Series C4ABD/4 **SET~3**

रोल नं.
Roll No.

प्रश्न–पत्र कोड
Q.P. Code **30/4/3**

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.

नोट / NOTE :

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

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

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

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

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

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

1. 12 cm त्रिज्या वाले एक वृत्त के एक त्रिज्यखण्ड का क्षेत्रफल 60π cm^2 है । इस त्रिज्यखण्ड के केंद्रीय कोण की माप है :

(A) $120°$ (B) $6°$

(C) $75°$ (D) $150°$

2. दी गई दो रेखाएँ परस्पर समांतर हैं । इनमें से एक रेखा का समीकरण $5x - 3y = 2$ है । तो दूसरी रेखा का समीकरण हो सकता है :

(A) $-15x - 9y = 5$ (B) $15x + 9y = 5$

(C) $9x - 15y = 6$ (D) $-15x + 9y = 5$

General Instructions :

Read the following instructions very carefully and strictly follow them :

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

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

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

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

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

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

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

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

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

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

SECTION A

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

1. The area of the sector of a circle of radius 12 cm is 60π cm^2. The central angle of this sector is :

(A) 120° (B) 6°

(C) 75° (D) 150°

2. Two lines are given to be parallel. The equation of one of these lines is $5x - 3y = 2$. The equation of the second line can be :

(A) $-15x - 9y = 5$ (B) $15x + 9y = 5$

(C) $9x - 15y = 6$ (D) $-15x + 9y = 5$

3. दिन में किसी समय, एक मीनार की छाया की लंबाई इसकी ऊँचाई के बराबर होती है । तो उस समय सूर्य का उन्नतांश है :

(A) $30°$ (B) $45°$

(C) $60°$ (D) $90°$

4. रैखिक समीकरण युग्म $y = 0$ तथा $y = -7$ का/के

(A) मात्र एक हल है (B) दो हल हैं

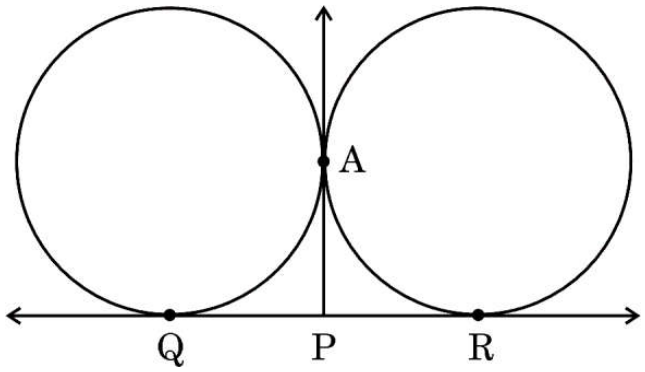
(C) अपरिमित रूप से अनन्त हल हैं (D) कोई हल नहीं है

5. $5\sqrt{2}$ cm त्रिज्या वाले वृत्त के अंतर्गत बने वर्ग का क्षेत्रफल है :

(A) $50\ cm^2$ (B) $100\ cm^2$

(C) $25\ cm^2$ (D) $200\ cm^2$

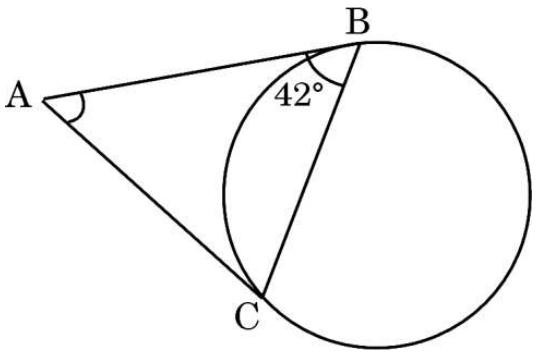
6. दी गई आकृति में, बिंदु A पर बाह्य स्पर्श करने वाले दो वृत्तों की एक उभयनिष्ठ स्पर्श-रेखा QR है । बिंदु A पर खींची गई स्पर्श-रेखा QR को P पर मिलती है । यदि AP = 4·2 cm है, तो QR की लंबाई है :



(A) 4·2 cm (B) 2·1 cm

(C) 8·4 cm (D) 6·3 cm

7. दी गई आकृति में, AB तथा AC एक वृत्त पर खींची गई स्पर्श-रेखाएँ हैं । यदि $\angle ABC = 42°$ है, तो $\angle BAC$ की माप है :



(A) $96°$ (B) $42°$

(C) $106°$ (D) $86°$

3. At some time of the day, the length of the shadow of a tower is equal to its height. Then, the Sun's altitude at that time is :

(A) 30° (B) 45°

(C) 60° (D) 90°

4. The pair of linear equations y = 0 and y = – 7 have

(A) exactly one solution (B) two solutions

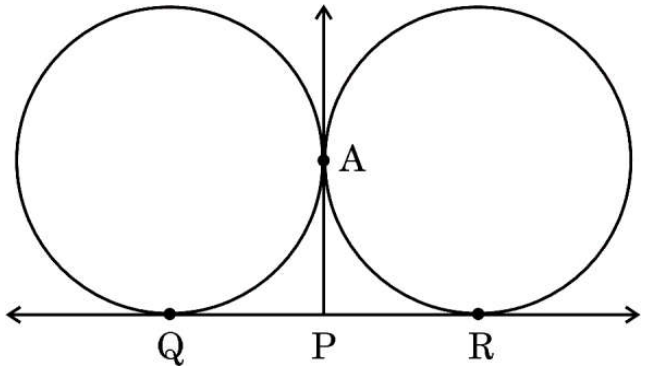
(C) infinitely many solutions (D) no solution

5. The area of the square inscribed in a circle of radius $5\sqrt{2}$ cm is :

(A) 50 cm^2 (B) 100 cm^2

(C) 25 cm^2 (D) 200 cm^2

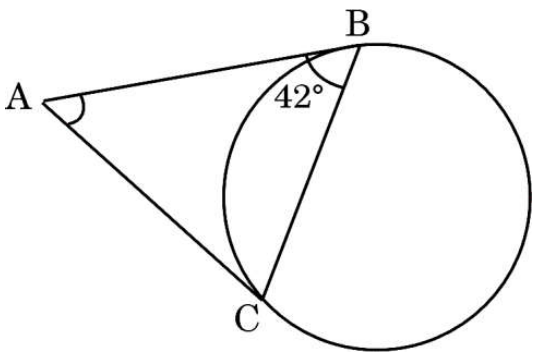
6. In the given figure, QR is a common tangent to the two given circles touching externally at A. The tangent at A meets QR at P. If AP = 4·2 cm, then the length of QR is :



(A) 4·2 cm (B) 2·1 cm

(C) 8·4 cm (D) 6·3 cm

7. In the given figure, AB and AC are tangents to the circle. If ∠ ABC = 42°, then the measure of ∠ BAC is :



(A) 96° (B) 42°

(C) 106° (D) 86°

8. भुजा 'a' वाले दो एकसमान ठोस घनों को किनारे से किनारा मिलाकर रखा गया । इस प्रकार बने घनाभ का सम्पूर्ण पृष्ठीय क्षेत्रफल है :

(A) $6a^2$ (B) $10a^2$

(C) $5a^2$ (D) $4a^2$

9. दो संख्याओं 65 तथा 104 का म.स. (HCF) 13 है । यदि 65 तथा 104 का ल.स. (LCM) 40x है, तो x का मान है :

(A) 5 (B) 13

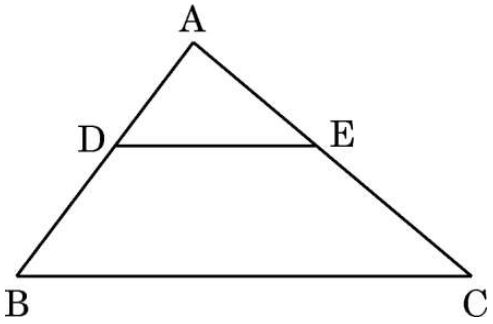
(C) 40 (D) 8

10. किसी घटना E के लिए, यदि $P(E) + P(\overline{E}) = q$ है, तो $q^2 - 4$ का मान है :

(A) -3 (B) 3

(C) 5 (D) -5

11. एक Δ ABC में, DE || BC है (जैसा कि आकृति में दर्शाया गया है) । यदि AD = 4 cm, AB = 9 cm तथा AC = 13·5 cm है, तो EC की लंबाई है :



(A) 6 cm (B) 7·5 cm

(C) 9 cm (D) 5·7 cm

12. यदि एक बहुपद $p(x) = x^2 - 5x + 6$ है, तो $p(1) + p(4)$ का मान है :

