Series : D7EGF

SET-3

रोल नं.
Roll No.

प्रश्न-पत्र कोड
Q.P. Code **30/7/3**

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 **27** हैं।
Please check that this question paper contains **27** printed pages.

(II) 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.

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

(IV) **कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में यथा स्थान पर प्रश्न का क्रमांक अवश्य लिखें।**
Please write down the Serial Number of the question in the answer-book at the given place before attempting it.

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

गणित (मानक)

MATHEMATICS (STANDARD)

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

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

सामान्य निर्देश :

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

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

(ii) *यह प्रश्न-पत्र **पाँच** खण्डों में विभाजित है – **क, ख, ग, घ** एवं **ङ**।*

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

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

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

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

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

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

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

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

खण्ड क

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

1. $\sqrt{2}$ और $\sqrt{3}$ के बीच एक परिमेय संख्या है :

(A) $\frac{\sqrt{2}+\sqrt{3}}{2}$ (B) $\frac{\sqrt{2}-\sqrt{3}}{2}$

(C) 1·3 (D) 1·8

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. A rational number between $\sqrt{2}$ and $\sqrt{3}$ is :

(A) $\frac{\sqrt{2}+\sqrt{3}}{2}$ (B) $\frac{\sqrt{2}-\sqrt{3}}{2}$

(C) 1·3 (D) 1·8

2. बहुपद $p(x) = x^2 - x - 6$ के शून्यक (zeroes) हैं :

(A) 3, 2 (B) $-3, 2$

(C) $3, -2$ (D) $-3, -2$

3. समीकरणों का युग्म $5x - 15y = 8$ और $3x - 9y = \frac{24}{5}$ का/के :

(A) एक हल है (B) दो हल हैं

(C) अनंत हल हैं (D) कोई हल नहीं है

4. एक त्रिभुज ABC में, DE, BC के समान्तर है, जहाँ D, AB पर और E, AC पर है। यदि $\frac{AD}{DB} = \frac{3}{4}$ है, तो $\frac{BC}{DE}$ का मान है :

(A) 2 : 5 (B) 3 : 7

(C) 7 : 3 (D) 5 : 3

5. यदि $p\left[\frac{2\sin 30^\circ}{1-\sin^2 30^\circ}\right] = q\left[\frac{2\sin 30^\circ}{1+\sin^2 30^\circ}\right]$ है, तो $p : q$ बराबर है :

(A) 1 : 1 (B) 4 : 3

(C) 3 : 5 (D) 4 : 5

6. यदि एक खंभे की ऊँचाई 6 m है और जमीन पर इसकी छाया $2\sqrt{3}$ m लम्बी है, तो सूर्य का उन्नयन कोण है :

(A) 60° (B) 45°

(C) 120° (D) 90°

2. The zeroes of the polynomial $p(x) = x^2 - x - 6$ are :

(A) 3, 2 (B) – 3, 2

(C) 3, – 2 (D) – 3, – 2

3. The pair of equations $5x - 15y = 8$ and $3x - 9y = \frac{24}{5}$ has :

(A) one solution (B) two solutions

(C) infinitely many solutions (D) no solution

4. In Δ ABC, DE is parallel to BC, with D on AB and E on AC. If $\frac{AD}{DB} = \frac{3}{4}$, then the value of $\frac{BC}{DE}$ is :

(A) 2 : 5 (B) 3 : 7

(C) 7 : 3 (D) 5 : 3

5. If $p\left[\frac{2\sin 30^\circ}{1-\sin^2 30^\circ}\right] = q\left[\frac{2\sin 30^\circ}{1+\sin^2 30^\circ}\right]$, then p : q is equal to :

(A) 1 : 1 (B) 4 : 3

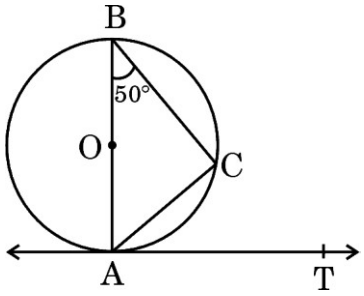
(C) 3 : 5 (D) 4 : 5

6. If a pole is 6 m high and it casts a shadow of length $2\sqrt{3}$ m on the ground, then the Sun's elevation is :

(A) 60° (B) 45°

(C) 120° (D) 90°

7. दी गई आकृति में, AT केन्द्र O वाले वृत्त की एक स्पर्श-रेखा है । यदि $\angle$ ABC = 50° है, तो $\angle$ CAT बराबर है :



(A) 70° (B) 50°

(C) 65° (D) 40°

8. एक टोपी बेलनाकार आकार की है, जिसके ऊपर एक अर्द्धगोलाकार शीर्ष है । यदि बेलनाकार भाग का आयतन अर्द्धगोलाकार भाग के आयतन के बराबर है, तो बेलनाकार भाग की ऊँचाई और अर्द्धगोलाकार भाग की ऊँचाई का अनुपात है :

(A) 2 : 3 (B) 1 : 3

(C) 2 : 1 (D) 3 : 1

9. यदि किसी खिलाड़ी के एक खेल जीतने की प्रायिकता 0·21 है, तो उसके उसी खेल हारने की प्रायिकता है :

(A) 1·79 (B) 0·81

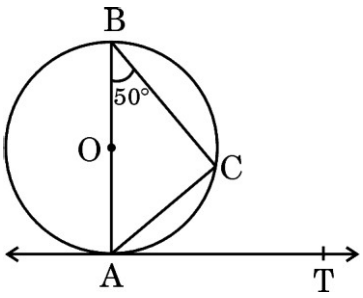
(C) 0·79% (D) 0·79

10. यदि दो धनात्मक पूर्णांक a और b को $a = x^3y^2$ और $b = xy^3$ के रूप में लिखा जाए, जहाँ x और y अभाज्य संख्याएँ हैं, तो a और b का लघुतम समापवर्त्य (LCM) है :

(A) xy (B) xy^2

(C) x^3y^3 (D) x^2y^2

7. In the given figure, AT is a tangent to a circle centred at O. If $\angle$ ABC = 50°, then $\angle$ CAT is equal to :



(A) 70° (B) 50°

(C) 65° (D) 40°

8. A cap is cylindrical in shape and is surmounted by a hemispherical top. If the volume of the cylindrical part is equal to that of the hemispherical part, then the ratio of the height of the cylindrical part to the height of the hemispherical part is :

(A) 2 : 3 (B) 1 : 3

(C) 2 : 1 (D) 3 : 1

9. If the probability of a player winning a game is 0·21, then the probability of him losing the same game is :

(A) 1·79 (B) 0·81

(C) 0·79% (D) 0·79

10. If two positive integers a and b are written as a = x^3y^2 and b = xy^3, where x and y are prime numbers, then LCM (a, b) is :

(A) xy (B) xy^2

(C) x^3y^3 (D) x^2y^2

11. यदि α और β, बहुपद $f(x) = px^2 - 2x + 3p$ के शून्यक हैं और $\alpha + \beta - \alpha\beta = 0$ है, तो p का मान है :

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

(C) $\frac{1}{3}$ (D) $-\frac{1}{3}$

12. निम्नलिखित में से कौन-सा अनुक्रम (sequence) एक समांतर श्रेढ़ी (AP) है ?

(A) 2, 4, 8, 16 ..... (B) $3, 3 + \sqrt{2}, 3 + 2\sqrt{2}, ...$

(C) 1, 3, 9, 27, ... (D) $\sqrt{3}, \sqrt{6}, \sqrt{9}, ...$

13. यदि बिंदु C(k, 4), बिंदुओं A(2, 6) और B(5, 1) को मिलाने वाले रेखाखंड को 2 : 3 के अनुपात में विभाजित करता है, तो k का मान है :

(A) 16 (B) $\frac{28}{5}$

(C) $\frac{16}{5}$ (D) $\frac{8}{5}$

14. एक समकोण त्रिभुज ABC में, जहाँ A पर समकोण है, यदि $\cos B = \frac{1}{4}$ है, तो $\cot B$ का मान है :

(A) $\frac{1}{4}$ (B) $\frac{1}{\sqrt{15}}$

(C) $\frac{\sqrt{15}}{1}$ (D) $\frac{4}{\sqrt{15}}$

11. If α and β are the zeroes of a polynomial $f(x) = px^2 - 2x + 3p$ and $\alpha + \beta - \alpha\beta = 0$, then the value of p is :

