	If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totalled up and written on the left-hand margin and encircled. This may be followed strictly.
8.	If a question does not have any parts, marks must be awarded on the left-hand margin and encircled. This may also be followed strictly.

9.	If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note "Extra Question".
10.	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
11.	A full scale of marks ____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.

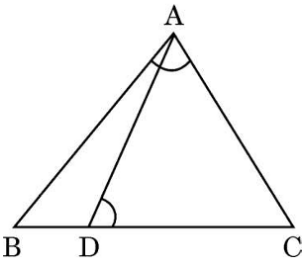
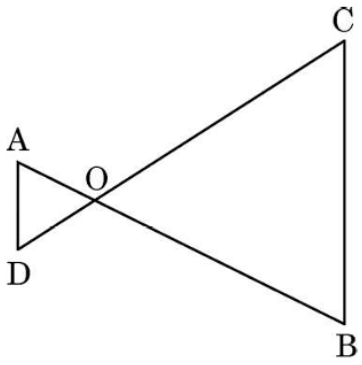
MARKING SCHEME
MATHEMATICS (Subject Code–041)
(PAPER CODE: 30/2/2)

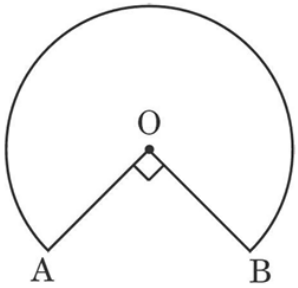
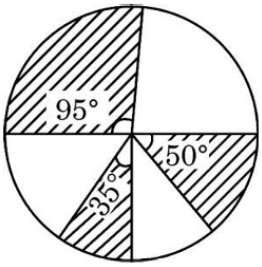
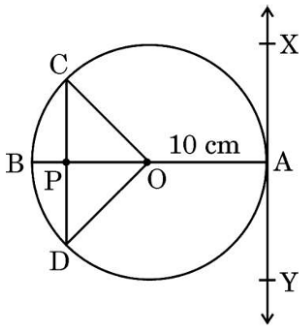
Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Marks
	SECTION A This section has **20** Multiple Choice Questions (MCQs) carrying 1 mark each.	
1.	The quadratic equation whose sum and product of roots are 'a' and '$\frac{1}{a}$' respectively is : (A) $ax^2 - ax + 1 = 0$ (B) $ax^2 - a^2x + 1 = 0$ (C) $ax^2 + ax + 1 = 0$ (D) $ax^2 + a^2x - 1 = 0$	
Sol.	(B) $ax^2 - a^2x + 1 = 0$	**1**
2.	The 9^{th} term from the end (towards first term) of the AP 7, 11, 15, 19, …., 147 is : (A) 135 (B) 125 (C) 115 (D) 39	
Sol.	(C) 115	**1**
3.	The perimeter of the triangle formed by the vertices (0, 0), (2, 0) and (0, 2) is : (A) 4 units (B) 6 units (C) $6\sqrt{2}$ units (D) $(4 + 2\sqrt{2})$ units	
Sol.	(D) $(4 + 2\sqrt{2})$ units	**1**
4.	The line represented by the equation $x - y = 0$ is : (A) parallel to x-axis (B) parallel to y-axis (C) passing through the origin (D) passing through the point (3, 2)	
Sol.	(C) passing through the origin.	**1**
5.	If -4 is a zero of the polynomial $p(x) = x^2 - x - (2 + 2k)$, then the value of k is : (A) 3 (B) 9 (C) 6 (D) -9	
Sol.	(B) 9	**1**
6.	The HCF of 40, 110 and 360 is : (A) 40 (B) 110 (C) 360 (D) 10	
Sol.	(D) 10	**1**