(A) 0 (B) 4

(C) 2 (D) -4

8. Two identical solid cubes of side 'a' are joined end-to-end. The total surface area of the resulting cuboid is :

(A) $6a^2$ (B) $10a^2$

(C) $5a^2$ (D) $4a^2$

9. The HCF of two numbers 65 and 104 is 13. If LCM of 65 and 104 is 40x, then the value of x is :

(A) 5 (B) 13

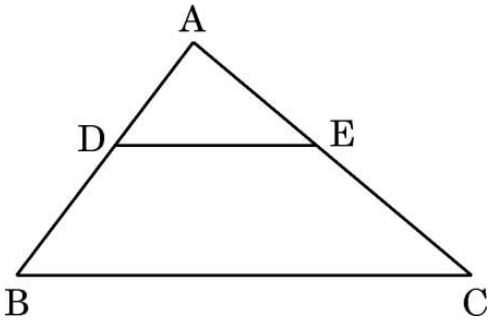
(C) 40 (D) 8

10. For an event E, if $P(E) + P(\overline{E}) = q$, then the value of $q^2 - 4$ is :

(A) – 3 (B) 3

(C) 5 (D) – 5

11. In Δ ABC, DE || BC (as shown in the figure). If AD = 4 cm, AB = 9 cm and AC = 13·5 cm, then the length of EC is :



(A) 6 cm (B) 7·5 cm

(C) 9 cm (D) 5·7 cm

12. If a polynomial p(x) is given by $p(x) = x^2 - 5x + 6$, then the value of p(1) + p(4) is :

(A) 0 (B) 4

(C) 2 (D) – 4

13. एक समांतर चतुर्भुज ABCD के तीन शीर्ष A(– 2, 3), B(6, 7) तथा C(8, 3) हैं, तो इसका चौथा शीर्ष D है :

(A) (0, 1) (B) (0, – 1)

(C) (– 1, 0) (D) (1, 0)

14. यदि किन्हीं आँकड़ों के बहुलक तथा माध्यक का अंतर 24 है, तो इनके माध्यक और माध्य का अंतर है :

(A) 12 (B) 24

(C) 8 (D) 36

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

(A) 4 (B) 10

(C) 16 (D) 8

16. एक निष्पक्ष पासे को एक बार उछालने पर 2 से बड़ी संख्या आने की प्रायिकता है :

(A) $\frac{2}{3}$ (B) $\frac{1}{3}$

(C) $\frac{1}{2}$ (D) $\frac{5}{6}$

17. यदि y = 1, द्विघात समीकरण $py^2 + py + 3 = 0$ का एक हल है, तो p का मान है :

(A) – 3 (B) 2

(C) $-\frac{3}{2}$ (D) – 2

18. θ का वह मान जिसके लिए $2 \sin^2 \theta = \frac{1}{2}$; जबकि $0° \leq \theta \leq 90°$, है

(A) 30° (B) 60°

(C) 45° (D) 90°

13. The fourth vertex D of a parallelogram ABCD whose three vertices are A(– 2, 3), B(6, 7) and C(8, 3) is :

(A) (0, 1) (B) (0, – 1)

(C) (– 1, 0) (D) (1, 0)

14. If the difference of mode and median of a data is 24, then the difference of its median and mean is :

(A) 12 (B) 24

(C) 8 (D) 36

15. Three numbers in A.P. have the sum 30. What is its middle term ?

(A) 4 (B) 10

(C) 16 (D) 8

16. The probability of throwing a number greater than 2 with a fair die is :

(A) $\frac{2}{3}$ (B) $\frac{1}{3}$

(C) $\frac{1}{2}$ (D) $\frac{5}{6}$

17. If y = 1 is one of the solutions of the quadratic equation $py^2 + py + 3 = 0$, then the value of p is :

(A) – 3 (B) 2

(C) $-\frac{3}{2}$ (D) – 2

18. The value of θ for which $2 \sin^2 \theta = \frac{1}{2}$; $0° \leq \theta \leq 90°$ is :

(A) 30° (B) 60°

(C) 45° (D) 90°

*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) :* एक रेखाखण्ड का मध्य-बिंदु इसे 1 : 1 के अनुपात में विभाजित करता है ।

तर्क (R) : बिंदु (– 3, k), बिंदुओं (– 5, 4) तथा (– 2, 3) को मिलाने वाले रेखाखण्ड को 1 : 2 के अनुपात में विभाजित करता है ।

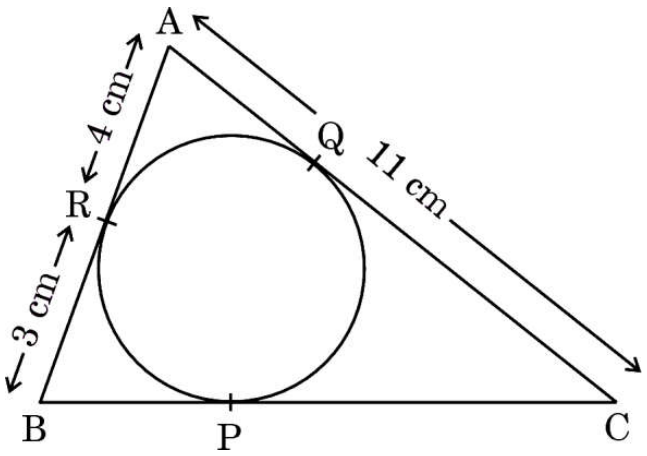
20. *अभिकथन (A) :* यदि एक वृत्त की परिधि 176 cm है, तो इसकी त्रिज्या 28 cm है ।

तर्क (R) : वृत्त की परिधि = $2\pi \times$ त्रिज्या

खण्ड ख

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

21. दी गई आकृति में, एक वृत्त के परिगत एक त्रिभुज ABC है । यदि AR = 4 cm, BR = 3 cm तथा AC = 11 cm है, तो BC की लंबाई ज्ञात कीजिए ।



*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) :* Mid-point of a line segment divides the line segment in the ratio 1 : 1.

Reason (R) : The ratio in which the point $(-3, k)$ divides the line segment joining the points $(-5, 4)$ and $(-2, 3)$ is 1 : 2.

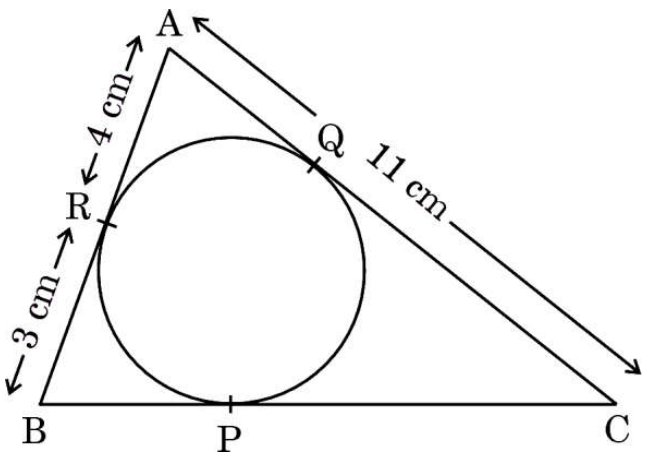
20. *Assertion (A) :* If the circumference of a circle is 176 cm, then its radius is 28 cm.

Reason (R): Circumference = $2\pi \times$ radius of a circle.

SECTION B

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

21. In the given figure, Δ ABC is circumscribing a circle. Find the length of BC, if AR = 4 cm, BR = 3 cm and AC = 11 cm.

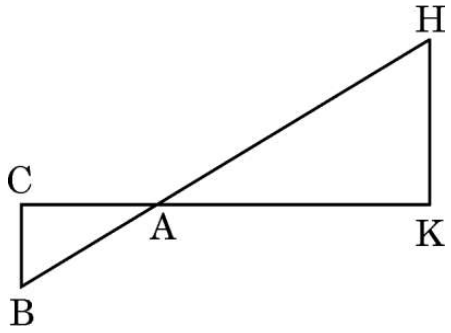


22. (a) मान ज्ञात कीजिए : $\frac{5\cos^2 60° + 4\sec^2 30° - \tan^2 45°}{\sin^2 30° + \sin^2 60°}$

अथवा

(b) यदि $\sin(A - B) = \frac{1}{2}$, $\cos(A + B) = \frac{1}{2}$; $0 < A + B \leq 90°$, $A > B$ है; तो $\angle A$ तथा $\angle B$ ज्ञात कीजिए ।

23. दी गई आकृति में, $\Delta AHK \sim \Delta ABC$ है । यदि AK = 8 cm, BC = 3·2 cm तथा HK = 6·4 cm है, तो AC की लंबाई ज्ञात कीजिए ।



24. (a) एक घड़ी की मिनट वाली सुई की लंबाई 14 cm है । 5 मिनट में इसके द्वारा घड़ी के तल पर रचित क्षेत्रफल ज्ञात कीजिए ।

अथवा

(b) 42 cm त्रिज्या वाले वृत्त की उस चाप की लंबाई ज्ञात कीजिए जो वृत्त के केंद्र पर 60° का कोण अंतरित करती है ।

25. तीन घंटियाँ क्रमशः 9, 12 तथा 15 मिनट के अंतराल पर बजती हैं । यदि वह एक साथ बजना शुरू करती हैं, तो कितने समय के बाद वह दोबारा एक साथ बजेंगी ?