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

(C) $\frac{1}{3}$ (D) $-\frac{1}{3}$

12. Which of the following sequences is an AP ?

(A) 2, 4, 8, 16 ..... (B) $3, 3 + \sqrt{2}, 3 + 2\sqrt{2}, ...$

(C) 1, 3, 9, 27, ... (D) $\sqrt{3}, \sqrt{6}, \sqrt{9}, ...$

13. If the point C(k, 4) divides the join of the points A(2, 6) and B(5, 1) in the ratio 2 : 3, then the value of k is :

(A) 16 (B) $\frac{28}{5}$

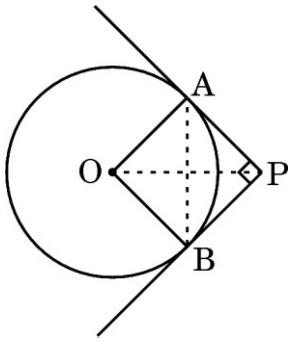
(C) $\frac{16}{5}$ (D) $\frac{8}{5}$

14. In a right triangle ABC, right-angled at A, if $\cos B = \frac{1}{4}$, then the value of cot B is :

(A) $\frac{1}{4}$ (B) $\frac{1}{\sqrt{15}}$

(C) $\frac{\sqrt{15}}{1}$ (D) $\frac{4}{\sqrt{15}}$

15. दी गई आकृति में, केन्द्र O वाले वृत्त पर बाह्य बिंदु P से खींची गई स्पर्श-रेखाएँ PA और PB परस्पर लंब हैं। यदि $AB = 5\sqrt{2}$ cm है, तो PA की लंबाई है :



(A) 5 cm (B) $5\sqrt{2}$ cm

(C) $2\sqrt{5}$ cm (D) 10 cm

16. 6 सेमी त्रिज्या वाले वृत्त से काटे गए एक वृत्तखंड का क्षेत्रफल $\frac{264}{7}$ cm^2 है। इस वृत्तखंड का केंद्रीय कोण है :

(A) 30° (B) 60°

(C) 90° (D) 120°

17. यदि a और b कोई दो धनात्मक पूर्णांक हैं, तो :

(A) म.स. (HCF) (a, b) + ल.स. (LCM) (a, b) = a + b

(B) म.स. (HCF) (a, b) + ल.स. (LCM) (a, b) = a × b

(C) म.स. (HCF) (a, b) × ल.स. (LCM) (a, b) = a × b

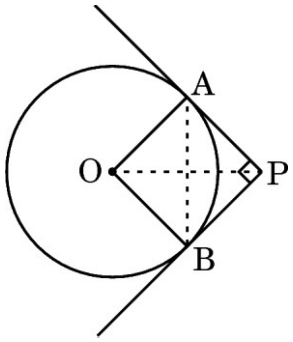
(D) म.स. (HCF) (a, b) = ल.स. (LCM) (a, b)

18. त्रिज्या r तथा ऊँचाई h वाला एक ठोस लंब-वृत्तीय शंकु, उसी त्रिज्या एवं ऊँचाई वाले एक ठोस बेलन के ऊपर रखा गया है। इस प्रकार बनी आकृति का कुल पृष्ठीय क्षेत्रफल है :

(A) $4\pi rh + 4\pi r^2$ (B) $4\pi rh + \pi r^2$

(C) $\pi r(\sqrt{r^2 + h^2} + 2h + r)$ (D) $\pi r^2(\sqrt{r^2 + h^2} + 2h + r)$

15. In the given figure, tangents PA and PB to the circle centred at O, from an external point P are perpendicular to each other. If AB = $5\sqrt{2}$ cm, then the length of PA is equal to :



(A) 5 cm (B) $5\sqrt{2}$ cm

(C) $2\sqrt{5}$ cm (D) 10 cm

16. A sector of a circle with area $\frac{264}{7}$ cm^2 is cut from a circle of radius 6 cm. The central angle of the sector is :

(A) 30° (B) 60°

(C) 90° (D) 120°

17. If a and b are any two positive integers, then :

(A) HCF (a, b) + LCM (a, b) = a + b

(B) HCF (a, b) + LCM (a, b) = a × b

(C) HCF (a, b) × LCM (a, b) = a × b

(D) HCF (a, b) = LCM (a, b)

18. A solid right circular cone of radius r and height h is placed over a solid cylinder of same height and radius. The total surface area of the shape so formed is :

(A) $4\pi rh + 4\pi r^2$ (B) $4\pi rh + \pi r^2$

(C) $\pi r(\sqrt{r^2 + h^2} + 2h + r)$ (D) $\pi r^2(\sqrt{r^2 + h^2} + 2h + r)$

*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 विकल्पों (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) :* निम्नलिखित आँकड़ों पर विचार कीजिए :

वर्ग	*बारंबारता*
65 – 85	4
85 – 105	5
105 – 125	13
125 – 145	20
145 – 165	14
165 – 185	7
185 – 205	4

माध्यक वर्ग की ऊपरी सीमा और बहुलक वर्ग की निम्न सीमा का अंतर 20 है।

तर्क (R) : वर्गीकृत आँकड़ों का माध्यक वर्ग और बहुलक वर्ग सदैव भिन्न होते हैं।

20. *अभिकथन (A) :* संख्याओं 1, 2, 3, ……., 15 में से यादृच्छया चुनी गई संख्या के 4 के गुणज होने की प्रायिकता $\frac{1}{3}$ है।

तर्क (R) : दो भिन्न सिक्कों को एक साथ उछाला जाता है। कम-से-कम एक चित आने की प्रायिकता $\frac{3}{4}$ है।

*Questions number **19** and **20** are Assertion and Reason based questions. Two statements are given, one is labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the options (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) :* Consider the following data :

Class	*Frequency*
65 – 85	4
85 – 105	5
105 – 125	13
125 – 145	20
145 – 165	14
165 – 185	7
185 – 205	4

The difference of the upper limit of the median class and the lower limit of the modal class is 20.

Reason (R) : The median class and modal class of grouped data are always different.

20. *Assertion (A) :* The probability that a number selected at random from the numbers 1, 2, 3, ..., 15 is a multiple of 4, is $\frac{1}{3}$.

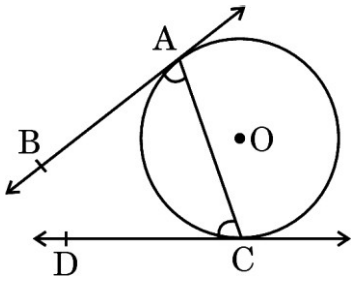
Reason (R) : Two different coins are tossed simultaneously. The probability of getting at least one head is $\frac{3}{4}$.

खण्ड ख

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

21. x-अक्ष पर उस बिंदु P के निर्देशांक ज्ञात कीजिए जो बिंदुओं A(– 1, 0) तथा B(5, 0) से समान दूरी पर है। (दूरी सूत्र का प्रयोग कीजिए)

22. दी गई आकृति में, AB और CD, केंद्र O वाले वृत्त की स्पर्श-रेखाएँ हैं। क्या $\angle BAC = \angle DCA$ है ? अपने उत्तर की पुष्टि कीजिए।



23. यदि बहुपद $25p^2 - 15p + 2$ के दो शून्यक α और β हैं, तो एक द्विघात बहुपद ज्ञात कीजिए, जिसके शून्यक $\frac{1}{3\alpha}$ और $\frac{1}{3\beta}$ हों।

24. (क) एक Δ PQR की भुजाओं PQ और PR पर क्रमश: बिंदु X और Y स्थित हैं। यदि PX, QX, PY और YR की लंबाइयाँ (cm में) क्रमश: 4, 4·5, 8 और 9 हैं, तो सिद्ध कीजिए कि XY || QR.

अथवा

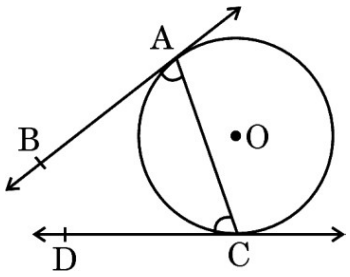
(ख) ABCD एक समलम्ब चतुर्भुज है जिसमें AB || DC तथा AD और BC पर क्रमश: बिंदु P और Q इस प्रकार हैं कि PQ || DC. यदि PD = 18 cm, BQ = 3·5 cm और QC = 15 cm हो, तो AD की लंबाई ज्ञात कीजिए।

SECTION B

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

21. Find the coordinates of a point P on x-axis equidistant from the points A(– 1, 0) and B(5, 0), using distance formula.

22. In the given figure, AB and CD are tangents to a circle centred at O. Is ∠ BAC = ∠ DCA ? Justify your answer.



23. If α and β are two zeroes of the polynomial $25p^2 - 15p + 2$, find a quadratic polynomial where zeroes are $\frac{1}{3\alpha}$ and $\frac{1}{3\beta}$.

24. (a) X and Y are points on the sides PQ and PR respectively, of a Δ PQR. If the lengths of PX, QX, PY and YR (in cm) are 4, 4·5, 8 and 9 respectively, then show that XY || QR.

OR

(b) ABCD is a trapezium in which AB || DC and P and Q are points on AD and BC respectively, such that PQ || DC. If PD = 18 cm, BQ = 3·5 cm and QC = 15 cm, then find the length of AD.