7.	If a large circular pizza is divided into 5 equal sectors, then the central angle of each sector will be : (A) 60° (B) 90° (C) 45° (D) 72°	
Sol.	(D) 72°	**1**
8.	The least number which is a perfect square and is divisible by each of 16, 20 and 50, is : (A) 1200 (B) 100 (C) 3600 (D) 2400	
Sol.	The correct option is not available in the given options. Full marks may be awarded to every attempt.	**1**
9.	In the given figure, PQ $\|\|$ BC. If $\frac{AP}{PB} = \frac{4}{13}$ and AC = 20·4 cm, then the length of AQ is :  (A) 2·8 cm (B) 5·8 cm (C) 3·8 cm (D) 4·8 cm	
Sol.	(D) 4.8 cm	**1**
10.	The coordinates of the end points of a diameter of a circle are (5, – 2) and (5, 2). The length of the radius of the circle is : (A) ± 2 (B) ± 4 (C) 4 (D) 2	
Sol.	(D) 2	**1**
11.	If $\sin(\alpha + \beta) = 1$, then the value of $\sin\left(\frac{\alpha+\beta}{2}\right)$ is : (A) $\frac{1}{\sqrt{2}}$ (B) $\frac{1}{2}$ (C) 0 (D) 1	
Sol.	(A) $\frac{1}{\sqrt{2}}$	**1**

12.	If $1080 = 2^p \times 3^q \times 5$, then $(p - q)$ is equal to : (A) 6 (B) -1 (C) 1 (D) 0	
Sol.	(D) 0	**1**
13.	If all the red face cards are removed from the deck of 52 playing cards, then the probability of getting a black jack from the remaining cards is : (A) $\frac{2}{46}$ (B) $\frac{2}{52}$ (C) $\frac{4}{48}$ (D) $\frac{2}{23}$	
Sol.	(A) $\frac{2}{46}$	**1**
14.	The equation of a line parallel to the x-axis and at a distance of 3 units below x-axis is : (A) $x = 3$ (B) $x = -3$ (C) $y = -3$ (D) $y = 3$	
Sol.	(C) $y = -3$	**1**
15.	In the given figure, RS is the tangent to the circle at the point L and MN is the diameter. If $\angle NML = 30°$, then $\angle RLM$ is :  (A) 30° (B) 60° (C) 90° (D) 120°	
Sol.	(B) 60°	**1**
16.	In a cricket match, a batsman hits the boundary 7 times out of the 42 balls he plays. The probability of his ***not*** hitting a boundary is : (A) $\frac{1}{7}$ (B) $\frac{2}{7}$ (C) $\frac{5}{6}$ (D) $\frac{1}{6}$	
Sol.	(C) $\frac{5}{6}$	**1**

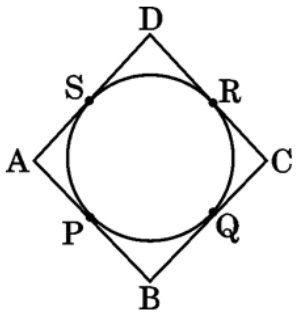
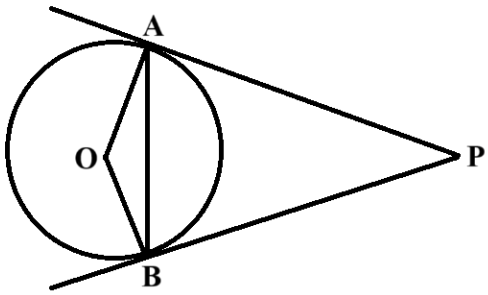
17.	Which of the following statements is ***incorrect*** ? (A) Two congruent figures are always similar. (B) A square and a rhombus of the same area are always similar. (C) Two equilateral triangles are always similar. (D) Two similar triangles need not be congruent.	
Sol.	(B) A square and a rhombus of the same area are always similar.	**1**
18.	If $\sin 30° \tan 45° = \frac{\sec 60°}{k}$, then the value of k is : (A) 4 (B) 3 (C) 2 (D) 1	
Sol.	(A) 4	**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 pair of linear equations $px + 3y + 59 = 0$ and $2x + 6y + 118 = 0$ will have infinitely many solutions if $p = 1$. *Reason (R):* If the pair of linear equations $px + 3y + 19 = 0$ and $2x + 6y + 157 = 0$ has a unique solution, then $p \neq 1$.	
Sol.	(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).	**1**
20	*Assertion (A) :* Common difference of the AP : 5, 1, – 3, – 7, … is 4. *Reason (R):* Common difference of the AP : $a_1, a_2, a_3, \ldots, a_n$ is obtained by $d = a_n - a_{n-1}$.	
Sol.	(D) Assertion (A) is false, but Reason (R) is true.	**1**
	SECTION B This section has **5** Very Short Answer (VSA) type questions carrying 2 marks each.	
21	Find a quadratic polynomial whose zeroes are 2 and $-\frac{7}{5}$.	
Sol.	Sum of zeroes = $2 + \left(-\frac{7}{5}\right) = \frac{3}{5}$ Product of zeroes = $2 \times \left(-\frac{7}{5}\right) = -\frac{14}{5}$	½ ½

