Series : EGFH2

SET~1

रोल नं.
Roll No.

प्रश्न-पत्र कोड
Q.P. Code **430/2/1**

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

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नोट

(I) कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ **23** हैं।

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

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

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

(V) इस प्रश्न-पत्र को पढ़ने के लिए 15 मिनट का समय दिया गया है । प्रश्न-पत्र का वितरण पूर्वाह्न में 10.15 बजे किया जाएगा । 10.15 बजे से 10.30 बजे तक परीक्षार्थी केवल प्रश्न-पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर-पुस्तिका पर कोई उत्तर नहीं लिखेंगे।

NOTE

(I) Please check that this question paper contains **23** printed pages.

(II) Q.P. Code given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.

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

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

(V) 15 minute time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the candidates will read the question paper only and will not write any answer on the answer-book during this period.

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गणित (बुनियादी)

MATHEMATICS (BASIC)

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

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

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सामान्य निर्देश :

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

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

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

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

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

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

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

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

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

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

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

खण्ड क

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

1. दो संख्याओं 3 और 5 के लिए, (HCF – LCM) का मान है :

(A) 2 (B) 4

(C) 14 (D) – 14

2. किसी प्राकृत संख्या n के लिए, संख्या 2^n कभी-भी समाप्त नहीं होती है अंक :

(A) 4 पर (B) 6 पर

(C) 2 पर (D) 0 पर

3. यदि समीकरण $x + y = c - 1$ का हल (0, 0) है, तो c का मान है :

(A) 0

(B) 1

(C) –1

(D) कोई वास्तविक संख्या

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General Instructions :

Read the following instructions very carefully and strictly follow them :

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

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

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

(iv) *In **Section B,** Questions no. **21** to **25** are Very Short Answer (VSA) type questions, carrying **2** marks each.*

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

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

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

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

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

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

SECTION A

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

1. The value of (HCF – LCM) for the two numbers 3 and 5 is :

(A) 2 (B) 4

(C) 14 (D) – 14

2. The number 2^n, where n is a natural number, cannot end with the digit :

(A) 4 (B) 6

(C) 2 (D) 0

3. If (0, 0) is the solution of the equation $x + y = c - 1$, then the value of c is :

(A) 0

(B) 1

(C) –1

(D) any real number

• • •

4. 'a' का वह मान, जिसके लिए $ax^2 + 3x + 1 = 0$ के वास्तविक और समान मूल हैं, है :

(A) $\frac{4}{9}$ (B) $\frac{9}{4}$

(C) $\frac{3}{2}$ (D) $\frac{2}{3}$

5. निम्नलिखित समीकरणों में से कौन-सा द्विघात समीकरण है ?

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

(C) $(x + 2)^3 = 2x(x^2 - 1)$ (D) $\sqrt{x} = x^2$

6. मूल-बिन्दु से बिन्दु (2, 3) की दूरी है :

(A) 2 (B) 3

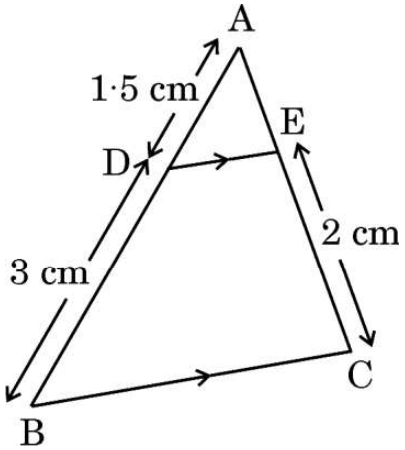
(C) 5 (D) $\sqrt{13}$

7. बिन्दुओं (1, 3) और (1, – 3) को मिलाने वाले रेखाखंड का मध्य-बिन्दु स्थित है :

(A) मूल-बिन्दु पर (B) दूसरे चतुर्थांश में

(C) x-अक्ष पर (D) y-अक्ष पर

8. दी गई आकृति में, यदि DE || BC, AD = 1·5 cm, DB = 3 cm और EC = 2 cm है, तो AC की लम्बाई है :



(A) 1·5 cm (B) 3 cm

(C) 3·5 cm (D) 4·5 cm

9. दो संकेंद्रित वृत्तों में, छोटे वृत्त की स्पर्श-रेखा बड़े वृत्त को काटती है :