25. (क) x का मान ज्ञात कीजिए, यदि :

$$2\ \text{cosec}^2\ 30° + x\ \sin^2\ 60° - \frac{3}{4}\ \tan^2\ 30° = 10$$

अथवा

(ख) यदि $\cos A = \frac{2}{5}$ है, तो $4 + 4\tan^2 A$ 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 $\sin\theta + \cos\theta = \sqrt{3}$ है, तो सिद्ध कीजिए कि :

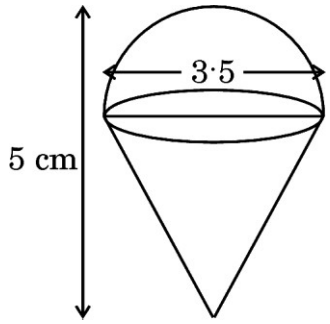
$$\tan\theta + \cot\theta = 1$$

अथवा

(ख) सिद्ध कीजिए कि :

$$(\sin\theta + \text{cosec}\ \theta)^2 + (\cos\theta + \sec\theta)^2 = 7 + \tan^2\theta + \cot^2\theta$$

27. काजल को अपने जन्मदिन पर एक लट्टू उपहार में मिला, जिस पर आश्चर्यजनक रूप से कोई रंग नहीं था। वह इसे अपने क्रेयान से रंगना चाहती है। लट्टू शंकु के आकार का है जिसके ऊपर एक अर्द्धगोला है। पूरे लट्टू की ऊँचाई 5 cm है और इसका व्यास 3·5 cm है। उसे कितने क्षेत्रफल को रंगना होगा ? [$\pi = \frac{22}{7}$ प्रयोग कीजिए]



25. (a) Find the value of x, if :

$$2\ \text{cosec}^2\ 30° + x\ \sin^2\ 60° - \frac{3}{4}\ \tan^2\ 30° = 10$$

OR

(b) If $\cos A = \frac{2}{5}$, then find the value of $4 + 4\ \tan^2 A$.

SECTION C

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

26. (a) If $\sin\theta + \cos\theta = \sqrt{3}$, then prove that :

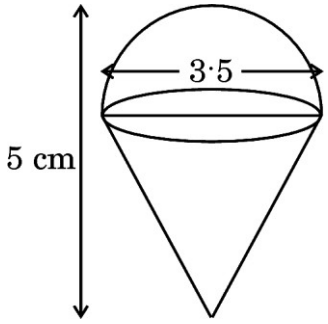
$$\tan\theta + \cot\theta = 1$$

OR

(b) Prove that :

$$(\sin\theta + \text{cosec}\ \theta)^2 + (\cos\theta + \sec\theta)^2 = 7 + \tan^2\theta + \cot^2\theta$$

27. Kajal got a playing top (lattu) as her birthday gift, which surprisingly had no colour on it. She wanted to colour it with her crayons. The top is shaped like a cone, surmounted by a hemisphere. The entire top is 5 cm in height and the diameter of the top is 3·5 cm. Find the area she has to colour. [Use $\pi = \frac{22}{7}$]



28. (क) सिद्ध कीजिए कि $\sqrt{5}$ एक अपरिमेय संख्या है।

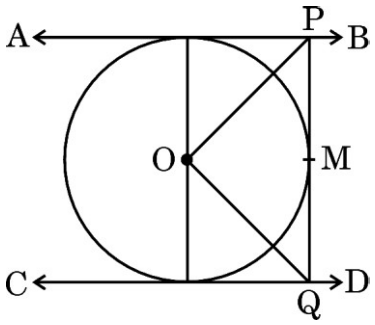
अथवा

(ख) दर्शाइए कि $\frac{2+3\sqrt{2}}{5}$ एक अपरिमेय संख्या है।

29. एक समकोण त्रिभुज ABC के शीर्ष A(x, y), B(– 3, – 2) और C(3, 2) हैं, जहाँ समकोण A पर है। x और y के बीच संबंध ज्ञात कीजिए। फिर x = 3 होने पर y के सभी संभावित मान ज्ञात कीजिए।

30. कौशिक एक बार में दो पासे फेंकता है और उन पर आने वाली संख्याओं का गुणनफल निकालता है। ऋषित एक पासा फेंकता है और उस पर आने वाली संख्या का वर्ग करता है। ज्ञात कीजिए कि किसके पास संख्या 36 प्राप्त करने की अधिक संभावना है।

31. दी गई आकृति में, AB और CD केंद्र O वाले वृत्त की दो समांतर स्पर्श-रेखाएँ हैं और एक अन्य स्पर्श-रेखा PQ जिसका स्पर्श बिंदु M है, AB को P पर और CD को Q पर प्रतिच्छेद करती है। सिद्ध कीजिए कि $\angle POQ = 90°$.



खण्ड घ

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

32. (क) Δ ABC एक समकोण त्रिभुज है जिसका समकोण C पर है। माना BC = a, CA = b, AB = c तथा C से AB पर डाले गए लंब की लंबाई p है। सिद्ध कीजिए कि :

(i) $cp = ab$

(ii) $\frac{1}{p^2} = \frac{1}{a^2} + \frac{1}{b^2}$

अथवा

28. (a) Prove that $\sqrt{5}$ is an irrational number.

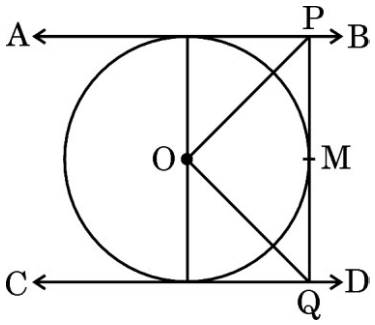
OR

(b) Show that $\frac{2+3\sqrt{2}}{5}$ is an irrational number.

29. A(x, y), B(– 3, – 2) and C(3, 2) are the vertices of a right triangle ABC, right-angled at A. Find the relationship between x and y. Hence, find all the possible values of y for which x = 3.

30. Kaushik throws two dice once and computes the product of the numbers appearing on the dice. Rishit throws one die and squares the number that appears on it. Find who has the better chance of getting the number 36.

31. In the figure, AB and CD are two parallel tangents to a circle with centre O and another tangent PQ with point of contact M, intersecting AB at P and CD at Q. Prove that $\angle$ POQ = 90°.



SECTION D

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

32. (a) Δ ABC is a right triangle right-angled at C. Let BC = a, CA = b, AB = c, and let p be the length of perpendicular from C on AB. Prove that :

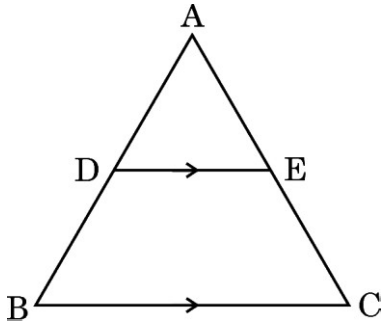
(i) cp = ab

(ii) $\frac{1}{p^2} = \frac{1}{a^2} + \frac{1}{b^2}$

OR

(ख) Δ ABC में, DE || BC है। सिद्ध कीजिए कि :

$$\frac{AD}{DB} = \frac{AE}{EC}$$



33. निम्न समीकरणों के आलेख खींचिए :

$2x - y = 1$ और $3x + 2y = 12$

इन रेखाओं द्वारा निरूपित समीकरणों और x-अक्ष द्वारा बनाए गए त्रिभुज के शीर्ष ज्ञात कीजिए। बनने वाले त्रिभुजाकार क्षेत्र को छायांकित कीजिए और इसका क्षेत्रफल ज्ञात कीजिए।

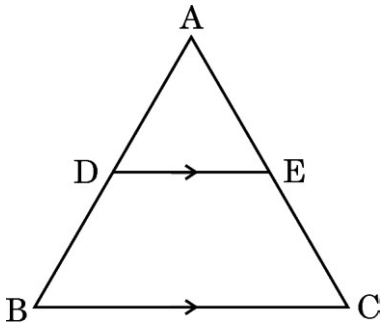
34. एक सर्वेक्षण में प्राप्त 110 श्रमिकों के दैनिक वेतन नीचे सारणीबद्ध हैं :

दैनिक वेतन (₹ में)	*श्रमिकों की संख्या*
100 – 120	10
120 – 140	15
140 – 160	20
160 – 180	22
180 – 200	18
200 – 220	12
220 – 240	13

इन श्रमिकों के माध्य दैनिक वेतन और बहुलक दैनिक वेतन की गणना कीजिए।

(b) In Δ ABC, DE || BC. Prove that :

$$\frac{AD}{DB} = \frac{AE}{EC}$$



33. Draw the graphs of the following equations :

$2x - y = 1$ and $3x + 2y = 12$

Determine the vertices of the triangle formed by the lines representing these equations and the x-axis. Shade the triangular region so formed and find its area.