	∴ Required quadratic polynomial is $x^2 - \frac{3}{5}x - \frac{14}{5}$ or $5x^2 - 3x - 14$	**1**
22 (a)	In the given figure, D is a point on the side BC of Δ ABC such that ∠ ADC = ∠ BAC. Show that $CA^2 = CD \cdot CB$.  	
Sol.	In Δ ACD and Δ BCA ∠ ADC = ∠ BAC ∠ ACD = ∠ BCA ∴ Δ ACD ~ Δ BCA So, $\frac{CA}{CB} = \frac{CD}{CA}$ $\Rightarrow CA^2 = CD.CB$	**1** ½ ½
	OR	
22 (b)	In the given figure, OA . OB = OC . OD. Show that ∠ A = ∠ C and ∠ B = ∠ D.  	
Sol.	Given OA.OB = OC.OD $\Rightarrow \frac{OA}{OC} = \frac{OD}{OB}$ & ∠ AOD = ∠ COB ∴ Δ AOD ~ Δ COB So, ∠ D = ∠ B and ∠ A = ∠ C	½ ½ ½ ½

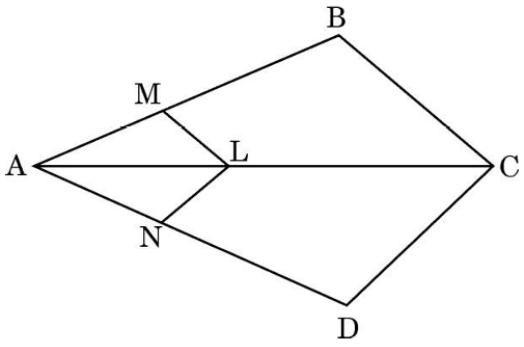
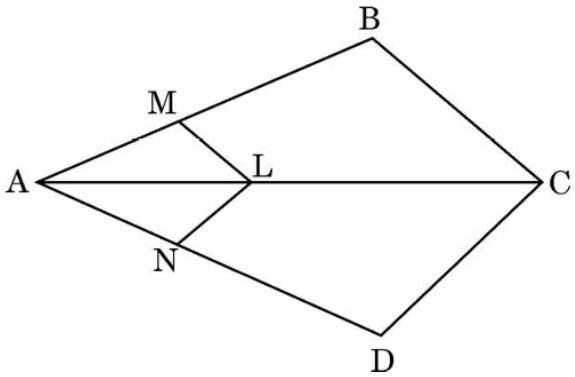
23 (a)	In the given figure, the shape of the top of a table is that of a sector of a circle with centre O and $\angle AOB = 90°$. If AO = OB = 42 cm, then find the perimeter of the top of the table.  	
Sol.	Reflex $\angle AOB = 360° - 90° = 270°$ Perimeter of the top of table = length of major arc + 2 × radius $= \frac{270}{360} \times 2 \times \frac{22}{7} \times 42 + 2 \times 42$ $= 282$ cm	½ **1** ½
	OR	
23 (b)	In the given figure, three sectors of a circle of radius 5 cm, making angles 35°, 50° and 95° at the centre are shaded. Find the area of the shaded region. [Use $\pi = \frac{22}{7}$]  	
Sol.	Area of shaded region $= \frac{95}{360} \times \frac{22}{7} \times (5)^2 + \frac{50}{360} \times \frac{22}{7} \times (5)^2 + \frac{35}{360} \times \frac{22}{7} \times (5)^2$ $= \frac{(95 + 50 + 35)}{360} \times \frac{22}{7} \times (5)^2$ $= \frac{180}{360} \times \frac{22}{7} \times (5)^2$ $= \frac{275}{7}$ cm^2 or 39.29 cm^2 approx.	**1** ½ ½
24.	At point A on the diameter AB of a circle of radius 10 cm, tangent XAY is drawn to the circle. Find the length of the chord CD parallel to XY at a distance of 16 cm from A.  	
Sol.	AP = 16 cm ∴ OP = 16 – 10 = 6 cm	½