खण्ड ग

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

26. (a) तीन सिक्कों को एक साथ उछाला गया । निम्न के प्राप्त होने की प्रायिकता क्या है ?

(i) कम-से-कम एक चित

(ii) मात्र दो पट

(iii) अधिक-से-अधिक एक पट

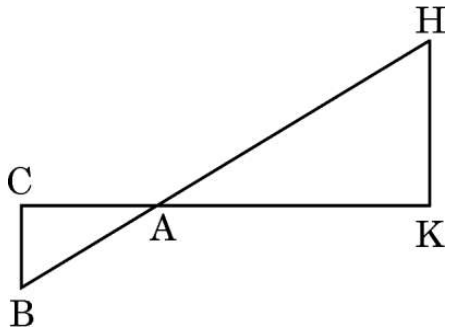
अथवा

22. (a) Evaluate : $\frac{5\cos^2 60° + 4\sec^2 30° - \tan^2 45°}{\sin^2 30° + \sin^2 60°}$

OR

(b) If $\sin(A - B) = \frac{1}{2}$, $\cos(A + B) = \frac{1}{2}$; $0 < A + B \leq 90°$, $A > B$; find $\angle A$ and $\angle B$.

23. In the given figure, $\Delta AHK \sim \Delta ABC$. If AK = 8 cm, BC = 3·2 cm and HK = 6·4 cm, then find the length of AC.



24. (a) The minute hand of a clock is 14 cm long. Find the area on the face of the clock described by the minute hand in 5 minutes.

OR

(b) Find the length of the arc of a circle which subtends an angle of 60° at the centre of the circle of radius 42 cm.

25. Three bells toll at intervals of 9, 12 and 15 minutes respectively. If they start tolling together, after what time will they next toll together ?

SECTION C

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

26. (a) Three coins are tossed simultaneously. What is the probability of getting

(i) at least one head ?

(ii) exactly two tails ?

(iii) at most one tail ?

OR

(b) एक पेटी में 90 डिस्क (discs) हैं, जिन पर 1 से 90 तक संख्याएँ अंकित हैं । यदि इस पेटी में से एक डिस्क यादृच्छया निकाला जाता है, तो इसकी प्रायिकता ज्ञात कीजिए कि इस डिस्क पर अंकित होगी :

(i) दो अंकों की संख्या जो 40 से कम है ।

(ii) 5 से भाज्य वह संख्या जो 50 से बड़ी है ।

(iii) एक पूर्ण वर्ग संख्या ।

27. सिद्ध कीजिए कि किसी वृत्त के परिगत समांतर चतुर्भुज समचतुर्भुज होता है ।

28. (a) बहुपद $4x^2 + 4x - 3$ के शून्यक ज्ञात कीजिए तथा शून्यकों तथा बहुपद के गुणांकों के बीच के संबंध की जाँच कीजिए ।

अथवा

(b) यदि α तथा β बहुपद $x^2 + x - 2$ के शून्यक हैं, तो $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$ का मान ज्ञात कीजिए ।

29. दिया गया है कि $\sqrt{3}$ एक अपरिमेय संख्या है, तो सिद्ध कीजिए कि $\frac{2-\sqrt{3}}{5}$ एक अपरिमेय संख्या है ।

30. एक छात्रावास के मासिक व्यय का एक भाग नियत है तथा शेष इस पर निर्भर करता है कि छात्र ने कितने दिन मेस में भोजन लिया है । एक विद्यार्थी A को, जो 20 दिन भोजन करती है, छात्रावास व्यय के रूप में ₹ 1,500 अदा करने पड़ते हैं, जबकि एक अन्य विद्यार्थी B को, जो 26 दिन भोजन करता है, ₹ 1,800 अदा करने पड़ते हैं । नियत व्यय और प्रतिदिन के भोजन का मूल्य ज्ञात कीजिए ।

31. सिद्ध कीजिए कि $\sqrt{\sec^2\theta + \operatorname{cosec}^2\theta} = \tan\theta + \cot\theta$.

(b) A box contains 90 discs which are numbered 1 to 90. If one disc is drawn at random from the box, find the probability that it bears a :

(i) 2-digit number less than 40.

(ii) number divisible by 5 and greater than 50.

(iii) a perfect square number.

27. Prove that the parallelogram circumscribing a circle is a rhombus.

28. (a) Find the zeroes of the polynomial $4x^2 + 4x - 3$ and verify the relationship between zeroes and coefficients of the polynomial.

OR

(b) If α and β are the zeroes of the polynomial $x^2 + x - 2$, then find the value of $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$.

29. Prove that $\frac{2-\sqrt{3}}{5}$ is an irrational number, given that $\sqrt{3}$ is an irrational number.

30. A part of monthly hostel charges is fixed and the remaining depends on the number of days one has taken food in the mess. When a student A takes food for 20 days, she has to pay ₹ 1,500 as hostel charges while another student B, who takes food for 26 days, pays ₹ 1,800. Find the fixed charges and the cost of food.

31. Prove that $\sqrt{\sec^2\theta + \text{cosec}^2\,\theta} = \tan\theta + \cot\theta$.

खण्ड घ

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

32. निम्नलिखित बंटन एक मोहल्ले के बच्चों के दैनिक जेब खर्च को दर्शाता है । माध्य दैनिक जेब खर्च ₹ 36·10 है । लुप्त बारंबारता f ज्ञात कीजिए ।

दैनिक जेब खर्च (₹ में)	20 – 25	25 – 30	30 – 35	35 – 40	40 – 45	45 – 50	50 – 55
बच्चों की संख्या	7	6	9	13	f	5	4

33. (a) एक रेलगाड़ी 90 km की दूरी एक स्थिर चाल से चलती है । यदि इसकी चाल 15 km/h अधिक होती, तो इसे यह यात्रा पूरी करने में 30 मिनट कम लगते । रेलगाड़ी की मूल चाल ज्ञात कीजिए ।

अथवा

(b) 'c' का वह मान ज्ञात कीजिए, जिसके लिए द्विघात समीकरण

$$(c + 1)\,x^2 - 6\,(c + 1)\,x + 3\,(c + 9) = 0;\ c \neq -1$$

के मूल वास्तविक तथा समान हों ।

34. (a) एक समांतर चतुर्भुज ABCD की बढ़ाई गई भुजा AD पर बिंदु E इस प्रकार है कि BE, भुजा CD को F पर काटती है । दर्शाइए कि Δ ABE ~ Δ CFB.

अथवा

(b) Δ ABC की भुजाएँ AB, BC तथा माध्यिका AD क्रमशः Δ PQR की भुजाओं PQ, QR तथा माध्यिका PM के समानुपाती हैं । सिद्ध कीजिए कि Δ ABC ~ Δ PQR.

35. एक बहुमंज़िले भवन के शीर्ष से एक 8 m ऊँचे भवन के शिखर तथा पाद के अवनमन कोण क्रमशः 30° तथा 45° हैं । बहुमंज़िले भवन की ऊँचाई तथा दोनों भवनों के बीच की दूरी ज्ञात कीजिए ।

SECTION D

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

32. The following distribution shows the daily pocket allowance of children of a locality. The mean daily pocket allowance is ₹ 36·10. Find the missing frequency, f.

Daily pocket allowance (in ₹)	20 – 25	25 – 30	30 – 35	35 – 40	40 – 45	45 – 50	50 – 55
Number of children	7	6	9	13	f	5	4

33. (a) A train travels a distance of 90 km at a constant speed. Had the speed been 15 km/h more, it would have taken 30 minutes less for the journey. Find the original speed of the train.

OR

(b) Find the value of 'c' for which the quadratic equation

$$(c + 1)\,x^2 - 6\,(c + 1)\,x + 3\,(c + 9) = 0;\ \ c \neq -1$$

has real and equal roots.