(A) शून्य बिंदु पर (B) एक बिंदु पर

(C) दो बिंदुओं पर (D) तीन बिंदुओं पर

• • •

4. The value of 'a' for which $ax^2 + 3x + 1 = 0$ has real and equal roots is :

(A) $\frac{4}{9}$ (B) $\frac{9}{4}$

(C) $\frac{3}{2}$ (D) $\frac{2}{3}$

5. Which of the following equations is a quadratic equation ?

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

(C) $(x + 2)^3 = 2x(x^2 - 1)$ (D) $\sqrt{x} = x^2$

6. The distance of the point (2, 3) from the origin is :

(A) 2 (B) 3

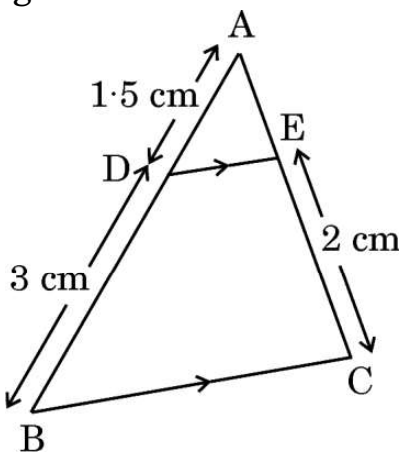
(C) 5 (D) $\sqrt{13}$

7. The mid-point of the line segment joining points (1, 3) and (1, – 3) lies :

(A) at the origin (B) in the second quadrant

(C) on x-axis (D) on y-axis

8. In the given figure, if DE || BC, AD = 1·5 cm, DB = 3 cm and EC = 2 cm, the length of AC is :



(A) 1·5 cm (B) 3 cm

(C) 3·5 cm (D) 4·5 cm

9. In two concentric circles, a tangent to the smaller circle will intersect the larger circle at :

(A) zero point (B) one point

(C) two points (D) three points

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10. $\frac{2 \tan 60^\circ}{1 - \tan^2 60^\circ}$ का मान है :

(A) -3 (B) $\sqrt{3}$

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

11. $(\sin^2 A + \cos^2 A) + (\sec^2 A - \tan^2 A) - (\cot^2 A - \text{cosec}^2 A)$ का मान है :

(A) 1 (B) –1

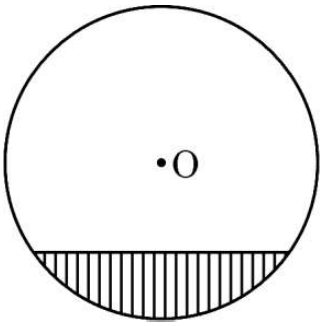
(C) 3 (D) – 2

12. जब सूर्य का उन्नयन 30° से 60° में बदलता है तो एक मीनार की छाया की लम्बाई :

(A) छोटी हो जाएगी (B) बड़ी हो जाएगी

(C) वही रहेगी (D) दुगुनी हो जाएगी

13. दी गई आकृति में, छायांकित भाग निरूपित करता है :



(A) लघु त्रिज्यखंड (B) दीर्घ त्रिज्यखंड

(C) लघु वृत्तखंड (D) दीर्घ वृत्तखंड

14. त्रिज्या r वाले एक वृत्त के चतुर्थांश का परिमाप है :

(A) $\frac{1}{4}\pi r^2$ (B) $\frac{1}{4}\pi r^2 + 2r$

(C) $\frac{\pi r}{2}$ (D) $\frac{\pi r}{2} + 2r$

15. एक शंकु और एक बेलन की आधार त्रिज्याएँ और आयतन समान हैं।

(शंकु की ऊँचाई : बेलन की ऊँचाई) है :

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

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

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10. The value of $\frac{2\tan 60^\circ}{1-\tan^2 60^\circ}$ is :

(A) -3 (B) $\sqrt{3}$

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

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

(A) 1 (B) –1

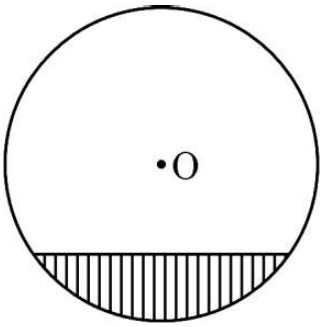
(C) 3 (D) – 2

12. The length of the shadow of a tower when the sun's altitude changes from 30° to 60° will :

(A) become shorter (B) become longer

(C) remain same (D) be doubled

13. In the given figure, the shaded region represents :



(A) minor sector (B) major sector

(C) minor segment (D) major segment

14. The perimeter of a quadrant of a circle of radius r is :

(A) $\frac{1}{4}\pi r^2$ (B) $\frac{1}{4}\pi r^2 + 2r$

(C) $\frac{\pi r}{2}$ (D) $\frac{\pi r}{2} + 2r$

15. A cone and a cylinder have the same base radius and volume.

The (height of cone : height of cylinder) is :

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

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

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16. बहुलक के सूत्र

$$\text{बहुलक} = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h$$

में f_1 दर्शाता है :

(A) बहुलक वर्ग की बारंबारता

(B) बहुलक वर्ग से ठीक पहले वाले वर्ग की बारंबारता

(C) बहुलक वर्ग के ठीक बाद में आने वाले वर्ग की बारंबारता

(D) बहुलक वर्ग की संचयी बारंबारता

17. किसी बंटन के लिए, यदि माध्य = माध्यक = a है, तो इस बंटन का बहुलक है :

(A) 3a (B) 2a

(C) a (D) 0

18. तीन पासों को एक साथ फेंकने पर संभव परिणामों की कुल संख्या है :

(A) 6 (B) 18

(C) 36 (D) 216

*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) :* 36 को विभाजित करने वाली अभाज्य संख्याएँ 6 को भी विभाजित करती हैं ।

तर्क (R) : कोई संख्या यदि p^2 को विभाजित करती है, तो वह p को भी विभाजित करती है ।

20. *अभिकथन (A) :* सभी सर्वांगसम त्रिभुज, समरूप त्रिभुज होते हैं ।

तर्क (R) : सर्वांगसम त्रिभुजों में, संगत भुजाओं का अनुपात 1 : 1 होता है ।

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16. In the formula of mode given by mode = $l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h$,

f_1 denotes the :

(A) frequency of the modal class

(B) frequency of class preceding modal class

(C) frequency of class succeeding modal class

(D) cumulative frequency of modal class

17. For a distribution, if mean = median = a, then its mode is :

(A) 3a (B) 2a

(C) a (D) 0

18. The total number of outcomes in the experiment of simultaneous throw of three dice is :

(A) 6 (B) 18

(C) 36 (D) 216

*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 Assertion (A).