	XY ‖ CD $\therefore \angle CPO = 90°$ In right Δ OPC, $CP = \sqrt{(10)^2 - (6)^2} = 8$ cm CD = 2 × CP = 2 × 8 = 16 cm	 **1** ½
25.	If $\tan A = \sqrt{3}$; where A is an acute angle, then find the value of $\frac{\sin^2 A}{1+\cos^2 A}$.	
Sol.	$\tan A = \sqrt{3} = \tan 60°$ $\Rightarrow A = 60°$ $\frac{\sin^2 A}{1+\cos^2 A} = \frac{\sin^2 60°}{1+\cos^2 60°}$ $= \frac{\left(\frac{\sqrt{3}}{2}\right)^2}{1+\left(\frac{1}{2}\right)^2}$ $= \frac{3}{5}$	½ **1** ½
	SECTION C This section has **6** Short Answer (SA) type questions carrying 3 marks each.	
26 (a)	If $\tan\theta + \sin\theta = m$ and $\tan\theta - \sin\theta = n$, then prove that $m^2 - n^2 = 4\sqrt{mn}$.	
Sol.	LHS = $m^2 - n^2$ = $(\tan\theta + \sin\theta)^2 - (\tan\theta - \sin\theta)^2$ = $4\tan\theta \sin\theta$ = $4\sqrt{\tan^2\theta . \sin^2\theta}$ = $4\sqrt{\tan^2\theta\,(1 - \cos^2\theta)}$ = $4\sqrt{\tan^2\theta - \sin^2\theta}$ = $4\sqrt{(\tan\theta + \sin\theta)(\tan\theta - \sin\theta)}$ = $4\sqrt{mn}$ = RHS	**1** ½ ½ ½ ½
	OR	
26 (b)	Prove that : $\frac{\cot A - 1}{2 - \sec^2 A} = \frac{\cot A}{1 + \tan A}$	
Sol.	LHS = $\frac{\frac{1}{\tan A} - 1}{2-(1+\tan^2 A)}$ = $\frac{\frac{1-\tan A}{\tan A}}{2-1-\tan^2 A}$ = $\frac{1-\tan A}{\tan A(1-\tan^2 A)}$ = $\frac{1}{\tan A\,(1+\tan A)}$	**1** ½ ½ ½