34. Daily wages of 110 workers, obtained in a survey, are tabulated below :

Daily wages (in ₹)	*Number of workers*
100 – 120	10
120 – 140	15
140 – 160	20
160 – 180	22
180 – 200	18
200 – 220	12
220 – 240	13

Compute the mean daily wages and modal daily wages of these workers.

35. (क) एक रेलगाड़ी 480 किमी की दूरी एकसमान चाल से तय करती है । यदि इसकी चाल 8 किमी/घंटा कम होती, तो उसी दूरी को तय करने में 3 घंटे अधिक लगते । रेलगाड़ी की वास्तविक चाल ज्ञात कीजिए।

अथवा

(ख) हिमाक्षी शांत जल में अपनी नाव को 5 किमी/घंटा की गति से चला सकती है। यदि नाव को 5·25 किमी ऊर्ध्वप्रवाह (upstream) ले जाने में उसे नाव को अनुप्रवाह (downstream) में वापस लाने की तुलना में 1 घंटा अधिक लगता है, तो ऊर्ध्वप्रवाह में नाव की गति ज्ञात कीजिए।

खण्ड ङ

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

प्रकरण अध्ययन – 1

36. वैभव ने एक वृत्ताकार खेत के चारों ओर बाड़ लगाई। बाड़ लगाने की कुल लागत ₹ 6,000 आई, जिसमें प्रति मीटर दर ₹ 30 थी। अब वह खेत को जोतने की योजना बना रहा है।

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

(i) खेत की परिमिति (परिधि) क्या है ? *1*

(ii) खेत की त्रिज्या क्या है ? *1*

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

OR

(b) Himakshi can row her boat at a speed of 5 km/h in still water. If she takes 1 hour more to row the boat 5·25 km upstream than to return downstream, find the speed of the boat in upstream.

SECTION E

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

Case Study – 1

36. Vaibhav installed a fence around a circular field, with the total cost amounting to ₹ 6,000 at a rate of ₹ 30 per m. He now plans to plough the field.

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

(i) What is the perimeter of the field ? *1*

(ii) What is the radius of the field ? *1*

(iii) (क) खेत का क्षेत्रफल क्या है ? 2

अथवा

(iii) (ख) यदि जोताई की दर ₹ 0·50 प्रति वर्ग मीटर है, तो खेत को जोतने की लागत ज्ञात कीजिए। 2

प्रकरण अध्ययन – 2

37. एक रोड रोलर, जिसे प्राय: रोलर कॉम्पैक्टर या सिर्फ रोलर भी कहा जाता है, एक इंजीनियरिंग वाहन है जिसका उपयोग मिट्टी, बजरी, कंक्रीट या डामर को सड़कों और नींव के निर्माण में दबाने (सघन करने) के लिए किया जाता है। इसी प्रकार की मशीनें लैंडफिल या कृषि में भी उपयोग की जाती हैं। एक रोड रोलर निर्माण कंपनी के पिछले रिकॉर्ड से पता चला कि प्रत्येक वर्ष उत्पादित वस्तुओं की संख्या एक समांतर श्रेढ़ी (AP) बनाती है। कंपनी ने चौथे वर्ष में 270 रोड रोलर और दसवें वर्ष में 510 रोड रोलर बनाए।

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

(i) कंपनी का प्रथम वर्ष का उत्पादन क्या था ? 1

(ii) कंपनी का आठवें वर्ष का उत्पादन क्या था ? 1

(iii) (क) कंपनी का पहले 6 वर्षों का कुल उत्पादन क्या था ? 2

अथवा

(iii) (ख) दूसरे वर्ष के उत्पादन और आठवें वर्ष के उत्पादन का अनुपात ज्ञात कीजिए। 2

(iii) (a) What is the area of the field ? *2*

OR

(iii) (b) Find the cost of ploughing the field at the rate of ₹ 0·50 per m^2. *2*

Case Study – 2

37. A road roller, often called a roller compactor or just a roller, is an engineering vehicle used to compact soil, gravel, concrete, or asphalt in the construction of roads and foundations. Similar machines are also used in landfills or agriculture. Past records of a road roller manufacturing company show that the number of products produced each year forms an Arithmetic Progression (AP). The company produced 270 road rollers in the 4^{th} year and 510 in the 10^{th} year.

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

(i) What was the company's production in the 1^{st} year ? *1*

(ii) What was the company's production in the 8^{th} year ? *1*

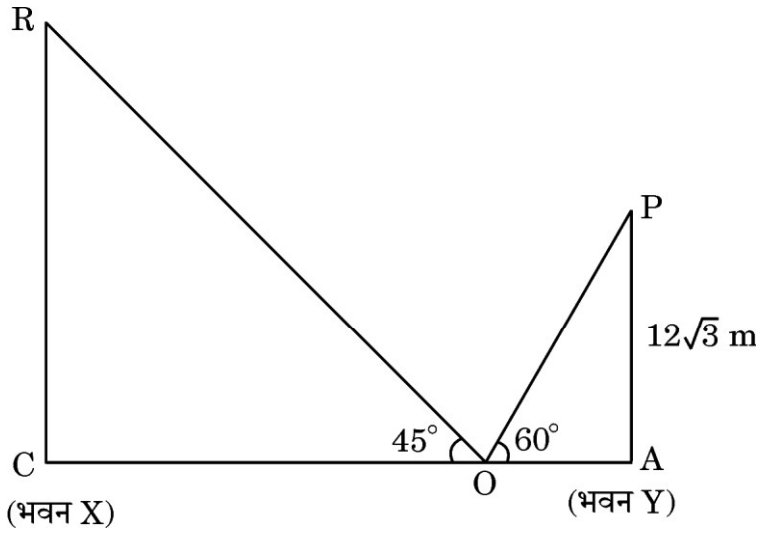
(iii) (a) What was the company's total production of the first 6 years ? *2*

OR

(iii) (b) Find the ratio of 2^{nd} year's production to 8^{th} year's production. *2*

प्रकरण अध्ययन – 3

38. एक सीढ़ी क्षैतिज रेखा से 60° के कोण पर झुकी हुई है और वह भवन Y की छत (छोर) की ऊर्ध्वाधर दीवार से सटी हुई है। सीढ़ी का आधार एक निश्चित बिंदु 'O' पर रखा गया है। कुछ समय बाद उसी आधार को स्थिर रखते हुए सीढ़ी को सामने स्थित भवन X की छत (छोर) पर इस प्रकार टिकाया जाता है कि वह भूमि के साथ 45° का कोण बनाती है। दोनों भवन एवं सीढ़ी का आधार 'O' एक सीधी रेखा में स्थित हैं।



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

(i) सीढ़ी की लंबाई ज्ञात कीजिए। *1*

(ii) बिंदु 'O' से भवन X तक की दूरी (OC) ज्ञात कीजिए। *1*

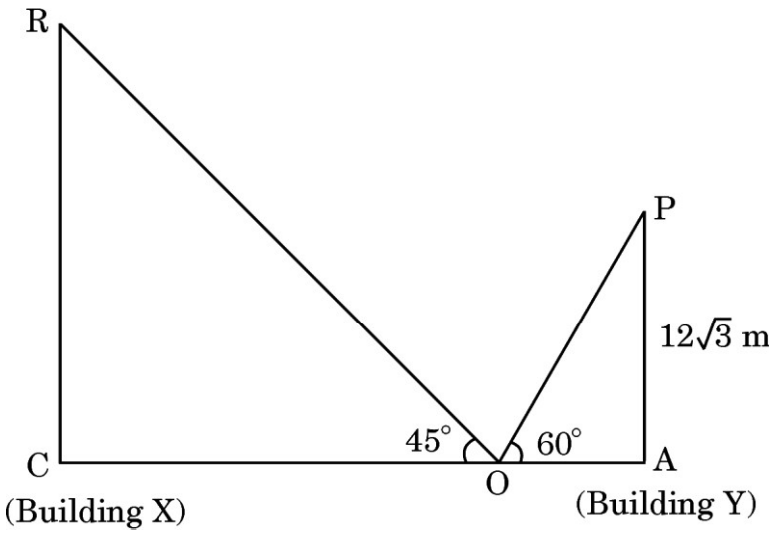
(iii) (क) दोनों भवनों के बीच की क्षैतिज दूरी ज्ञात कीजिए। *2*

अथवा

(iii) (ख) भवन X की ऊँचाई ज्ञात कीजिए। *2*

Case Study – 3

38. A ladder inclined at an angle of 60° to the horizontal is leaning against the vertical wall of the terrace (top) of the building Y. The foot of the ladder is kept fixed at point 'O'. After some time, keeping the same foot fixed, it is made to lean against the terrace (top) of the opposite building X, at an angle of 45° with the ground. Both buildings along with the foot of the ladder, fixed at 'O' are in a straight line.