(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is ***not*** the correct explanation of Assertion (A).

(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false, but Reason (R) is true.

19. *Assertion (A) :* The prime numbers which divide 36 also divide 6.

Reason (R) : Any number which divides p^2 also divides p.

20. *Assertion (A) :* All congruent triangles are similar.

Reason (R) : In congruent triangles, the ratio of corresponding sides is 1 : 1.

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खण्ड ख

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

21. (क) c का मान ज्ञात कीजिए जिसके लिए निम्नलिखित रैखिक समीकरण युग्म के अपरिमित रूप से अनेक हल हैं :

$$cx + 3y = c - 3$$
$$12x + cy = c$$

अथवा

(ख) x और y के लिए हल कीजिए :

$$3x + 2y = 65$$
$$2x + 3y = 60$$

22. त्रिभुज ABC की भुजा BC पर एक बिंदु D इस प्रकार स्थित है कि $\angle ADC = \angle BAC$. सिद्ध कीजिए कि $(CA)^2 = CB \cdot CD$.

23. सिद्ध कीजिए कि वृत्त के किसी बिंदु पर खींची गई स्पर्श-रेखा, स्पर्श बिंदु से गुज़रने वाली त्रिज्या पर लंब होती है।

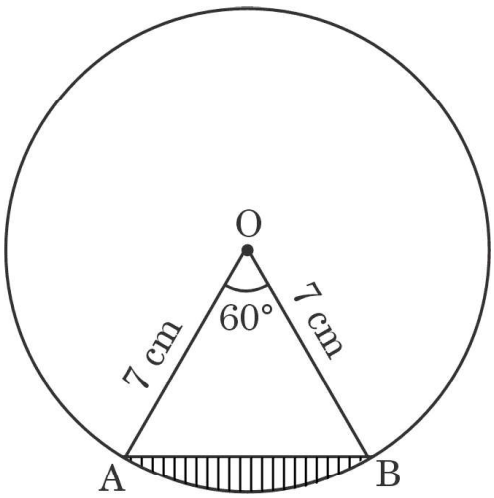
24. मान ज्ञात कीजिए :

$$\frac{\cos 45^\circ}{\sec 30^\circ + \operatorname{cosec} 30^\circ}$$

25. (क) एक बड़े वृत्त के त्रिज्यखण्ड, जिसका केंद्रीय कोण 120° है, का क्षेत्रफल एक छोटे वृत्त के क्षेत्रफल के बराबर है। छोटे वृत्त और बड़े वृत्त की त्रिज्याएँ क्रमश: 'r' और 'R' हैं। r : R ज्ञात कीजिए।

अथवा

(ख) दी गई आकृति में, त्रिज्या 7 cm के वृत्त का केन्द्र O है। AB, वृत्त की एक जीवा है। छायांकित भाग का परिमाप ज्ञात कीजिए।



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SECTION B

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

21. (a) Find the value of c for which the following pair of linear equations has infinitely many solutions :

$cx + 3y = c - 3$

$12x + cy = c$

OR

(b) Solve for x and y :

$3x + 2y = 65$

$2x + 3y = 60$

22. D is a point on side BC of Δ ABC such that $\angle$ ADC = $\angle$ BAC. Prove that $(CA)^2 = CB \cdot CD$.

23. Prove that the tangent drawn at any point of the circle is perpendicular to the radius through the point of contact.

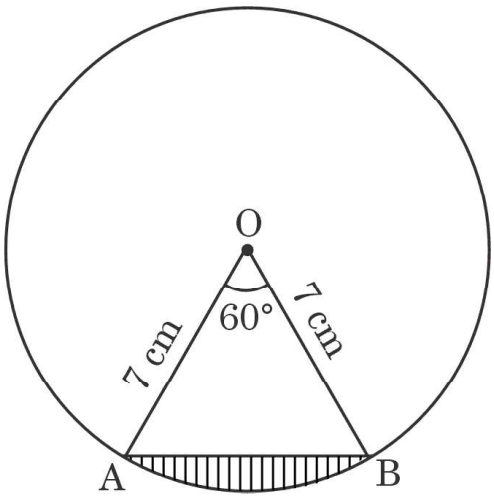
24. Evaluate :

$$\frac{\cos 45^\circ}{\sec 30^\circ + \operatorname{cosec} 30^\circ}$$

25. (a) The area of a smaller circle is equal to the area of a sector of a larger circle with central angle 120°. The radii of the smaller and larger circles are 'r' and 'R' respectively. Find r : R.

OR

(b) In the given figure, O is the centre of a circle of radius 7 cm. AB is a chord of the circle. Find the perimeter of the shaded region.