34. (a) E is a point on the side AD produced of a parallelogram ABCD and BE intersects CD at F. Show that Δ ABE ~ Δ CFB.

OR

(b) Sides AB, BC and the median AD of Δ ABC are respectively proportional to sides PQ, QR and the median PM of another Δ PQR. Prove that Δ ABC ~ Δ PQR.

35. The angles of depression of the top and the bottom of a 8 m tall building from the top of a multi-storeyed building are 30° and 45° respectively. Find the height of the multi-storeyed building and the distance between the two buildings.

खण्ड ङ

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

प्रकरण अध्ययन – 1

36. ट्रेजर हंट एक रोमांचक और साहसिक खेल है, जहाँ प्रतिभागी छिपे हुए खजाने को खोजने के लिए सुरागों/संख्याओं/मानचित्रों की एक शृंखला का अनुसरण करते हैं । खिलाड़ी प्रतिष्ठित पुरस्कार का स्थान जानने के लिए एक रोमांचक खोज में लगे रहते हैं, समस्याओं और पहेलियों को सुलझाते हैं ।

एक ट्रेजर हंट खेल खेलते समय कुछ सुराग (संख्याएँ) विभिन्न स्थानों में छिपे होते हैं जो सामूहिक रूप में एक A.P. बनाते हैं । यदि nवें स्थान पर संख्या $20 + 4n$ है, तो खिलाड़ियों की मदद के लिए निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) पहले स्थान पर कौन-सी संख्या है ? *1*

(ii) (a) कौन-सा स्थान 112 क्रमांकित है ? *2*

अथवा

(b) पहले 10 स्थानों की सभी संख्याओं का योगफल क्या है ? *2*

(iii) कौन-सी संख्या $(n - 2)$वें स्थान पर है ? *1*

SECTION E

This section comprises 3 case study based questions of 4 marks each. *3×4=12*

Case Study – 1

36. Treasure Hunt is an exciting and adventurous game where participants follow a series of clues/numbers/maps to discover hidden treasures. Players engage in a thrilling quest, solving puzzles and riddles to unveil the location of the coveted prize.

While playing a treasure hunt game, some clues (numbers) are hidden in various spots collectively forming an A.P. If the number on the n^{th} spot is $20 + 4n$, then answer the following questions to help the players in spotting the clues :

(i) Which number is on first spot ? *1*

(ii) (a) Which spot is numbered as 112 ? *2*

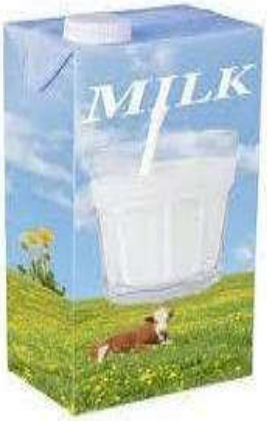
OR

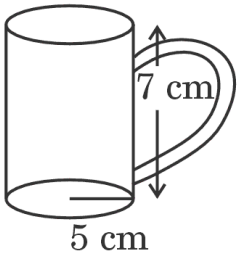
(b) What is the sum of all the numbers on the first 10 spots ? *2*

(iii) Which number is on the $(n - 2)^{th}$ spot ? *1*

प्रकरण अध्ययन – 2

37. टैम्पर-प्रूफ टेट्रा-पैक दूध ताज़गी और सुरक्षा दोनों की गारंटी देता है । यह दूध बेजोड़ गुणवत्ता सुनिश्चित करता है, इसमें निहित पोषण मूल्यों को संरक्षित करता है और इसे स्वास्थ्य के प्रति जागरुक व्यक्तियों के लिए एक विश्वसनीय विकल्प बनाता है ।





500 mL दूध 15 cm × 8 cm × 5 cm आयाम के घनाभाकार पैकेट में पैक हैं तथा यह दूध के पैकेट 30 cm × 32 cm × 15 cm के घनाभाकार कार्टन (डिब्बे) में रखे हैं ।

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

(i) घनाभाकार कार्टन (डिब्बे) का आयतन ज्ञात कीजिए । *1*

(ii) (a) दूध के एक पैकेट का संपूर्ण पृष्ठीय क्षेत्रफल ज्ञात कीजिए । *2*

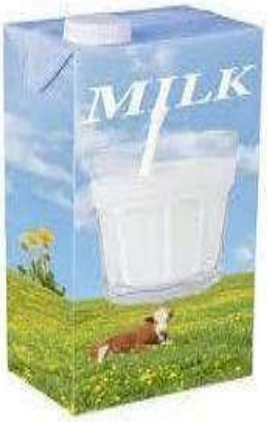
अथवा

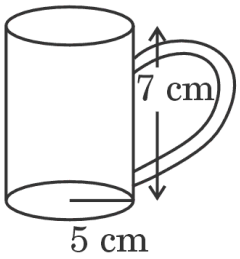
(b) एक कार्टन (डिब्बे) में कितने दूध के पैकेट आ सकते हैं ? *2*

(iii) आकृति में दिखाए गए कप में कितना दूध आ सकता है ? *1*

Case Study – 2

37. Tamper-proof tetra-packed milk guarantees both freshness and security. This milk ensures uncompromised quality, preserving the nutritional values within and making it a reliable choice for health-conscious individuals.





500 mL milk is packed in a cuboidal container of dimensions 15 cm × 8 cm × 5 cm. These milk packets are then packed in cuboidal cartons of dimensions 30 cm × 32 cm × 15 cm.