	$= \frac{\cot A}{1+\tan A}$ = RHS	½
27.	If (a, b) is the mid-point of the line segment joining the points A(10, – 6) and B(k, 4) and a – 2b = 18, then find the value of k.	
Sol.	$a = \frac{10+k}{2}$ and $b = \frac{-6+4}{2} = -1$ Given, a – 2b = 18 $\Rightarrow \frac{10+k}{2} - 2(-1) = 18$ $\Rightarrow k = 22$	½ ½ 1 1
28.	A sum of ₹ 2,000 is invested at 7% per annum simple interest. Calculate the interests at the end of 1st, 2nd and 3rd year. Do these interests form an AP ? If so, find the interest at the end of the 27th year.	
Sol.	Interest at the end of 1st year = $\frac{2000 \times 7 \times 1}{100}$ = ₹ 140 Interest at the end of 2nd year = $\frac{2000 \times 7 \times 2}{100}$ = ₹ 280 Interest at the end of 3rd year = $\frac{2000 \times 7 \times 3}{100}$ = ₹ 420 140, 280, 420, … Yes, Interests form an AP with first term = 140 and common difference = 140 Interest at the end of 27th year = 140 + 26 × 140 = ₹ 3780	½ ½ ½ ½ ½ ½
29.	Prove that $\sqrt{3}$ is an irrational number.	
Sol.	Let $\sqrt{3}$ be a rational number. $\therefore \sqrt{3} = \frac{p}{q}$, where $q \neq 0$ and let p & q be coprimes. $\Rightarrow 3q^2 = p^2$ $\Rightarrow p^2$ is divisible by 3. $\Rightarrow$ p is divisible by 3. ----- ① Let p = 3a, where 'a' is some integer $\therefore 9a^2 = 3q^2$ $\Rightarrow q^2 = 3a^2$ $\Rightarrow q^2$ is divisible by 3 $\Rightarrow$ q is divisible by 3 ----- ② $\therefore$ 3 divides both p & q. ① and ② leads to contradiction as p and q are coprimes. Hence, $\sqrt{3}$ is an irrational number.	½ 1 1 ½
30.	The length of the hour hand of a clock is 10 cm. Find the area of the minor sector swept by the hour hand of the clock between 5 a.m. to 8 a.m. Also, find the area of the major sector.	
Sol.	Central angle subtended by hour hand between 5 am to 8 am = $\frac{360°}{12} \times 3 = 90°$ Area of minor segment = $\frac{90}{360} \times \frac{22}{7} \times (10)^2$	½ 1

	$= \frac{550}{7}$ or 78.57 cm^2 approx.	½
	Area of circle = $\frac{22}{7} \times (10)^2 = \frac{2200}{7}$ cm^2	½
	Area of major segment = $\frac{2200}{7} - \frac{550}{7}$	
	$= \frac{1650}{7}$ or 235.71 cm^2 approx.	½
31 (a)	Prove that the parallelogram circumscribing a circle is a rhombus.	
Sol.	Correct figure	½
		
	We know that lengths of tangents drawn from an external point to a circle are equal ∴ AP = AS --- ① BP = BQ --- ② CR = CQ --- ③ DR = DS --- ④	**1**
	Adding ①, ②, ③ and ④, we have	
	(AP + BP) + (CR + DR) = AS + (BQ + CQ) + DS	
	⟹ AB + CD = BC + AD	½
	∵ AB = CD and BC = AD	½
	∴ AB = BC = CD = AD	½
	Therefore, ABCD is a rhombus.	
	OR	
31 (b)	Prove that the angle between the two tangents drawn from an external point to a circle is supplementary to the angle subtended by the line-segment joining the points of contact at the centre.	
Sol.	PA and PB are tangents from the external point P to the circle with centre O. Correct figure	**1**
		
	∠ OAP = ∠ OBP = 90°	**1**
	In quadrilateral OAPB, ∠ APB + ∠ OAP + ∠ OBP + ∠ AOB = 360°	½

	$\Rightarrow \angle APB + 90° + 90° + \angle AOB = 360°$ $\Rightarrow \angle APB + \angle AOB = 180°$ $\therefore \angle APB$ and $\angle AOB$ are supplementary.	½
	SECTION D This section has **4** Long Answer (LA) type questions carrying 5 marks each.	
32 (a)	The sum of the areas of two squares is 52 cm^2 and difference of their perimeters is 8 cm. Find the lengths of the sides of the two squares.	
Sol.	Let the lengths of the sides of two squares be 'x' cm and 'y' cm such that x > y. ATQ $x^2 + y^2 = 52$ --- ① $4x - 4y = 8$ or $x - y = 2$ --- ② From ① and ②, we have $y^2 + 2y - 24 = 0$ $\Rightarrow (y + 6)(y - 4) = 0$ $\therefore y = 4$ So, $x = 2 + 4 = 6$ $\therefore$ Lengths of the sides of two squares are 6 cm and 4 cm respectively.	**1** **1** **1** **1** ½ ½
	OR	
32 (b)	The time taken by a person to travel an upward distance of 150 km was $2\frac{1}{2}$ hours more than the time taken in the downward return journey. If he returned at a speed of 10 km/h more than the speed while going up, find the speeds in each direction.	
Sol.	Let the speed in upward direction be 'x' km/h and the speed in downward direction = (x + 10) km/h ATQ $\frac{150}{x} - \frac{150}{x+10} = \frac{5}{2}$ $\Rightarrow x^2 + 10x - 600 = 0$ $\Rightarrow (x + 30)(x - 20) = 0$ $\therefore x = 20$ and $x + 10 = 20 + 10 = 30$ Therefore, speeds in upward and downward direction are 20 km/h and 30 km/h respectively.	½ **2** **1** ½ ½ ½