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खण्ड ग

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

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

अथवा

(ख) अंकगणित का आधारभूत प्रमेय लिखिए और इसके प्रयोग से, 36 और 54 का ल.स. (LCM) ज्ञात कीजिए।

27. बहुपद $p(x) = 3x^2 - 2x - 1$ के शून्यक ज्ञात कीजिए और $p(x)$ के शून्यकों तथा $p(x)$ के गुणांकों के बीच संबंध की सत्यता की जाँच कीजिए।

28. (क) निम्नलिखित रैखिक समीकरण युग्म को ग्राफ़ द्वारा हल कीजिए :

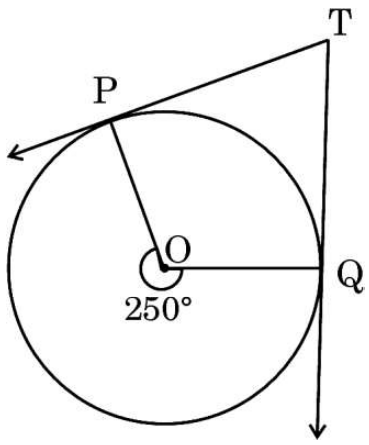
$2x - y = 2$ और $4x - y = 4$

इन समीकरणों से निरूपित रेखाएँ, y-अक्ष को जिन बिंदुओं पर प्रतिच्छेदित करती हैं, उन बिंदुओं के निर्देशांक भी लिखिए।

अथवा

(ख) क्रिकेट कोचिंग प्रदान करने वाली एक अकादमी ने 10 बल्ले और 5 गेंदें, ₹ 32,500 में खरीदे। बाद में, अकादमी ने 2 बल्ले और 8 गेंदें, ₹ 10,000 में खरीदे। यदि बल्ले और गेंद की कीमत में कोई बदलाव नहीं हुआ हो, तो 1 बल्ले और 1 गेंद की कीमत ज्ञात कीजिए।

29. दी गई आकृति में, TP और TQ, वृत्त के बिन्दुओं P और Q पर क्रमश: स्पर्श-रेखाएँ हैं। यदि प्रतिवर्ती $\angle POQ = 250°$ है, तो चतुर्भुज POQT के प्रत्येक कोण की माप ज्ञात कीजिए।



30. निम्नलिखित त्रिकोणमितीय सर्वसमिका को सिद्ध कीजिए :

$$\frac{\cos\theta}{1+\sin\theta} + \frac{1+\sin\theta}{\cos\theta} = 2\sec\theta$$

• • •

SECTION C

*This section has **6** Short Answer (SA) type questions carrying **3** marks each.* $6\times3=18$

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

OR

(b) State the "Fundamental Theorem of Arithmetic" and use it to find LCM of 36 and 54.

27. Find the zeroes of the polynomial $p(x) = 3x^2 - 2x - 1$ and verify the relationship between the zeroes of p(x) and the coefficients of p(x).

28. (a) Solve graphically the following pair of linear equations :

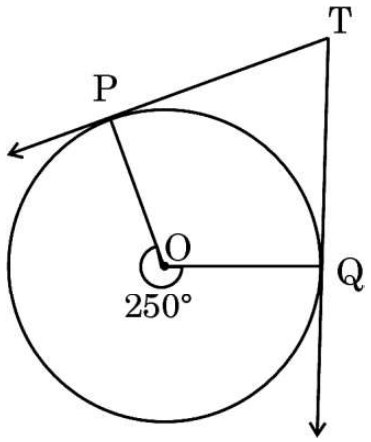
$2x - y = 2$ and $4x - y = 4$

Also, write the coordinates of the points where the lines represented by these equations cut the y-axis.

OR

(b) An academy offering cricket coaching bought 10 bats and 5 balls for ₹ 32,500. Later, the academy bought 2 bats and 8 balls for ₹ 10,000. If there is no change in the cost of the bat and of the ball, find the cost of 1 bat and 1 ball.

29. In the given figure, TP and TQ are tangents at points P and Q of the circle respectively. If reflex $\angle$ POQ = 250°, find the measure of each angle of quadrilateral POQT.

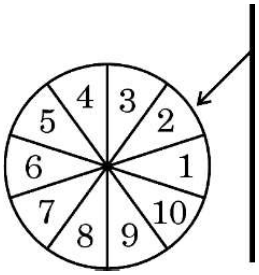


30. Prove the following trigonometric identity :

$$\frac{\cos\theta}{1+\sin\theta} + \frac{1+\sin\theta}{\cos\theta} = 2\sec\theta$$

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31. संयोग (chance) के एक खेल में, एक पहिये को घुमाया जाता है, जो विश्राम में आने के बाद संख्याओं 1, 2, 3, ..., 10 (दी गई आकृति में दिखाए अनुसार) में से किसी एक संख्या को इंगित करता है।



यदि सभी परिणाम समप्रायिक हैं, तो इसकी क्या प्रायिकता है कि यह पहिया :

(i) 2 से बड़ी अभाज्य संख्या को इंगित करेगा ?

(ii) 9 से छोटी विषम संख्या को इंगित करेगा ?

(iii) 4 के गुणज को इंगित करेगा ?