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

(i) Find the volume of the cuboidal carton. *1*

(ii) (a) Find the total surface area of a milk packet. *2*

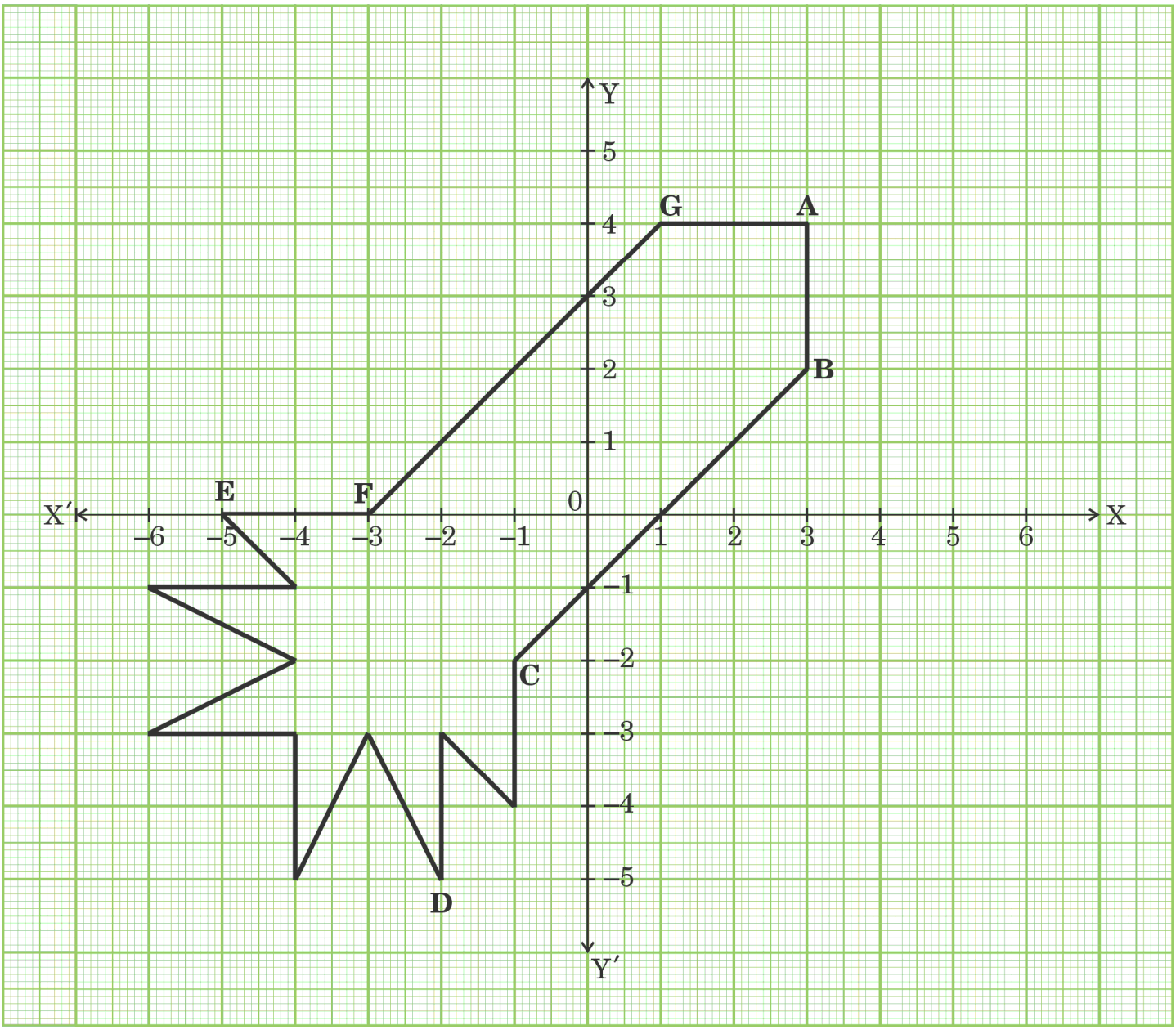
OR

(b) How many milk packets can be filled in a carton ? *2*

(iii) How much milk can the cup (as shown in the figure) hold ? *1*

प्रकरण अध्ययन – 3

38. रेयान को छोटी उम्र से ही तारों की जगमगाहट और अंतरिक्ष की विशालता बहुत आकर्षित करती थी । वह हमेशा एक दिन अंतरिक्ष-यात्री बनने का सपना देखता था । इसलिए उसने ग्राफ पेपर पर अपने राकेट डिज़ाइन को स्केच करना शुरू कर दिया । ऐसा एक डिज़ाइन नीचे दिया गया है :



उपर्युक्त पर आधारित, निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) F तथा G को मिलाने वाले रेखाखण्ड का मध्य-बिंदु ज्ञात कीजिए । *1*

(ii) (a) बिंदुओं A तथा C के बीच की दूरी कितनी है ? *2*

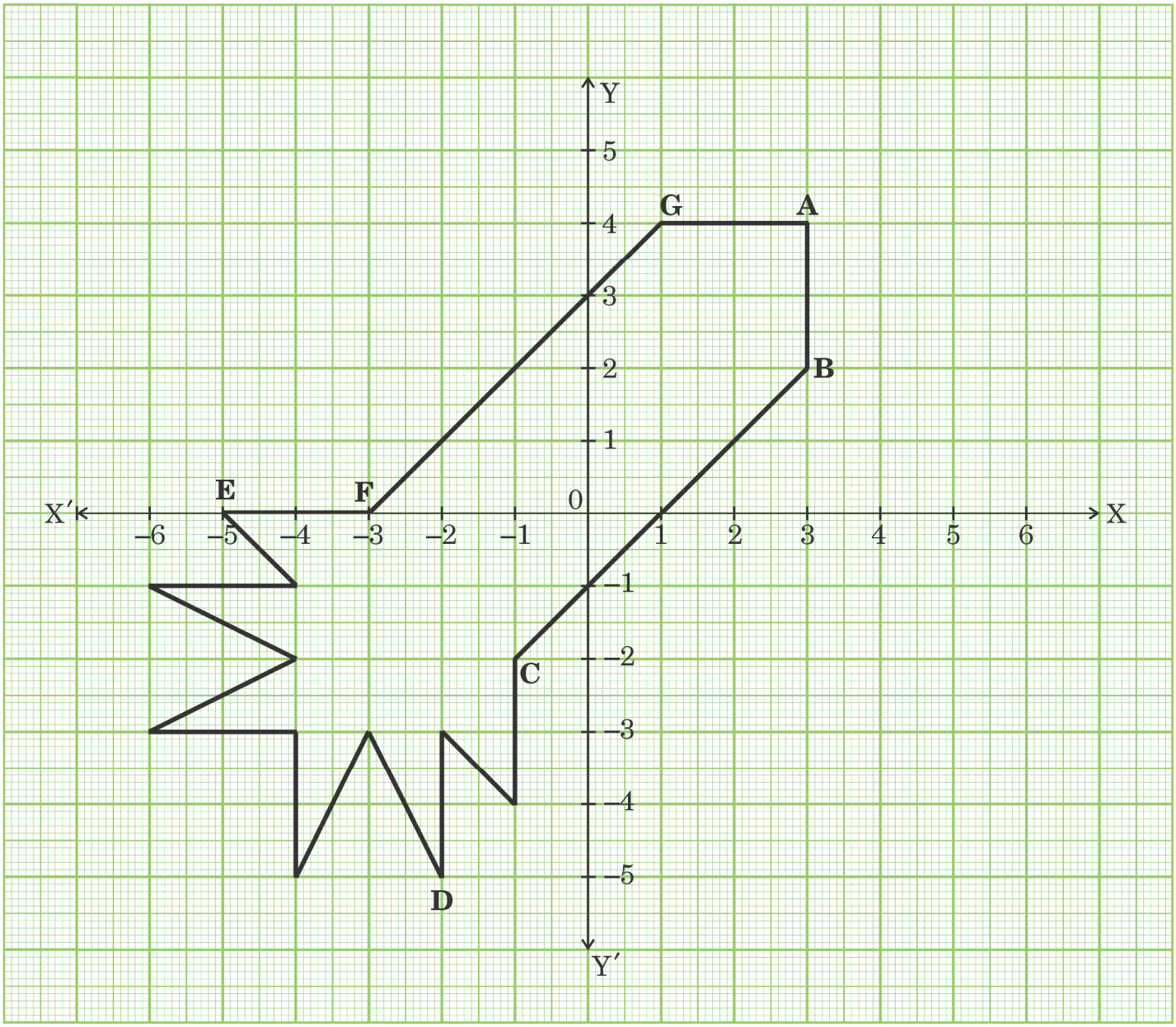
अथवा

(b) बिंदुओं A तथा B को मिलाने वाले रेखाखण्ड को 1 : 3 के अनुपात में अंतः विभाजन करने वाले बिंदु के निर्देशांक ज्ञात कीजिए । *2*

(iii) बिंदु D के निर्देशांक क्या हैं ? *1*

Case Study – 3

38. Ryan, from a very young age, was fascinated by the twinkling of stars and the vastness of space. He always dreamt of becoming an astronaut one day. So he started to sketch his own rocket designs on the graph sheet. One such design is given below :



Based on the above, answer the following questions :

(i) Find the mid-point of the segment joining F and G. *1*

(ii) (a) What is the distance between the points A and C ? *2*

OR

(b) Find the coordinates of the point which divides the line segment joining the points A and B in the ratio 1 : 3 internally. *2*

(iii) What are the coordinates of the point D ? *1*

Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2024
MATHEMATICS PAPER CODE 30/4/3

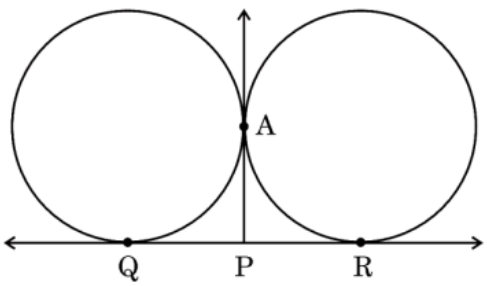
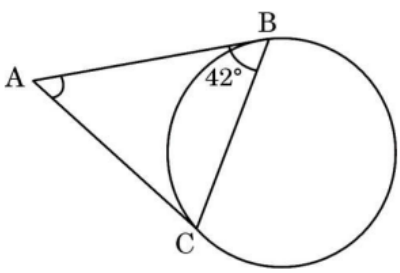
General Instructions: -

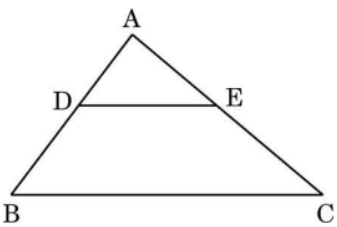
1	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested 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	**In Q1-Q20, if a candidate attempts the question more than once (without cancelling the previous attempt), marks shall be awarded for the first attempt only and the other answer scored out with a note "Extra Question".**
10	**In Q21-Q38, if a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note "Extra Question".**
11	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
12	A full scale of marks _____ (example 0 to 80/70/60/50/40/30 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.
13	Every examiner has to necessarily do evaluation work for full working hours i.e., 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines). This is in view of the reduced syllabus and number of questions in question paper.
14	Ensure that you do not make the following common types of errors committed by the Examiner in the past:- ● Leaving answer or part thereof unassessed in an answer book. ● Giving more marks for an answer than assigned to it. ● Wrong 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.
15	While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0) Marks.
16	Any 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.
17	The Examiners should acquaint themselves with the guidelines given in the "**Guidelines for spot Evaluation**" before starting the actual evaluation.
18	Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totalled and written in figures and words.
19	The candidates are entitled to obtain photocopy of the Answer Book on request on payment of the prescribed processing fee. All Examiners/Additional Head Examiners/Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme.