33.	Prove that a line drawn parallel to one side of a triangle to intersect the other two sides in distinct points divides the other two sides in the same ratio. Hence, in the figure given below, prove that $\frac{AM}{MB} = \frac{AN}{ND}$ where LM $\|\|$ CB and LN $\|\|$ CD.  	
Sol.	Correct figure, given, to prove and construction Correct proof  In Δ ABC, LM $\|$ CB $\frac{AM}{MB} = \frac{AL}{LC}$ --- ① In Δ ADC, LN $\|$ CD $\frac{AN}{ND} = \frac{AL}{LC}$ --- ② from ① and ②, we have $\frac{AM}{MB} = \frac{AN}{ND}$	**1½** **1½** **1** **½** **½**

34. Find the mean and median for the following data :

Classes	*Frequency*
5 – 15	2
15 – 25	3
25 – 35	5
35 – 45	7
45 – 55	4
55 – 65	2
65 – 75	2

Sol.

Classes	frequency (f_i)	x_i	$f_i x_i$	*cf*
5 – 15	2	10	20	2
15 – 25	3	20	60	5
25 – 35	5	30	150	10
35 – 45	7	40	280	17
45 – 55	4	50	200	21
55 – 65	2	60	120	23
65 – 75	2	70	140	25
Total	25		970	