खण्ड घ

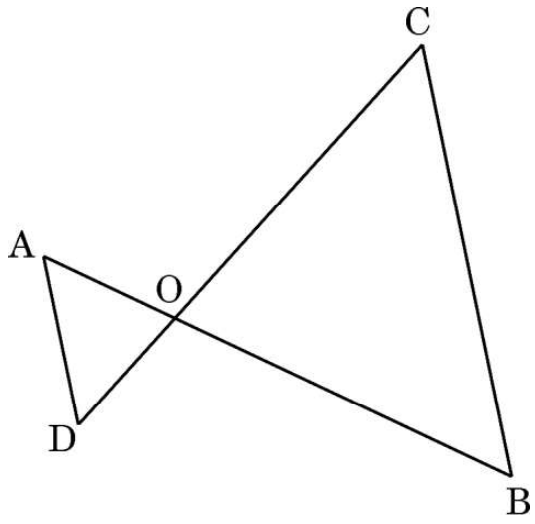
*इस खण्ड में **4** दीर्घ-उत्तरीय (LA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक के **5** अंक हैं।* $4 \times 5 = 20$

32. (क) दो वर्गों के क्षेत्रफलों का योगफल 2650 cm^2 है । यदि उनके परिमापों का योगफल 280 cm है, तो दिए गए दो वर्गों की भुजाएँ ज्ञात कीजिए।

अथवा

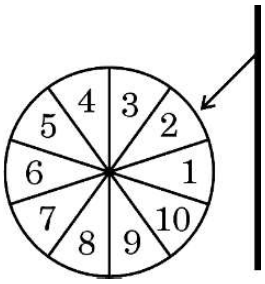
(ख) समीकरण $\frac{1}{x} - \frac{1}{x-2} = 3$, $(x \neq 0, 2)$ को एक द्विघात समीकरण के मानक रूप में व्यक्त कीजिए। अत:, इस प्रकार प्राप्त हुए द्विघात समीकरण के मूल ज्ञात कीजिए।

33. दो त्रिभुजों की समरूपता की कसौटी SAS को लिखिए । दी गई आकृति में, दिया गया है कि OA . OC = OB . OD. कसौटी SAS का प्रयोग करके, सिद्ध कीजिए कि AD || CB.



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31. A game of chance consists of spinning a wheel which comes to rest at one of the numbers from 1 to 10 (as shown in the given figure) with equal probabilities.



What is the probability that the wheel stops at

(i) a prime number greater than 2 ?

(ii) an odd number less than 9 ?

(iii) a multiple of 4 ?

SECTION D

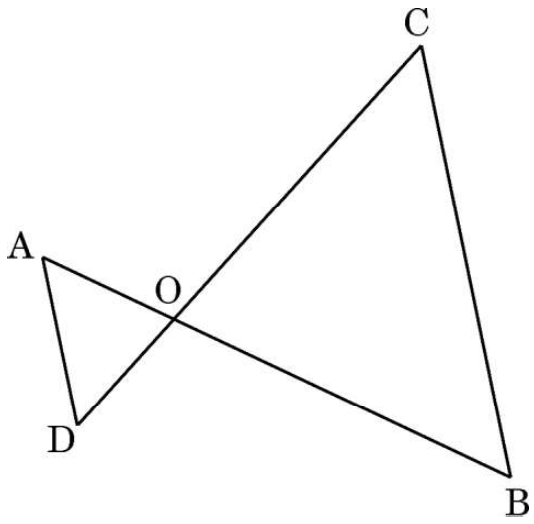
*This section has **4** Long Answer (LA) type questions carrying **5** marks each.* $4\times5=20$

32. (a) The sum of areas of two squares is 2650 cm^2. If the sum of their perimeters is 280 cm, find the sides of the two given squares.

OR

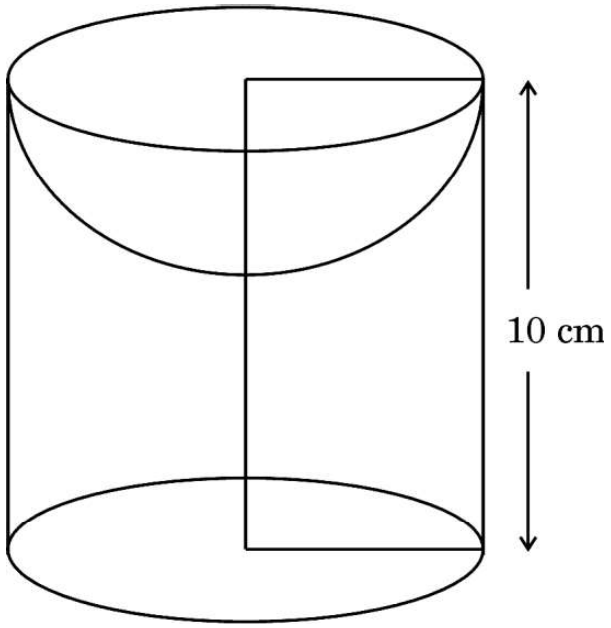
(b) Express the equation $\frac{1}{x}-\frac{1}{x-2}=3$, $(x \neq 0, 2)$ as a quadratic equation in standard form. Hence, find the roots of the quadratic equation so obtained.

33. State the SAS criteria of similarity of two triangles. In the given figure, it is given that OA . OC = OB . OD. Use the SAS criteria to prove that AD || CB.