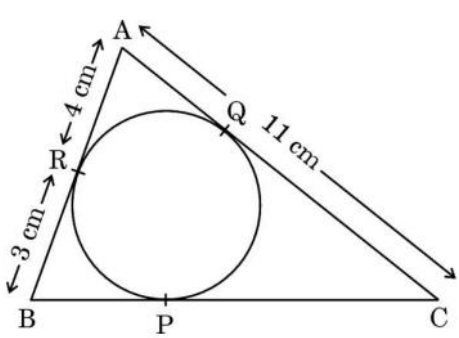
MARKING SCHEME
MATHEMATICS (Subject Code–041)
(PAPER CODE: 30/4/3)

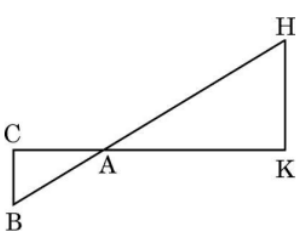
Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Marks
	SECTION A This section comprises Multiple Choice Questions (MCQs) of 1 mark each	
1.	The area of the sector of a circle of radius 12 cm is 60π cm^2. The central angle of this sector is : (A) 120° (B) 6° (C) 75° (D) 150°	
Sol.	(D) 150°	1
2.	Two lines are given to be parallel. The equation of one of these lines is $5x - 3y = 2$. The equation of the second line can be : (A) $-15x - 9y = 5$ (B) $15x + 9y = 5$ (C) $9x - 15y = 6$ (D) $-15x + 9y = 5$	
Sol.	(D) $-15x + 9y = 5$	1
3.	At some time of the day, the length of the shadow of a tower is equal to its height. Then, the Sun's altitude at that time is : (A) 30° (B) 45° (C) 60° (D) 90°	
Sol.	(B) 45°	1
4.	The pair of linear equations $y = 0$ and $y = -7$ have (A) exactly one solution (B) two solutions (C) infinitely many solutions (D) no solution	
Sol.	(D) no solution	1
5.	The area of the square inscribed in a circle of radius $5\sqrt{2}$ cm is : (A) 50 cm^2 (B) 100 cm^2 (C) 25 cm^2 (D) 200 cm^2	
Sol.	(B) 100 cm^2	1

6.	In the given figure, QR is a common tangent to the two given circles touching externally at A. The tangent at A meets QR at P. If AP = 4·2 cm, then the length of QR is :  (A) 4·2 cm (B) 2·1 cm (C) 8·4 cm (D) 6·3 cm	
Sol.	(C) 8.4 cm	1
7.	In the given figure, AB and AC are tangents to the circle. If $\angle$ ABC = 42°, then the measure of $\angle$ BAC is :  (A) 96° (B) 42° (C) 106° (D) 86°	
Sol.	(A) 96°	1
8.	Two identical solid cubes of side 'a' are joined end-to-end. The total surface area of the resulting cuboid is : (A) $6a^2$ (B) $10a^2$ (C) $5a^2$ (D) $4a^2$	
Sol.	(B) $10a^2$	1

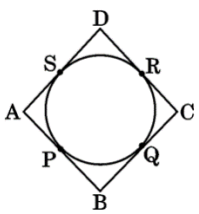
9.	The HCF of two numbers 65 and 104 is 13. If LCM of 65 and 104 is 40x, then the value of x is : (A) 5 (B) 13 (C) 40 (D) 8	
Sol.	(B) 13	1
10.	For an event E, if P(E) + P($\overline{E}$) = q, then the value of $q^2 - 4$ is : (A) -3 (B) 3 (C) 5 (D) -5	
Sol.	(A) -3	1
11.	In Δ ABC, DE $\parallel$ BC (as shown in the figure). If AD = 4 cm, AB = 9 cm and AC = 13·5 cm, then the length of EC is :  (A) 6 cm (B) 7·5 cm (C) 9 cm (D) 5·7 cm	
Sol.	(B) 7.5 cm	1
12.	If a polynomial p(x) is given by $p(x) = x^2 - 5x + 6$, then the value of p(1) + p(4) is : (A) 0 (B) 4 (C) 2 (D) -4	
Sol.	(B) 4	1
13.	The fourth vertex D of a parallelogram ABCD whose three vertices are A(– 2, 3), B(6, 7) and C(8, 3) is : (A) (0, 1) (B) (0, –1) (C) (–1, 0) (D) (1, 0)	
Sol.	(B) (0,-1)	1

14.	If the difference of mode and median of a data is 24, then the difference of its median and mean is : (A) 12 (B) 24 (C) 8 (D) 36	
Sol.	(A) 12	1
15.	Three numbers in A.P. have the sum 30. What is its middle term ? (A) 4 (B) 10 (C) 16 (D) 8	
Sol.	(B) 10	1
16.	The probability of throwing a number greater than 2 with a fair die is : (A) $\frac{2}{3}$ (B) $\frac{1}{3}$ (C) $\frac{1}{2}$ (D) $\frac{5}{6}$	
Sol.	(A) $\frac{2}{3}$	1
17.	If $y = 1$ is one of the solutions of the quadratic equation $py^2 + py + 3 = 0$, then the value of p is : (A) -3 (B) 2 (C) $-\frac{3}{2}$ (D) -2	
Sol.	(C) $-\frac{3}{2}$	1
18.	The value of θ for which $2\sin^2\theta = \frac{1}{2}$; $0° \le \theta \le 90°$ is : (A) 30° (B) 60° (C) 45° (D) 90°	
Sol.	(A) 30°	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) :* Mid-point of a line segment divides the line segment in the ratio 1 : 1. *Reason (R) :* The ratio in which the point (– 3, k) divides the line segment joining the points (– 5, 4) and (– 2, 3) is 1 : 2.	
Sol.	(C) Assertion (A) is true but Reason (R) is false	1
20.	*Assertion (A) :* If the circumference of a circle is 176 cm, then its radius is 28 cm. *Reason (R):* Circumference = $2\pi \times$ radius of a circle.	
Sol.	(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).	1
	SECTION B This section comprises Very Short Answer (VSA) type questions of 2 marks each.	
21.	In the given figure, Δ ABC is circumscribing a circle. Find the length of BC, if AR = 4 cm, BR = 3 cm and AC = 11 cm. 	
Sol.	BP = BR = 3 cm and AQ = AR = 4 cm	½

	QC = AC – AQ = 11 – 4 = 7 cm PC = QC = 7 cm ∴ BC = BP + PC = 3 + 7 = 10 cm	½ ½ ½
22. (a)	Evaluate : $\frac{5\cos^2 60° + 4\sec^2 30° - \tan^2 45°}{\sin^2 30° + \sin^2 60°}$	
Sol.	$\frac{5\left(\frac{1}{2}\right)^2+4\left(\frac{2}{\sqrt{3}}\right)^2-(1)^2}{\left(\frac{1}{2}\right)^2+\left(\frac{\sqrt{3}}{2}\right)^2}$ $= \frac{67}{12}$	1½ ½
	OR	
22. (b)	If $\sin(A - B) = \frac{1}{2}$, $\cos(A + B) = \frac{1}{2}$; $0 < A + B \leq 90°$, $A > B$; find ∠A and ∠B.	
Sol.	sin(A – B) = sin 30° A – B = 30° --------(i) cos(A+B) = cos 60° A + B = 60° ---------(ii) Solving (i) and (ii) A = 45° , B = 15°	½ ½ 1
23.	In the given figure, Δ AHK ~ Δ ABC. If AK = 8 cm, BC = 3·2 cm and HK = 6·4 cm, then find the length of AC.  	
Sol.	∵ ΔAHK ~ΔABC (given) ∴ $\frac{HK}{BC} = \frac{AK}{AC}$	