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

(i) Find the length of the ladder. *1*

(ii) Find the distance of the building X from point 'O', i.e. OC. *1*

(iii) (a) Find the horizontal distance between the two buildings. *2*

OR

(iii) (b) Find the height of the building X. *2*

Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2026 (2nd Board Examination)
MATHEMATICS (STANDARD)
MATHEMATICS (STANDARD) (041) (PAPER CODE 30/7/3)

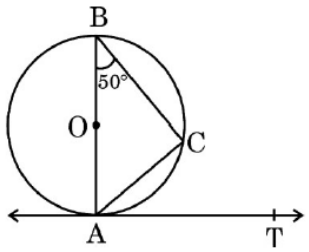
General Instructions: -

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 BNS."**
3.	Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one's own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. **However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and due marks be awarded to them. In Class-X, while evaluating the Competency-based questions, please try to understand given answer and even if reply is not from Marking Scheme but correct competency is enumerated by the candidate, due marks should be awarded.**
4.	The Marking scheme carries only suggested value points for the answers. These are in the nature of Guidelines only and do not constitute the complete answer. The students can have their own expression and if the expression is correct, the due marks should be awarded accordingly.
5.	The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. If there is any variation, the same should be zero after deliberation and discussion. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.
6.	Evaluators will mark (✓) wherever answer is correct. For wrong answer CROSS 'X" be marked. Evaluators will not put right (✓) while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing.**
7.	If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totalled up and written on the left-hand margin and encircled. This may be followed strictly.
8.	If a question does not have any parts, marks must be awarded on the left-hand margin and encircled. This may also be followed strictly.
9.	If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note **"Extra Question"**.

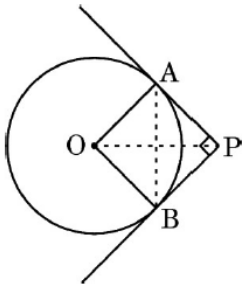
10.	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
11.	A full scale of **0 to** marks as given in Question Paper has to be used. Please do not hesitate to award full marks if the answer deserves it.
12.	Every examiner has to necessarily do evaluation work for full working hours i.e., 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines). This is in view of the reduced syllabus and number of questions in question paper.
13.	Ensure that you do not make the following common types of errors committed by the Examiner in the past:- ● Leaving answer or part thereof unassessed in an answer book. ● Giving more marks for an answer than assigned to it. ● Wrong totalling of marks awarded to an answer. ● Wrong transfer of marks from the inside pages of the answer book to the title page. ● Wrong question wise totalling on the title page. ● Wrong totalling of marks of the two columns on the title page. ● Wrong grand total. ● Marks in words and figures not tallying/not same. ● Wrong transfer of marks from the answer book to Online Award List. ● Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.) ● Half or a part of answer marked correct and the rest as wrong, but no marks awarded.
14.	While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0) Marks.
15.	Any unassessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.
16.	The Examiners should acquaint themselves with the guidelines given in the "**Guidelines for spot Evaluation**" before starting the actual evaluation.
17.	Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totalled and written in figures and words.
18.	The candidates are entitled to obtain Photocopy of the Answer Book on request on payment of the prescribed processing fee. All Examiners/Additional Head Examiners/Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme.

MARKING SCHEME
MATHEMATICS (Subject Code–041)
(PAPER CODE: 30/7/3)

Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Marks
	SECTION – A **This section has 20 Multiple Choice Questions (MCQs) carrying 1 mark each.**	
1.	A rational number between $\sqrt{2}$ and $\sqrt{3}$ is : (A) $\frac{\sqrt{2}+\sqrt{3}}{2}$ (B) $\frac{\sqrt{2}-\sqrt{3}}{2}$ (C) 1·3 (D) 1·8	
Sol.	As correct option is not there, so 1 mark to be given to all.	**1**
2.	The zeroes of the polynomial $p(x) = x^2 - x - 6$ are : (A) 3, 2 (B) – 3, 2 (C) 3, – 2 (D) – 3, – 2	
Sol.	(C) $3, -2$	**1**
3.	The pair of equations $5x - 15y = 8$ and $3x - 9y = \frac{24}{5}$ has : (A) one solution (B) two solutions (C) infinitely many solutions (D) no solution	
Sol.	(C) infinitely many solutions	**1**
4.	In Δ ABC, DE is parallel to BC, with D on AB and E on AC. If $\frac{AD}{DB} = \frac{3}{4}$, then the value of $\frac{BC}{DE}$ is : (A) 2 : 5 (B) 3 : 7 (C) 7 : 3 (D) 5 : 3	
Sol.	(C) 7: 3	**1**

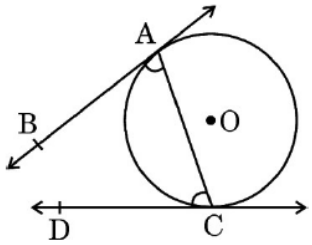
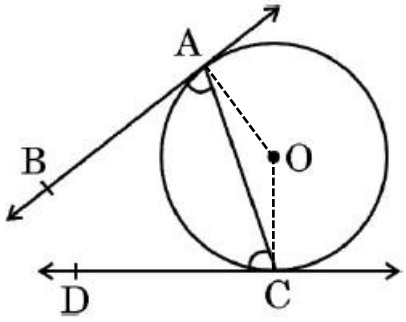
5.	If $p\left[\frac{2\sin 30^\circ}{1-\sin^2 30^\circ}\right] = q\left[\frac{2\sin 30^\circ}{1+\sin^2 30^\circ}\right]$, then p : q is equal to : (A) 1 : 1 (B) 4 : 3 (C) 3 : 5 (D) 4 : 5	
Sol.	(C) 3:5	**1**
6.	If a pole is 6 m high and it casts a shadow of length $2\sqrt{3}$ m on the ground, then the Sun's elevation is : (A) 60° (B) 45° (C) 120° (D) 90°	
Sol.	(A) 60°	**1**
7.	In the given figure, AT is a tangent to a circle centred at O. If $\angle ABC = 50°$, then $\angle CAT$ is equal to :  (A) 70° (B) 50° (C) 65° (D) 40°	
Sol.	(B) 50°	**1**
8.	A cap is cylindrical in shape and is surmounted by a hemispherical top. If the volume of the cylindrical part is equal to that of the hemispherical part, then the ratio of the height of the cylindrical part to the height of the hemispherical part is : (A) 2 : 3 (B) 1 : 3 (C) 2 : 1 (D) 3 : 1	
Sol.	(A) 2:3	**1**

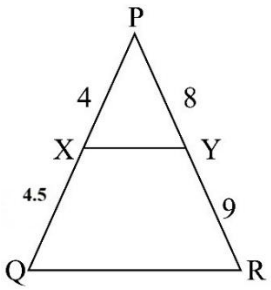
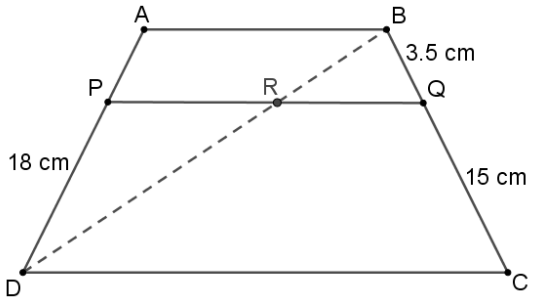
9.	If the probability of a player winning a game is 0·21, then the probability of him losing the same game is : (A) 1·79 (B) 0·81 (C) 0·79% (D) 0·79	
Sol.	(D) 0.79	**1**
10.	If two positive integers a and b are written as $a = x^3y^2$ and $b = xy^3$, where x and y are prime numbers, then LCM (a, b) is : (A) xy (B) xy^2 (C) x^3y^3 (D) x^2y^2	
Sol.	(C) x^3y^3	**1**
11.	If α and β are the zeroes of a polynomial $f(x) = px^2 - 2x + 3p$ and $\alpha + \beta - \alpha\beta = 0$, then the value of p is : (A) $-\frac{2}{3}$ (B) $\frac{2}{3}$ (C) $\frac{1}{3}$ (D) $-\frac{1}{3}$	
Sol.	(B) $\frac{2}{3}$	**1**
12.	Which of the following sequences is an AP ? (A) 2, 4, 8, 16 ..... (B) $3, 3+\sqrt{2}, 3+2\sqrt{2}, ...$ (C) 1, 3, 9, 27, ... (D) $\sqrt{3}, \sqrt{6}, \sqrt{9}, ...$	
Sol.	(B) $3, 3+\sqrt{2}, 3+2\sqrt{2}, ...$	**1**

13.	If the point C(k, 4) divides the join of the points A(2, 6) and B(5, 1) in the ratio 2 : 3, then the value of k is : (A) 16 (B) $\frac{28}{5}$ (C) $\frac{16}{5}$ (D) $\frac{8}{5}$	
Sol.	(C) $\frac{16}{5}$	**1**
14.	In a right triangle ABC, right-angled at A, if cos B = $\frac{1}{4}$, then the value of cot B is : (A) $\frac{1}{4}$ (B) $\frac{1}{\sqrt{15}}$ (C) $\frac{\sqrt{15}}{1}$ (D) $\frac{4}{\sqrt{15}}$	
Sol.	(B) $\frac{1}{\sqrt{15}}$	**1**
15.	In the given figure, tangents PA and PB to the circle centred at O, from an external point P are perpendicular to each other. If AB = $5\sqrt{2}$ cm, then the length of PA is equal to :  (A) 5 cm (B) $5\sqrt{2}$ cm (C) $2\sqrt{5}$ cm (D) 10 cm	
Sol.	(A) 5 cm	**1**