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34. लकड़ी के एक ठोस बेलन के एक सिरे से इसी व्यास वाला एक अर्धगोला काट कर निकाल लिया जाता है, जैसा आकृति में दिखाया गया है। यदि बेलन की ऊँचाई 10 cm और व्यास 14 cm है, तो शेष बचे हुए लकड़ी के ठोस का कुल पृष्ठीय क्षेत्रफल ज्ञात कीजिए। ($\pi = \frac{22}{7}$ प्रयोग कीजिए)



35. (क) एक पौधे की 40 पत्तियों की लम्बाइयाँ निकटतम मिलीमीटर में मापी जाती हैं तथा प्राप्त आँकड़ों को निम्नलिखित सारणी के रूप में निरूपित किया जाता है :

लम्बाई (mm में)	*पत्तियों की संख्या*
100 – 120	8
120 – 140	9
140 – 160	12
160 – 180	5
180 – 200	6

पत्तियों की माध्यक लम्बाई (mm में) ज्ञात कीजिए।

अथवा

(ख) एक कक्षा अध्यापक ने अपनी कक्षा के 30 विद्यार्थियों की अनुपस्थिति निम्नलिखित रूप में रिकॉर्ड (Record) की।

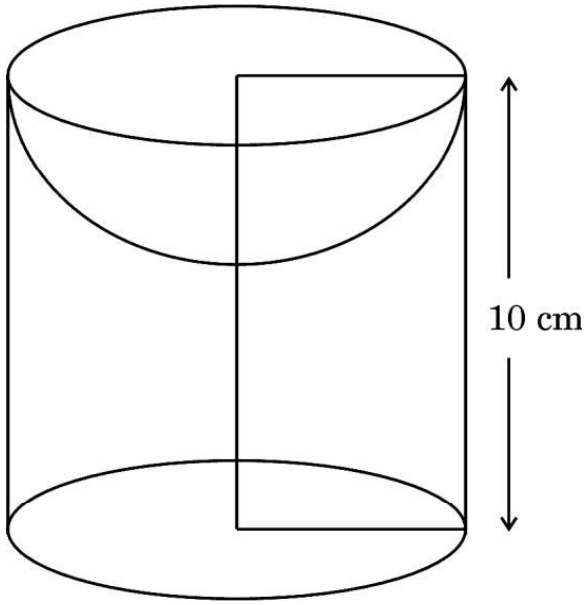
दिनों की संख्या	0 – 4	4 – 8	8 – 12	12 – 16	16 – 20	20 – 24
अनुपस्थित विद्यार्थियों की संख्या	1	8	x	6	5	y

यदि एक विद्यार्थी की अनुपस्थिति की माध्य संख्या 12 है, तो x और y के मान ज्ञात कीजिए।

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34. A wooden article was made by scooping out a hemisphere (of same diameter) from one end of a solid cylinder as shown in the given figure. If the height of the cylinder is 10 cm and the diameter of the cylinder is 14 cm, find the total surface area of the remaining wooden article.

(Use $\pi = \frac{22}{7}$)



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

Length in (mm)	*Number of leaves*
100 – 120	8
120 – 140	9
140 – 160	12
160 – 180	5
180 – 200	6

Find the median length (in mm) of the leaves.

OR

(b) A class teacher has the following absentees record of 30 students of a class.

Number of days	0 – 4	4 – 8	8 – 12	12 – 16	16 – 20	20 – 24
Number of Absent students	1	8	x	6	5	y

If the mean number of days a student was absent is 12, find the values of x and y.

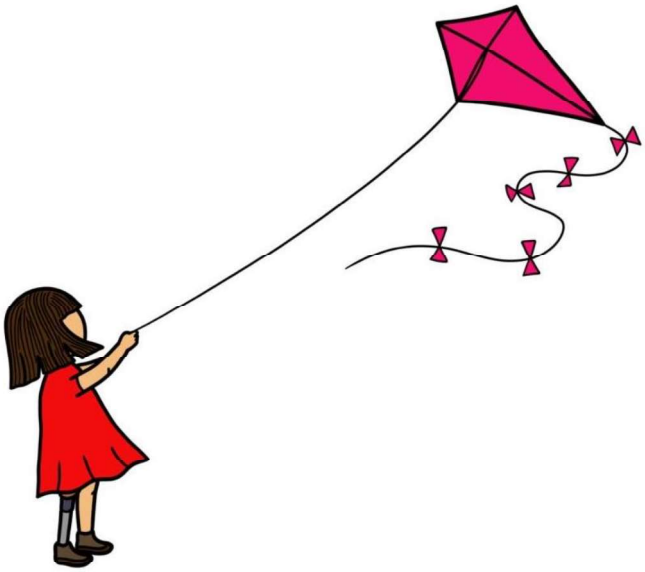
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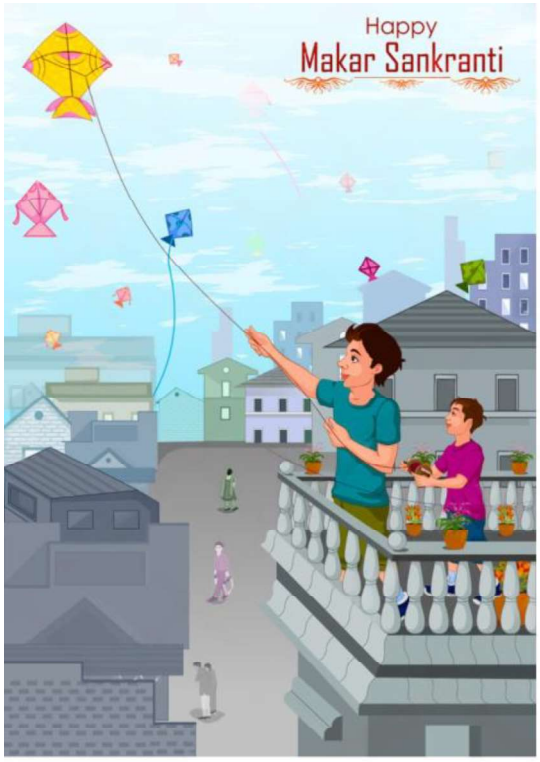
खण्ड ङ