Correct table **1½**

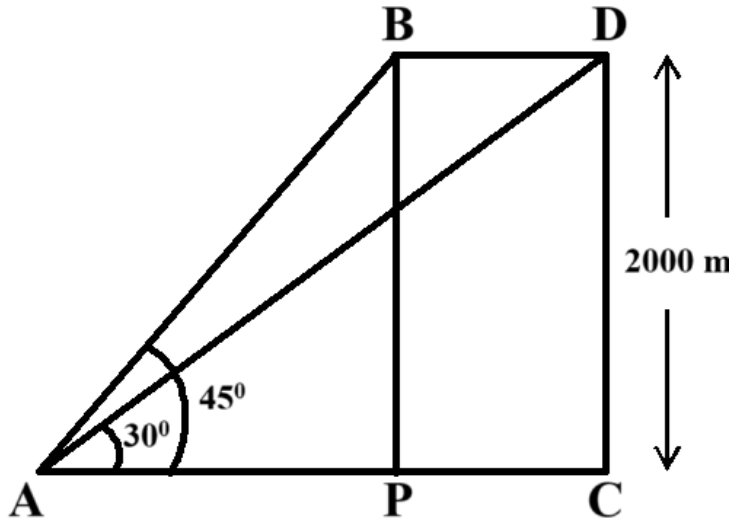
Mean = $\frac{970}{25}$ **1**

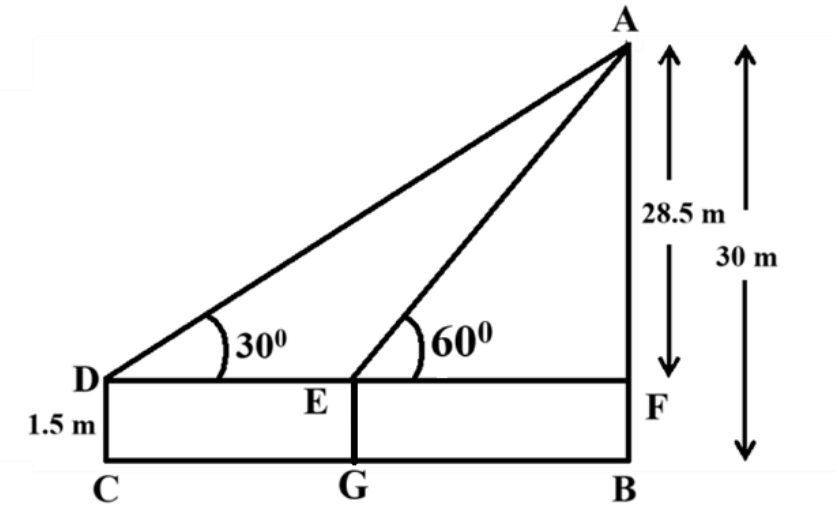
= 38.8 **½**

Median class is 35 – 45 **½**

Median = $35 + \left(\frac{\frac{25}{2} - 10}{7}\right) \times 10$ **1**

= $\frac{270}{7}$ or 38.57 approx. **½**

35 (a)	The angle of elevation of an airborne helicopter from a point A on the ground is 45°. After a flight of 15 seconds, the angle of elevation of the helicopter changes to 30°. If the helicopter is flying at a constant height of 2000 m, find the speed of the helicopter. (Take $\sqrt{3}$ = 1·732)	
Sol.	Correct figure 	**1**
	In right Δ APB	
	$\frac{2000}{AP} = \tan 45° = 1$	½
	$\Rightarrow$ AP = 2000 m	½
	In right Δ ACD	
	$\frac{2000}{AC} = \tan 30° = \frac{1}{\sqrt{3}}$	½
	$\Rightarrow$ AC = 2000 $\sqrt{3}$ m	½
	BD = PC = AC – AP = 2000 $\sqrt{3}$ – 2000 = 2000 (1.732 – 1) = 1464 m	**1**
	Time taken from B to D = 15 sec	
	Speed = $\frac{1464}{15}$ = 97.6 m/s	**1**
	OR	

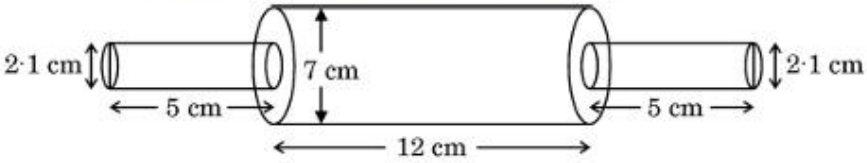
35 (b)	A girl 1·5 m tall is standing at some distance from a 30 m high tower. The angle of elevation from her eye to the top of the tower increases from 30° to 60° as she walks towards the tower. Find the distance she walked towards the tower.	
Sol.	Correct figure 	**1**
	AF = 30 – 1·5 = 28·5 m	½
	In right Δ AFE	
	$\frac{28.5}{EF} = \tan 60° = \sqrt{3}$	**1**
	$\Rightarrow EF = \frac{28.5}{\sqrt{3}}$ m	½
	In right Δ ADF	
	$\frac{28.5}{DF} = \tan 30° = \frac{1}{\sqrt{3}}$	½
	$\Rightarrow DF = 28.5\sqrt{3}$ m	½
	Distance travelled by the girl towards the tower, DE = DF – EF	
	$= 28.5\sqrt{3} - \frac{28.5}{\sqrt{3}}$	
	$= \frac{57}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$	½
	$= 19\sqrt{3}$ m or 32.91 m approx.	½
	Distance travelled by girl towards the tower is $19\sqrt{3}$ m or 32.91 m.	