	$\Rightarrow \frac{6.4}{3.2} = \frac{8.0}{AC}$ $\Rightarrow$ AC = 4 cm	1 1
24.(a)	The minute hand of a clock is 14 cm long. Find the area on the face of the clock described by the minute hand in 5 minutes.	
Sol.	Angle subtended in 5 min. = 30° Area described by minute hand = $\frac{30}{360} \times \frac{22}{7} \times 14 \times 14$ $= \frac{154}{3}$ cm^2 or 51.33 cm^2 approx.	½ 1 ½
	OR	
24.(b)	Find the length of the arc of a circle which subtends an angle of 60° at the centre of the circle of radius 42 cm.	
Sol.	Length of arc = $2 \times \frac{22}{7} \times 42 \times \frac{60}{360}$ = 44 cm	1½ ½
25.	Three bells toll at intervals of 9, 12 and 15 minutes respectively. If they start tolling together, after what time will they next toll together ?	
Sol.	$9 = 3^2$ $12 = 2^2 \times 3$ $15 = 3 \times 5$ L.C.M = $2^2 \times 3^2 \times 5 = 180$ Three bells will toll together after 180 min.	1 1
	SECTION C This section comprises of Short Answer (SA) type questions of 3 marks each.	
26.(a)	Three coins are tossed simultaneously. What is the probability of getting (i) at least one head ? (ii) exactly two tails ? (iii) at most one tail ?	
Sol.	Total number of outcomes = 8	

	(i) P (at least one head) = $\frac{7}{8}$ (ii) P (exactly 2 tails) = $\frac{3}{8}$ (iii) P (at most one tail) = $\frac{4}{8}$ *or* $\frac{1}{2}$	1 1 1
	OR	
26.(b)	A box contains 90 discs which are numbered 1 to 90. If one disc is drawn at random from the box, find the probability that it bears a : (i) 2-digit number less than 40. (ii) number divisible by 5 and greater than 50. (iii) a perfect square number.	
Sol.	Total outcomes = 90 (i) P (2 digit number less than 40) = $\frac{30}{90}$ or $\frac{1}{3}$ (ii) P (a number divisible by 5 and greater than 50) = $\frac{8}{90}$ or $\frac{4}{45}$ (iii) P (a perfect square number) = $\frac{9}{90}$ or $\frac{1}{10}$	1 1 1
27.	Prove that the parallelogram circumscribing a circle is a rhombus.	
Sol.	Correct figure  AP = AS -----(i) BP = BQ -----(ii) CR = CQ -----(iii) DR = DS -----(iv) Adding (i), (ii), (iii) & (iv) AP + BP + CR + DR = AS + BQ + CQ + DS	½ 1

	$\Rightarrow$ AB + CD = AD + BC But ABCD is a parallelogram $\Rightarrow$AB = CD and AD = BC $\therefore$ 2AB = 2AD or AB = AD Hence, ABCD is a rhombus.	1 ½
28(a)	Find the zeroes of the polynomial $4x^2 + 4x - 3$ and verify the relationship between zeroes and coefficients of the polynomial.	
Sol.	P(x) = $4x^2 + 4x - 3$ = (2x + 3) (2x – 1) $\therefore$ Zeroes of the polynomial are $\frac{-3}{2}$, $\frac{1}{2}$ Sum of Zeroes = $\frac{-3}{2} + \frac{1}{2} = \frac{-3+1}{2} = -1 = \frac{-4}{4} = \frac{-(\text{coefficient of x})}{(\text{coefficient of x}^2)}$ Product of Zeroes = $\frac{-3}{2} \times \frac{1}{2} = \frac{-3}{4} = \frac{\text{constant term}}{\text{coefficient of x}^2}$	1 1 ½ ½
	OR	
28.(b)	If α and β are the zeroes of the polynomial $x^2 + x - 2$, then find the value of $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$.	
Sol.	Here $\alpha + \beta = -1$ and $\alpha\beta = -2$ $\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = \frac{\alpha^2+\beta^2}{\alpha\beta} = \frac{(\alpha+\beta)^2-2\alpha\beta}{\alpha\beta}$ $= \frac{(-1)^2-2(-2)}{-2} = -\frac{5}{2}$	1 1 1
29.	Prove that $\frac{2-\sqrt{3}}{5}$ is an irrational number, given that $\sqrt{3}$ is an irrational number.	
Sol.	Assuming $\frac{2-\sqrt{3}}{5}$ to be a rational number. $\Rightarrow \frac{2-\sqrt{3}}{5} = \frac{p}{q}$,where p and q are integers & $q \neq 0$ $\Rightarrow \sqrt{3} = \frac{2q-5p}{q}$ Here RHS is rational but LHS is irrational. Therefore our assumption is wrong.	 ½ 1 ½ ½

	Hence $\frac{2-\sqrt{3}}{5}$ is an irrational number.	½
30.	A part of monthly hostel charges is fixed and the remaining depends on the number of days one has taken food in the mess. When a student A takes food for 20 days, she has to pay ₹ 1,500 as hostel charges while another student B, who takes food for 26 days, pays ₹ 1,800. Find the fixed charges and the cost of food.	
Sol.	Let the monthly fixed charges of hostel be ₹ x and cost of food be ₹ y per day. A.T.Q x + 20y = 1500 --------(i) x + 26y = 1800 ---------(ii) Solving equations (i) & (ii) x = 500 , y = 50 Hence, the monthly fixed charges of hostel be ₹ 500 and cost of food be ₹ 50 per day.	 1 1 ½ + ½
31.	Prove that $\sqrt{\sec^2\theta + \operatorname{cosec}^2\theta} = \tan\theta + \cot\theta$.	
Sol.	L.H.S = $\sqrt{sec^2\theta + cosec^2\theta}$ = $\sqrt{1 + tan^2\theta + 1 + cot^2\theta}$ = $\sqrt{(tan\theta + cot\theta)^2}$ = tan θ + cot θ = R.H.S	 1 1 1

SECTION D

This section comprises Long Answer (LA) type questions of 5 marks each.

32. The following distribution shows the daily pocket allowance of children of a locality. The mean daily pocket allowance is ₹ 36·10. Find the missing frequency, f.

Daily pocket allowance (in ₹)	20 – 25	25 – 30	30 – 35	35 – 40	40 – 45	45 – 50	50 – 55
Number of children	7	6	9	13	f	5	4

Sol.

Daily pocket allowance (in ₹)	Number of children (f_i)	x_i	$x_i f_i$
20 – 25	7	22.5	157.5
25 – 30	6	27.5	165
30 – 35	9	32.5	292.5
35 – 40	13	37.5	487.5
40 – 45	f	42.5	42.5 f
45 – 50	5	47.5	237.5
50 – 55	4	52.5	210.0
Total	44 + f		1550 + 42.5 f

Correct table — 2

Mean = 36.10

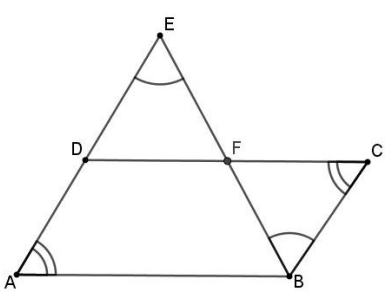
$\frac{1550+42.5\,f}{44+f} = 36.10$ — 2

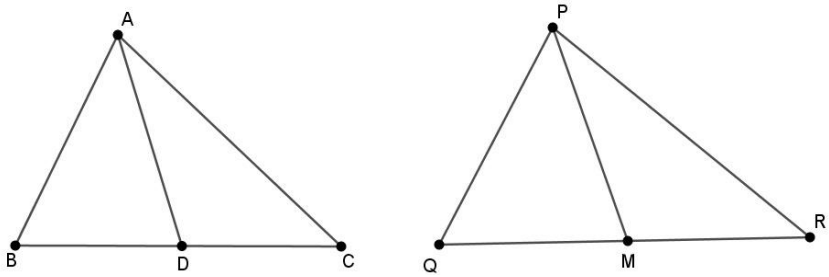
$\Rightarrow$ f = 6 — 1

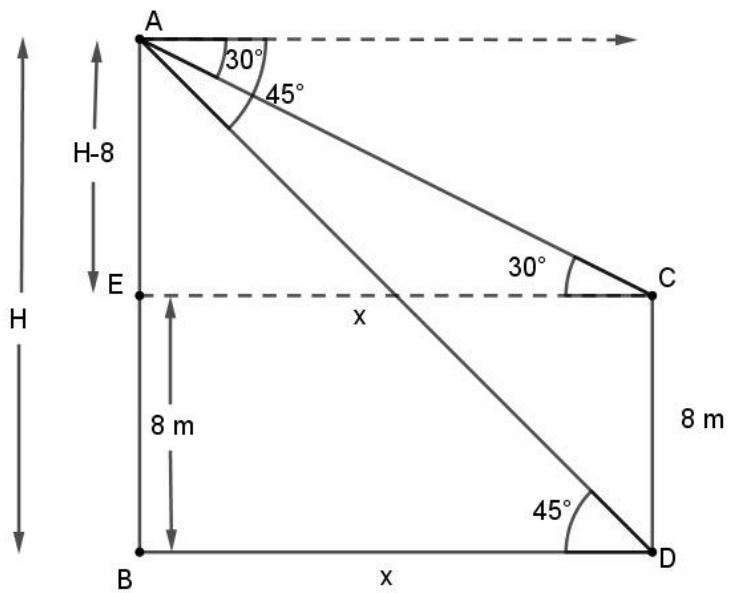
33.(a) A train travels a distance of 90 km at a constant speed. Had the speed been 15 km/h more, it would have taken 30 minutes less for the journey. Find the original speed of the train.