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

प्रकरण अध्ययन – 1

36. पतंग उत्सव भारत में एक लोकप्रिय त्योहार है जो मकर संक्रांति के दौरान मनाया जाता है। यह त्योहार लोगों द्वारा अपनी छतों से पतंग उड़ाकर मनाया जाता है। रीना और रवि भी त्योहार का आनंद लेने के लिए पतंग उड़ा रहे हैं। रीना की पतंग की ऊँचाई धरती से 60 m ऊपर है। पतंग से जुड़ी डोर अस्थायी रूप से धरती पर एक बिंदु से बँधी होती है, और धरती के साथ डोर का झुकाव 30° है। रवि 10 m ऊँची इमारत से पतंग उड़ा रहा है। उसकी पतंग भी धरती से 60 m ऊपर उड़ रही है और रवि द्वारा इस्तेमाल की गई डोर की लम्बाई रीना की डोर के समान है। θ, छत के एक बिन्दु से रवि की पतंग का उन्नयन कोण है।





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

(i) रीना द्वारा इस्तेमाल करने वाली डोर की लम्बाई ज्ञात कीजिए। *1*

(ii) $\sin\theta$ का मान ज्ञात कीजिए। *1*

(iii) (क) यदि डोर की लम्बाई में किसी परिवर्तन के बिना, θ को 60° में बदला जाता है, तो धरती से रवि की पतंग की ऊँचाई क्या होगी ? ($\sqrt{3} = 1{\cdot}7$ प्रयोग कीजिए) *2*

अथवा

(ख) यदि डोरी का झुकाव धरती के साथ 30° है, तो रवि की पतंग की धरती से ऊँचाई कितनी होगी, यह मानते हुए कि डोरी की लम्बाई नहीं बदलती है ? *2*

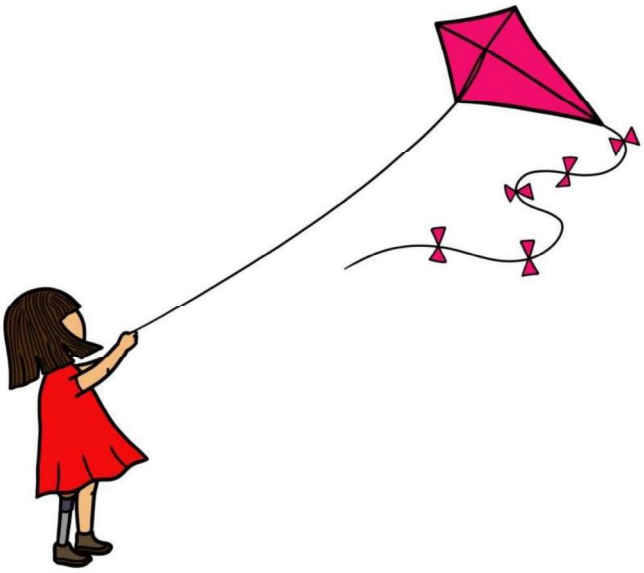
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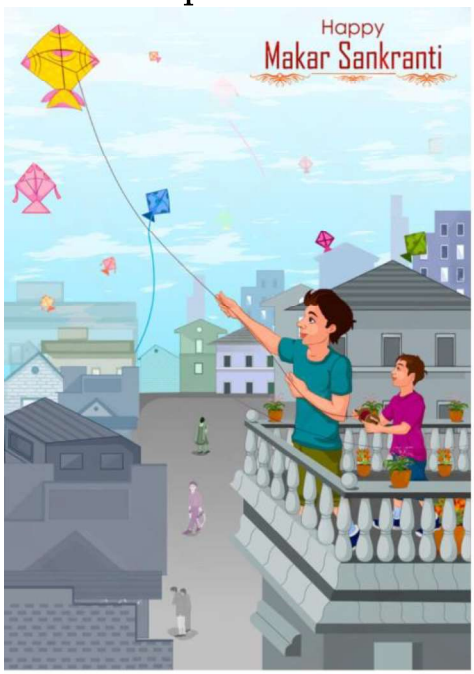
SECTION E

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

Case Study – 1

36. Kite festival is a popular festival in India which takes place during Makar Sankranti. The festival is celebrated by people flying kites from their rooftops. Reena and Ravi are also flying kites to enjoy the festival. The height of Reena's kite is 60 m above the ground. The string attached to the kite is temporarily tied to a point on the ground, and the inclination of the string with the ground is 30°. Ravi is flying a kite from a 10 m high building. His kite is also flying 60 m above the ground and the length of the string used by Ravi is same as that of Reena's. θ is the angle of elevation of Ravi's kite from a point on the rooftop.