16.	A sector of a circle with area $\frac{264}{7}$ cm^2 is cut from a circle of radius 6 cm. The central angle of the sector is : (A) 30° (B) 60° (C) 90° (D) 120°	
Sol.	(D) 120°	**1**
17.	If a and b are any two positive integers, then : (A) HCF (a, b) + LCM (a, b) = a + b (B) HCF (a, b) + LCM (a, b) = a × b (C) HCF (a, b) × LCM (a, b) = a × b (D) HCF (a, b) = LCM (a, b)	
Sol.	(C) $HCF(a,b) \times LCM(a,b) = a \times b$	**1**
18.	A solid right circular cone of radius r and height h is placed over a solid cylinder of same height and radius. The total surface area of the shape so formed is : (A) $4\pi rh + 4\pi r^2$ (B) $4\pi rh + \pi r^2$ (C) $\pi r(\sqrt{r^2+h^2} + 2h + r)$ (D) $\pi r^2(\sqrt{r^2+h^2} + 2h + r)$	
Sol.	(C) $\pi r(\sqrt{r^2+h^2} + 2h + r)$	**1**
	*Questions number **19** and **20** are Assertion and Reason based questions. Two statements are given, one is labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the options (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.	

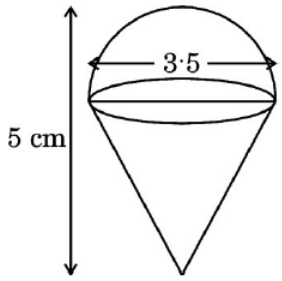
19.	*Assertion (A) :* Consider the following data : | *Class*	*Frequency*
---	---
65 – 85	4
85 – 105	5
105 – 125	13
125 – 145	20
145 – 165	14
165 – 185	7
185 – 205	4 | The difference of the upper limit of the median class and the lower limit of the modal class is 20. *Reason (R) :* The median class and modal class of grouped data are always different.	
Sol.	(C) Assertion (A) is true, but Reason (R) is false.	**1**
20.	*Assertion (A) :* The probability that a number selected at random from the numbers 1, 2, 3, ..., 15 is a multiple of 4, is $\frac{1}{3}$. *Reason (R) :* Two different coins are tossed simultaneously. The probability of getting at least one head is $\frac{3}{4}$.	
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 the coordinates of a point P on x-axis equidistant from the points A(– 1, 0) and B(5, 0), using distance formula.	
Sol.	Let the coordinates of point P be $(x, 0)$ Here $PA = PB \Rightarrow PA^2 = PB^2$ $\Rightarrow (-1-x)^2 + 0 = (5-x)^2 + 0$	½ ½

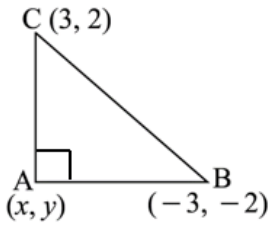
	Solving, we get $x = 2$ $\therefore$ Coordinates of point P are $(2,0)$	½ ½
22.	In the given figure, AB and CD are tangents to a circle centred at O. Is $\angle$ BAC = $\angle$ DCA ? Justify your answer.  	
Sol.	 Join OA and OC Since OA = OC $\therefore \angle OAC = \angle OCA$ (i) Since tangent is perpendicular to radius $\Rightarrow \angle BAC = 90° - \angle CAO = 90° - \angle ACO$ (using (i)) $= \angle DCA$	½ ½ **1**
23.	If α and β are two zeroes of the polynomial $25p^2 - 15p + 2$, find a quadratic polynomial where zeroes are $\frac{1}{3\alpha}$ and $\frac{1}{3\beta}$.	
Sol.	Here, $\alpha + \beta = \frac{15}{25}, \alpha\beta = \frac{2}{25}$ Let the required polynomial be $x^2 - Sx + P$ $S = \frac{1}{3\alpha} + \frac{1}{3\beta} = \frac{1}{3}\left(\frac{\alpha+\beta}{\alpha\beta}\right) = \frac{5}{2}$	½ ½

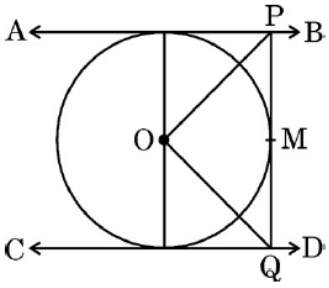
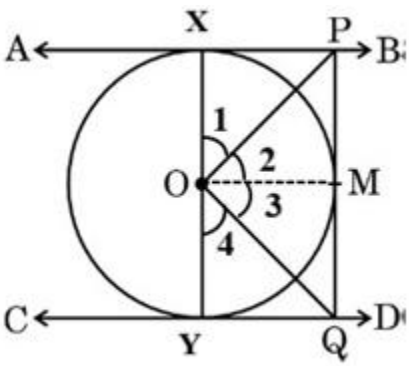
	$P = \frac{1}{3\alpha} \times \frac{1}{3\beta} = \frac{1}{9}\left(\frac{1}{\alpha\beta}\right) = \frac{25}{18}$ $\therefore$ Required polynomial is $x^2 - \frac{5}{2}x + \frac{25}{18}$ or $18x^2 - 45x + 25$	½ ½
24 (a).	X and Y are points on the sides PQ and PR respectively, of a Δ PQR. If the lengths of PX, QX, PY and YR (in cm) are 4, 4·5, 8 and 9 respectively, then show that XY || QR.	
Sol.	 Here, $\frac{PX}{XQ} = \frac{4}{4.5} = \frac{8}{9}$ and $\frac{PY}{YR} = \frac{8}{9}$ Therefore, $\frac{PX}{XQ} = \frac{PY}{YR}$ $\Longrightarrow$ XY || QR	**1** ½ ½
	OR	
24 (b).	ABCD is a trapezium in which AB || DC and P and Q are points on AD and BC respectively, such that PQ || DC. If PD = 18 cm, BQ = 3·5 cm and QC = 15 cm, then find the length of AD.	
Sol.	 Join BD	½

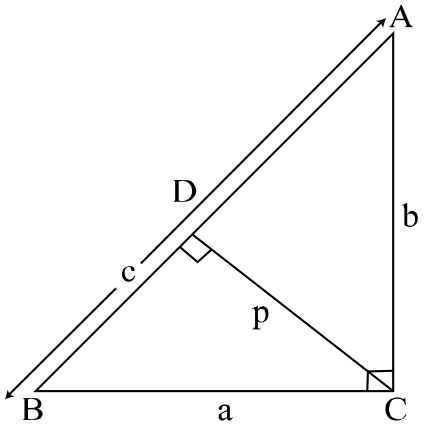
	In ΔBDC, RQ $\|\|$ DC $\therefore \frac{BR}{RD} = \frac{BQ}{QC}$ (i) In ΔDAB, PR $\|\|$ AB $\therefore \frac{BR}{RD} = \frac{AP}{PD}$ (ii) Using (i) and (ii), $\frac{BQ}{QC} = \frac{AP}{PD}$ $\Longrightarrow \frac{3.5}{15} = \frac{AP}{18}$ $\Longrightarrow AP = 4.2$ cm Hence, $AD = 4.2 + 18 = 22.2$ cm	½ ½ ½
25 (a) .	Find the value of x, if : $2\ \text{cosec}^2 30° + x \sin^2 60° - \frac{3}{4} \tan^2 30° = 10$	
Sol.	$2\text{cosec}^2 30° + x \sin^2 60° - \frac{3}{4}\tan^2 30° = 10$ $\Longrightarrow 2 \times (2)^2 + x \times \left(\frac{\sqrt{3}}{2}\right)^2 - \frac{3}{4} \times \left(\frac{1}{\sqrt{3}}\right)^2 = 10$ $\Longrightarrow 8 + \frac{3x}{4} - \frac{1}{4} = 10$ $\Longrightarrow x = 3$	 **1** ½ ½
	OR	
25 (b).	If $\cos A = \frac{2}{5}$, then find the value of $4 + 4 \tan^2 A$.	
Sol.	$4 + 4\tan^2 A = 4(1 + \tan^2 A) = 4 \sec^2 A = \frac{4}{\cos^2 A}$ $= 4 \times \left(\frac{25}{4}\right) = 25$	**1** **1**