Sol. Let the original speed be x km/h

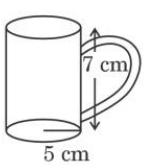
New speed = (x + 15) km/h — ½

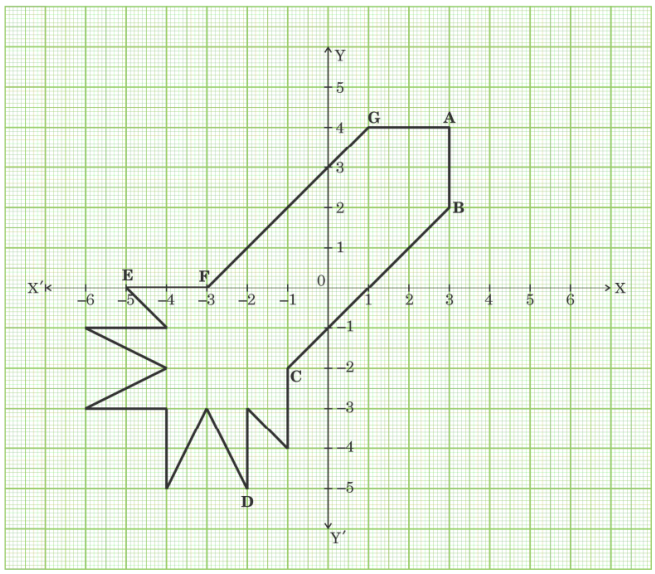
	A.T.Q. $\frac{90}{x} - \frac{90}{x+15} = \frac{1}{2}$ $\Rightarrow x^2 + 15x - 2700 = 0$ $\Rightarrow$(x + 60) (x – 45) = 0 x ≠ –60 So, x = 45 The original speed of the train = 45 km/h	1½ 1 1 1
	OR	
33.(b)	Find the value of 'c' for which the quadratic equation $(c + 1)x^2 - 6(c + 1)x + 3(c + 9) = 0;\ c \neq -1$ has real and equal roots.	
Sol.	For real and equal roots, $\{-6(c + 1)\}^2 - 4(c + 1) \times 3(c + 9) = 0$ $\Rightarrow$ 12(c + 1) (2c – 6) = 0 c ≠ –1 So, c = 3	2 2 1
34(a).	E is a point on the side AD produced of a parallelogram ABCD and BE intersects CD at F. Show that Δ ABE ~ Δ CFB.	
Sol.	Correct figure  In ΔABE and ΔCFB ∠EAB = ∠BCF ∠AEB = ∠CBF $\Rightarrow$ ΔABE ~ ΔCFB	2 1 1 1

	OR	
34(b).	Sides AB, BC and the median AD of Δ ABC are respectively proportional to sides PQ, QR and the median PM of another Δ PQR. Prove that Δ ABC ~ Δ PQR.	
Sol.	Correct figure 	1
	$\because \frac{AB}{PQ} = \frac{BC}{QR} = \frac{AD}{PM}$	
	$\therefore \frac{AB}{PQ} = \frac{2BD}{2QM} = \frac{AD}{PM}$	1
	$\Rightarrow \frac{AB}{PQ} = \frac{BD}{QM} = \frac{AD}{PM}$ -------(i)	
	$\Rightarrow \Delta ABD \sim \Delta PQM$	1
	$\Rightarrow \angle B = \angle Q$ -----(ii)	1
	In ΔABC and ΔPQR	
	$\frac{AB}{PQ} = \frac{BC}{QR}$	
	$\angle B = \angle Q$	
	$\therefore \Delta ABC \sim \Delta PQR$	1

35.	The angles of depression of the top and the bottom of a 8 m tall building from the top of a multi-storeyed building are 30° and 45° respectively. Find the height of the multi-storeyed building and the distance between the two buildings.	
Sol.	Correct figure  Let height of multi storeyed building AB be H m and CD is a tall building. Let the distance between the two buildings be X m. In ΔABD $\tan 45° = 1 = \frac{H}{X}$ $\Longrightarrow$ H = X --------(i) In ΔAEC $\tan 30° = \frac{1}{\sqrt{3}} = \frac{H-8}{X}$ $\Longrightarrow$ $X = \sqrt{3}\,(H - 8)$ --------(ii) Solving equations (i) & (ii) $X = 4\,(3 + \sqrt{3})$	1 1 ½ 1 ½ ½

	and H = 4 $(3 + \sqrt{3})$ The height of the multi storeyed building is 4 $(3 + \sqrt{3})$ m and the distance between the two buildings is 4 $(3 + \sqrt{3})$ m.	½
	SECTION E This section comprises 3 case-study based questions of 4 marks each.	
36.	**Case Study – 1** Treasure Hunt is an exciting and adventurous game where participants follow a series of clues/numbers/maps to discover hidden treasures. Players engage in a thrilling quest, solving puzzles and riddles to unveil the location of the coveted prize. While playing a treasure hunt game, some clues (numbers) are hidden in various spots collectively forming an A.P. If the number on the n^{th} spot is 20 + 4n, then answer the following questions to help the players in spotting the clues :  (i) Which number is on first spot ? (ii) (a) Which spot is numbered as 112 ? **OR** (b) What is the sum of all the numbers on the first 10 spots ? (iii) Which number is on the $(n - 2)^{th}$ spot ?	
Sol.	(i) Number on the first spot = 20 + 4 × 1 = 24 (ii) (a) 20 + 4n = 112 $\Rightarrow$ n = 23	1 1 1

	OR	
	(ii) (b) d = 4	½
	$S_{10} = \frac{10}{2}[2 \times 24 + 9 \times 4]$	1
	= 420	½
	(iii) Number on the $(n-2)^{th}$ spot = 20 + 4(n - 2)	
	= 12 + 4n	1
37.	**Case Study – 2** Tamper-proof tetra-packed milk guarantees both freshness and security. This milk ensures uncompromised quality, preserving the nutritional values within and making it a reliable choice for health-conscious individuals.    500 mL milk is packed in a cuboidal container of dimensions 15 cm × 8 cm × 5 cm. These milk packets are then packed in cuboidal cartons of dimensions 30 cm × 32 cm × 15 cm. Based on the above given information, answer the following questions : (i) Find the volume of the cuboidal carton. (ii) (a) Find the total surface area of a milk packet. **OR** (b) How many milk packets can be filled in a carton ? (iii) How much milk can the cup (as shown in the figure) hold ?	
Sol.	(i) Volume of cuboidal carton = 30×32×15	½
	= 14400 cm^3	½

	(ii)(a) Total surface area of milk packet = $2(15\times8+8\times5+5\times15)$	1
	$= 470\ cm^2$	1
	OR	
	(ii) (b) Number of milk packets in carton = $\frac{30\times32\times15}{15\times8\times5}$	1
	$= 24$	1
	(iii) Capacity of the cup = $\frac{22}{7} \times 5 \times 5 \times 7$	½
	$= 550\ cm^3$ or 550 ml	½
38.	**Case Study – 3** Ryan, from a very young age, was fascinated by the twinkling of stars and the vastness of space. He always dreamt of becoming an astronaut one day. So he started to sketch his own rocket designs on the graph sheet. One such design is given below :  Based on the above, answer the following questions : (i) Find the mid-point of the segment joining F and G. (ii) (a) What is the distance between the points A and C ? **OR** (b) Find the coordinates of the point which divides the line segment joining the points A and B in the ratio 1 : 3 internally. (iii) What are the coordinates of the point D ?	
Sol.	(i) Mid point of FG is $\left(\frac{-3+1}{2}, \frac{0+4}{2}\right) = (-1,2)$	1

	(ii) (a) AC = $\sqrt{(-1-3)^2 + (-2-4)^2}$	1
	= $\sqrt{52}$ or $2\sqrt{13}$	1
	OR	
	(ii) (b) The coordinates of required point are $\left(\frac{1\times3+3\times3}{1+3}, \frac{1\times2+3\times4}{1+3}\right)$	1
	i.e. $\left(3, \frac{7}{2}\right)$	1
	(iii) D(-2, -5)	1