	SECTION E This section has **3** case study based questions carrying 4 marks each.	
36.	**Case Study – 1** Rahul is a lucky charm for his cricket team. He has a jar of cards with numbers from 10 to 74. Before each match, he draws a card from the jar. If the card bears an even number, the team wins. If the number is even and divisible by 5, they win by a big margin. If the number is an odd number less than 30, they win by a small margin. And if the number is a prime number between 50 and 74, they lose.  Answer the following questions if Rahul draws a card today : (i) What is the probability that Rahul draws a card with an even number ? (ii) What is the probability that Rahul draws a card with an odd number less than 30 ? (iii) (a) What is the probability that Rahul draws a card with a prime number between 50 and 74 ? **OR** (b) What is the probability that Rahul draws a card with an even number divisible by 5 ?	
Sol.	(i) Total possible outcomes = 74 – 10 + 1 = 65 P (even number) = $\frac{33}{65}$ (ii) P (odd number less than 30) = $\frac{10}{65}$ or $\frac{2}{13}$ (iii) (a) Favourable outcomes are 53, 59, 61, 67, 71, 73 Number of favourable = 6 P (prime number between 50 and 74) = $\frac{6}{65}$ **OR** (b) Favourable outcomes are 10, 20, 30, 40, 50, 60, 70 Number of favourble outcomes = 7 P (even number divisble by 5) = $\frac{7}{65}$	½ ½ **1** **1** **1** **1** **1**

37.

Case Study – 2

A skilled carpenter decided to craft a special rolling pin for the local baker. He carefully joined three cylindrical pieces of wood – two small ones on the ends and one larger in the centre to create a perfect tool. The baker loved the rolling pin, as it rolled out the smoothest dough for breads and pastries.



The length of the bigger cylindrical part is 12 cm and diameter is 7 cm and the length of each smaller cylindrical part is 5 cm and diameter is 2·1 cm.

Based on the above information, answer the following questions :

(i) Find the volume of the bigger cylindrical part.

(ii) Find the curved surface area of the bigger cylindrical part.

(iii) (a) Find the ratio of the volume of the bigger cylindrical part to the total volume of the two smaller (identical) cylindrical parts.

OR

(b) Find the sum of the curved surface areas of the two identical smaller cylindrical parts.

Sol.

(i) Volume of the bigger cylindrical part $= \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times 12$ ½

$= 462 \text{ cm}^3$ ½

(ii) The Curved Surface Area of bigger cylindrical part $= 2 \times \frac{22}{7} \times \frac{7}{2} \times 12$ ½

$= 264 \text{ cm}^2$ ½

(iii) (a) Total volume of the two smaller cylindrical parts $= 2 \times \frac{22}{7} \times \frac{2.1}{2} \times \frac{2.1}{2} \times 5$ ½

$= 34.65 \text{ cm}^3$ ½

Required ratio $= \frac{462}{34.65} = \frac{3080}{231}$ 1

∴ required ratio is 3080:231

OR

(b) The Sum of Curved Surface Area of two smaller cylindrical parts $= 2 \times 2 \times \frac{22}{7} \times \frac{2.1}{2} \times 5$ 1

$= 66 \text{ cm}^2$ 1

38.

Case Study – 3

A school is organizing a grand cultural event to show the talent of its students. To accommodate the guests, the school plans to rent chairs and tables from a local supplier. It finds that rent for each chair is ₹ 50 and for each table is ₹ 200. The school spends ₹ 30,000 for renting the chairs and tables. Also, the total number of items (chairs and tables) rented are 300.

If the school rents 'x' chairs and 'y' tables, answer the following questions :

(i) Write down the pair of linear equations representing the given information.

(ii) (a) Find the number of chairs and number of tables rented by the school.

OR

(b) If the school wants to spend a maximum of ₹ 27,000 on 300 items (tables and chairs), then find the number of chairs and tables it can rent.

(iii) What is maximum number of tables that can be rented in ₹ 30,000 if no chairs are rented ?

Sol.

(i) $x + y = 300$ ½

and $50x + 200y = 30000$ or $x + 4y = 600$ ½

(ii) (a) $x + y = 300$ and $x + 4y = 600$

Solving the equations, we get

$x = 200$ and $y = 100$ **1 + 1**

∴ Number of chairs and tables rented by the school are 200 and 100 respectively.

OR

(b) $x + y = 300$ and $50x + 200y = 27000$ or $x + 4y = 540$ **1**

Solving the equations, we get

$x = 220$ and $y = 80$ ½ + ½

∴ Number of chairs and tables rented by the school are 220 and 80 respectively.

(iii) Number of tables = $\frac{30000}{200} = 150$ **1**

∴ Maximum number of tables that can be rented is 150 if no chairs are rented.