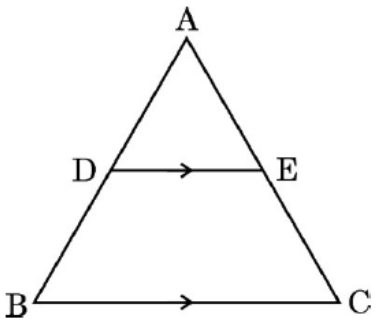
	SECTION – C **This section has 6 Short Answer (SA) type questions carrying 3 marks each.**	
26 (a).	If $\sin\theta + \cos\theta = \sqrt{3}$, then prove that : $\tan\theta + \cot\theta = 1$	
Sol.	$(\sin\theta + \cos\theta)^2 = 3$ $\Rightarrow \sin^2\theta + \cos^2\theta + 2\sin\theta\cos\theta = 3$ $\Rightarrow 2\sin\theta\cos\theta = 2$ $\Rightarrow \sin\theta\cos\theta = 1$ (i) $\text{LHS} = \tan\theta + \cot\theta$ $= \frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta}$ $= \frac{\sin^2\theta+\cos^2\theta}{\sin\theta\cos\theta}$ $= \frac{1}{1} = 1 = \text{RHS}$ (using (i))	**1** **1** **½** **½**
	OR	
26(b).	Prove that : $(\sin\theta + \text{cosec}\,\theta)^2 + (\cos\theta + \sec\theta)^2 = 7 + \tan^2\theta + \cot^2\theta$	
Sol.	$\text{LHS} = \sin^2\theta + \text{cosec}^2\theta + 2\sin\theta\,\text{cosec}\,\theta + \cos^2\theta + \sec^2\theta + 2\cos\theta\sec\theta$ $= (\sin^2\theta + \cos^2\theta) + (1 + \cot^2\theta) + 2\sin\theta \times \frac{1}{\sin\theta} + (1 + \tan^2\theta) + 2\cos\theta \times \frac{1}{\cos\theta}$ $= 3 + 2 + 2 + \tan^2\theta + \cot^2\theta$ $= 7 + \tan^2\theta + \cot^2\theta = \text{RHS}$	**1** **1** **½** **½**

27.	Kajal got a playing top (lattu) as her birthday gift, which surprisingly had no colour on it. She wanted to colour it with her crayons. The top is shaped like a cone, surmounted by a hemisphere. The entire top is 5 cm in height and the diameter of the top is 3·5 cm. Find the area she has to colour. [Use $\pi = \frac{22}{7}$]  	
Sol.	Here $r = \frac{3.5}{2}$ cm $= \frac{7}{4}$ cm and height of the cone $(h) = 5 - \frac{7}{4} = \frac{13}{4}$ cm Hence $l = \sqrt{\left(\frac{7}{4}\right)^2 + \left(\frac{13}{4}\right)^2} = \frac{\sqrt{218}}{4}$ cm Area to be colured $= 2\pi r^2 + \pi rl$ $= 2 \times \frac{22}{7} \times \left(\frac{7}{4}\right)^2 + \frac{22}{7} \times \frac{7}{4} \times \frac{\sqrt{218}}{4}$ $= \left(\frac{77}{4} + \frac{11}{8}\sqrt{218}\right)\ cm^2 = 39.46$ cm^2 (approx.)	½ ½ **1** **1**
28 (a).	Prove that $\sqrt{5}$ is an irrational number.	
Sol.	Let $\sqrt{5}$ be a rational number. $\therefore \sqrt{5} = \frac{p}{q}$, where $q \neq 0$ and let p & q be coprime. $5q^2 = p^2 \implies p^2$ is divisible by $5 \implies p$ is divisible by 5 ----- (i) Let $p = 5a$, where 'a' is some integer $25a^2 = 5\,q^2 \implies q^2 = 5\ a^2 \implies q^2$ is divisible by 5 $\implies q$ is divisible by 5 ----- (ii) (i) and (ii) leads to a contradiction as 'p' and 'q' are coprime.	½ **1** **1** ½

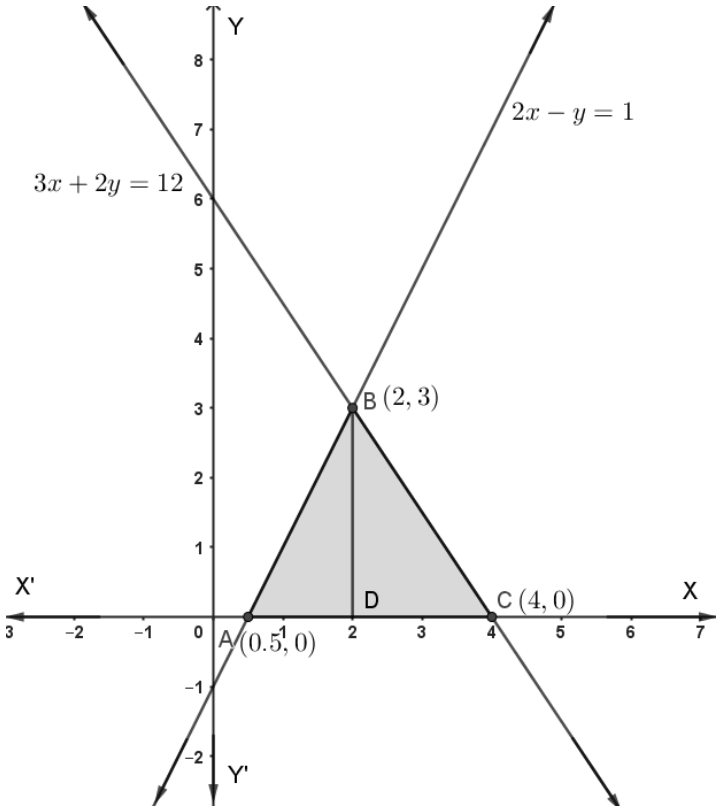
	$\therefore \sqrt{5}$ is an irrational number.	
	OR	
28 (b).	Show that $\frac{2+3\sqrt{2}}{5}$ is an irrational number.	
Sol.	Let $\frac{2+3\sqrt{2}}{5}$ be a rational number m $\therefore \frac{2+3\sqrt{2}}{5} = m$ $\Longrightarrow \sqrt{2} = \frac{5m-2}{3}$ As m is rational $\Longrightarrow \frac{5m-2}{3}$ is rational, But $\sqrt{2}$ is an irrational number $\therefore$ LHS $\neq$ RHS $\therefore \frac{2+3\sqrt{2}}{5}$ is an irrational number.	½ **1** **1** ½
29.	A(x, y), B(– 3, – 2) and C(3, 2) are the vertices of a right triangle ABC, right-angled at A. Find the relationship between x and y. Hence, find all the possible values of y for which x = 3.	
Sol.	 $BC^2 = AC^2 + AB^2$ $\therefore (3+3)^2 + (2+2)^2 = (x-3)^2 + (y-2)^2 + (x+3)^2 + (y+2)^2$ $\Longrightarrow 52 = 2(x^2 + y^2) + 26$ $\Longrightarrow x^2 + y^2 = 13$ At $x = 3, y^2 = 4 \Longrightarrow y = 2, -2$	**1** **1** **1**

30.	Kaushik throws two dice once and computes the product of the numbers appearing on the dice. Rishit throws one die and squares the number that appears on it. Find who has the better chance of getting the number 36.	
Sol.	When Kaushik throws two dice, Total number of outcomes $= 36$ Favourable outcome is (6,6) i.e., one $\therefore$ P(getting the number 36) $= \frac{1}{36}$ When Rishit throws a die, Total number of outcomes $= 6$ Favourable outcome is 6 i.e., one $\therefore$ P(getting the number 36) $= \frac{1}{6}$ Since $\frac{1}{6} > \frac{1}{36}$ So, Rishit has the better chance of getting the number 36.	**1** **1** ½ ½
31.	In the figure, AB and CD are two parallel tangents to a circle with centre O and another tangent PQ with point of contact M, intersecting AB at P and CD at Q. Prove that $\angle$ POQ = 90°. 	
Sol.		

	Join OM $\Delta PXO \cong \Delta PMO$ $\Longrightarrow \angle 1 = \angle 2$ (i) $\Delta QYO \cong \Delta QMO$ $\Longrightarrow \angle 4 = \angle 3$ (ii) Since XOY is a line $\therefore \angle 1 + \angle 2 + \angle 3 + \angle 4 = 180°$ $\Longrightarrow \angle 2 + \angle 3 = 90°$ (using (i) and (ii)) or $\angle POQ = 90°$	½ 1 ½ ½ ½
	SECTION – D **This section has 4 Long Answer (LA) type questions carrying 5 marks each.**	
32 (a).	Δ ABC is a right triangle right-angled at C. Let BC = a, CA = b, AB = c, and let p be the length of perpendicular from C on AB. Prove that : (i) cp = ab (ii) $\frac{1}{p^2} = \frac{1}{a^2} + \frac{1}{b^2}$	
Sol.	 (i) $\Delta ADC \sim \Delta ACB$ $\Longrightarrow \frac{AC}{AB} = \frac{DC}{BC}$	 1 1

	$\Rightarrow \frac{b}{c} = \frac{p}{a} \Rightarrow cp = ab$	½
	(ii) From part (i), $p = \frac{ab}{c}$ or $p^2 = \frac{a^2b^2}{c^2}$	½
	$\Rightarrow p^2 = \frac{a^2b^2}{a^2+b^2}$	1
	$\Rightarrow \frac{1}{p^2} = \frac{a^2+b^2}{a^2b^2} = \frac{1}{a^2} + \frac{1}{b^2}$	1
	OR	
32 (b).	In Δ ABC, DE $\|\|$ BC. Prove that : $\frac{AD}{DB} = \frac{AE}{EC}$  	
Sol.	Correct Given, To prove, figure and construction Correct Proof	**2** **3**
	OR	
33.	Draw the graphs of the following equations : $2x - y = 1$ and $3x + 2y = 12$ Determine the vertices of the triangle formed by the lines representing these equations and the x-axis. Shade the triangular region so formed and find its area.	

Sol.



Drawing correct graph — **1 + 1**

Coordinates of vertices of ΔABC are A (0.5, 0), B (2, 3), C (4, 0) — **1½**

Correct shading — **½**

Area of $\Delta ABC = \frac{1}{2} \times AC \times BD$

$= \frac{1}{2} \times 3.5 \times 3 = \frac{21}{4}$ or 5.25 sq units — **1**

34. Daily wages of 110 workers, obtained in a survey, are tabulated below :

Daily wages (in ₹)	*Number of workers*
100 – 120	10
120 – 140	15
140 – 160	20
160 – 180	22
180 – 200	18
200 – 220	12
220 – 240	13

Compute the mean daily wages and modal daily wages of these workers.

Sol.

Daily Wages	x	f	$u = \frac{x-170}{20}$	fu
$100-120$	110	10	-3	-30
$120-140$	130	15	-2	-30
$140-160$	150	20	-1	-20
$160-180$	170	22	0	0
$180-200$	190	18	1	18
$200-220$	210	12	2	24
$220-240$	230	13	3	39
Total		110		1

Correct Table — **2**

Mean $= 170 + 20 \times \frac{1}{110}$

$= ₹\ 170.18$ (approx.) — **1**

Modal class is $160-180$ — **½**

$\therefore$ Mode $= 160 + \frac{22-20}{2\times22-20-18} \times 20$ — **1**

$= ₹\ 166.67$ (approx.) — **½**

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

Sol.

Let the original speed of the train be x km/h

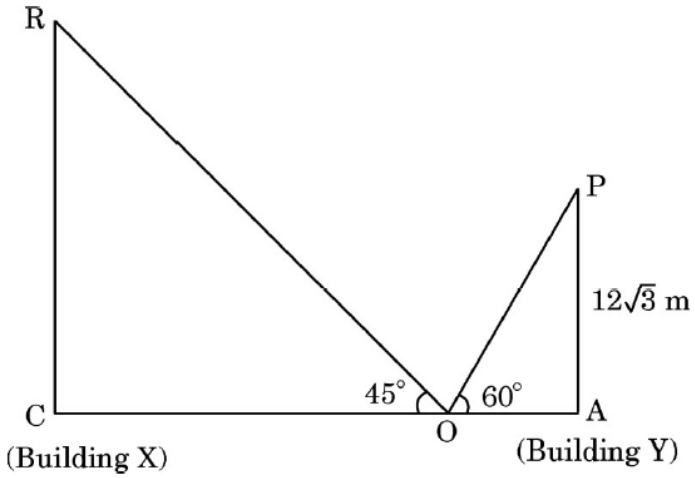
$\therefore \frac{480}{x-8} - \frac{480}{x} = 3$ — **2**

	$\Rightarrow x^2 - 8x - 1280 = 0$	**1**
	$\Rightarrow (x - 40)(x + 32) = 0$	**1**
	$x \neq -32$	
	$\therefore x = 40$	**1**
	So, the original speed of train is 40 km/h	
	OR	
35 (b).	Himakshi can row her boat at a speed of 5 km/h in still water. If she takes 1 hour more to row the boat 5·25 km upstream than to return downstream, find the speed of the boat in upstream.	
Sol.	Let the speed of the stream be x km/h	
	$\therefore \frac{5.25}{5-x} - \frac{5.25}{5+x} = 1$	**2**
	$\Rightarrow 2x^2 + 21x - 50 = 0$	**1**
	$\Rightarrow (2x + 25)(x - 2) = 0$	**1**
	$x \neq \frac{-25}{2}$	
	$\therefore x = 2$	**½**
	Speed of the boat upstream $= 5 - 2 = 3$ km/h	**½**

	SECTION – E **This section has 3 case study based questions carrying 4 marks each.**	
36.	Vaibhav installed a fence around a circular field, with the total cost amounting to ₹ 6,000 at a rate of ₹ 30 per m. He now plans to plough the field. Based on the information given above, answer the following questions : (i) What is the perimeter of the field ? *1* (ii) What is the radius of the field ? *1* (iii) (a) What is the area of the field ? *2* **OR** (iii) (b) Find the cost of ploughing the field at the rate of ₹ 0·50 per m^2. *2*	
Sol.	(i) Perimeter of the field $= \frac{6000}{30} = 200$ m (ii) Let r be the radius of the field $2\pi r = 200$ m $\Rightarrow r = \frac{200\times7}{2\times22} = \frac{350}{11} = 31.8$ m (approx.) (iii) (a) Area of the field $= \frac{22}{7} \times \frac{350}{11} \times \frac{350}{11}$ $= 3181.8$ m^2 (approx.) **OR** (iii) (b) Area of the field $= \frac{22}{7} \times \frac{350}{11} \times \frac{350}{11}$ $= 3181.8$ m^2 (approx.) Cost of ploughing the field $= 3181.8 \times 0.50$ $=$ ₹1590.90 (approx.)	**1** **1** **1** **1** **1** ½ ½

37.	A road roller, often called a roller compactor or just a roller, is an engineering vehicle used to compact soil, gravel, concrete, or asphalt in the construction of roads and foundations. Similar machines are also used in landfills or agriculture. Past records of a road roller manufacturing company show that the number of products produced each year forms an Arithmetic Progression (AP). The company produced 270 road rollers in the 4^{th} year and 510 in the 10^{th} year. Based on the information given above, answer the following questions : (i) What was the company's production in the 1^{st} year ? *1* (ii) What was the company's production in the 8^{th} year ? *1* (iii) (a) What was the company's total production of the first 6 years ? *2* **OR** (iii) (b) Find the ratio of 2^{nd} year's production to 8^{th} year's production. *2*	
Sol.	(i) $a + 3d = 270$ (I) $a + 9d = 510$ (II) Solving equations (I) and (II) $a = 150$ $\therefore$ production in first year $= 150$ (ii) $a + 3d = 270$ (I) $a + 9d = 510$ (II) Solving equations (I) and (II) $d = 40$ $\therefore a_8 = 150 + 280 = 430$ (iii) (a) $S_6 = \frac{6}{2}[2 \times 150 + 5 \times 40]$ $= 1500$ **OR** (iii) (b) $a_2 = 150 + 40 = 190$ $\therefore a_2 : a_8 = 190 : 430 = 19 : 43$	½ ½ ½ ½ **1** **1** **1** **1**

38. A ladder inclined at an angle of 60° to the horizontal is leaning against the vertical wall of the terrace (top) of the building Y. The foot of the ladder is kept fixed at point 'O'. After some time, keeping the same foot fixed, it is made to lean against the terrace (top) of the opposite building X, at an angle of 45° with the ground. Both buildings along with the foot of the ladder, fixed at 'O' are in a straight line.



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

(i) Find the length of the ladder. *1*

(ii) Find the distance of the building X from point 'O', i.e. OC. *1*

(iii) (a) Find the horizontal distance between the two buildings. *2*

OR

(iii) (b) Find the height of the building X. *2*

Sol.

(i) $\frac{12\sqrt{3}}{OP} = \sin 60° = \frac{\sqrt{3}}{2}$ ½

$\Rightarrow$ length of ladder $= OP = 24$ m ½

(ii) $OR = OP = 24$

$\therefore \frac{OC}{24} = \cos 45° = \frac{1}{\sqrt{2}}$ ½

$\Rightarrow OC = 12\sqrt{2}$ m ½

(iii) (a) In ΔPAO, $\frac{12\sqrt{3}}{OA} = \tan 60° = \sqrt{3}$ ½

$\Rightarrow OA = 12$ m ½

	Horizontal distance $= AO + OC = 12(\sqrt{2} + 1)$ m	**1**
	OR	
	(iii) In ΔOCR, $\frac{CR}{OC} = \tan 45° = 1$	**1**
	$\Rightarrow CR = OC = 12\sqrt{2}$ m	**1**