Based on the above information, answer the following questions :

(i) Find the length of string used by Reena. *1*

(ii) Find the value of sin θ. *1*

(iii) (a) If θ changes to 60°, without changing the length of the string, what will be the height of Ravi's kite above the ground ? (Use $\sqrt{3}$ =1·7) *2*

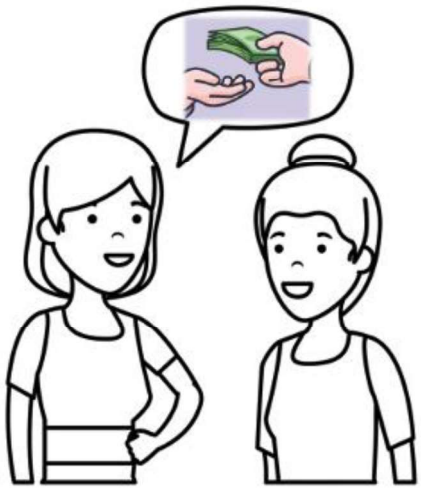
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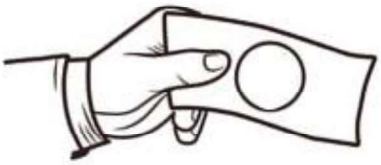
(b) What would have been the height of Ravi's kite above the ground, if the string had an inclination of 30° with the ground, assuming that the length of the string does not change ? *2*

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प्रकरण अध्ययन – 2

37. एक महिला ने अपनी दोस्त से ₹ 10,00,000 उधार लिए और अगले महीने से मासिक किस्तों में उधार लिया हुआ पैसा वापस करने का वादा किया। एक महीने पश्चात, उसने ₹ 10,000 वापस किए, अगले महीने उसने ₹ 15,000 वापस किए, तीसरे महीने में उसने ₹ 20,000 वापस किए और इसी तरह प्रत्येक महीने की किस्त में समान रूप से वृद्धि करते हुए वापस करती रही।







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

(i) दसवें महीने में भुगतान की गई किस्त की राशि ज्ञात कीजिए। *1*

(ii) कौन-सी किस्त में उसने ₹ 40,000 का भुगतान किया था ? *1*

(iii) (क) कितनी किस्तों में उसने कुल ₹ 11,50,000 का भुगतान किया है ? *2*

अथवा

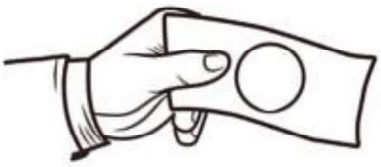
(ख) कितनी किस्तों तक, वह कुल ₹ 3,25,000 की राशि का भुगतान कर चुकी थी ? *2*

• • •

Case Study – 2

37. A woman borrowed ₹ 10,00,000 from her friend and promised to return the borrowed money in monthly instalments beginning from the next month. After one month, she returned ₹ 10,000, the next month she returned ₹ 15,000, the third month she returned ₹ 20,000 and so on, thereby increasing the monthly instalment uniformly.







Based on the above information, answer the following questions :

(i) Find the amount of instalment paid in the tenth month. *1*

(ii) In which instalment did she pay ₹ 40,000 ? *1*

(iii) (a) If she returned ₹ 11,50,000 in all, how many instalments did she pay ? *2*

OR

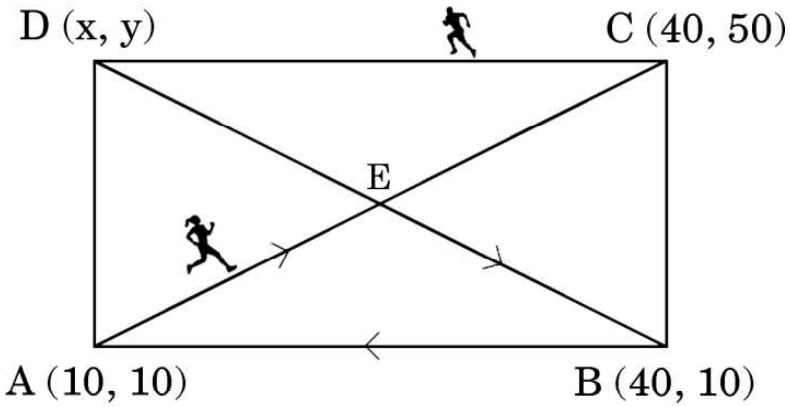
(b) By which instalment has she returned a total amount of ₹ 3,25,000 ? *2*

• • •

प्रकरण अध्ययन – 3

38. एक मैदान आयताकार है। इस आयताकार मैदान ABCD के चारों कोनों के निर्देशांक A(10, 10), B(40, 10), C(40, 50) और D(x, y) हैं। दो दोस्त अनिल और अनिता ने एक दौड़ लगाने का फैसला किया। अनिता ने बिंदु A से दौड़ना शुरू किया और वह बिन्दु E की ओर, विकर्ण AC की दिशा में, चल पड़ी, जहाँ E, ABCD के दोनों विकर्णों का प्रतिच्छेद बिन्दु है। बिन्दु E पर पहुँचकर, वह बिन्दु B की ओर, विकर्ण DB की दिशा में जाती है और बिन्दु B पर पहुँचने पर वह BA की दिशा में जाकर बिन्दु A पर वापस आती है। अनिल बिंदु C से आरम्भ करके, D से होते हुए बिन्दु A तक दौड़ लगाता है।





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

(i) बिंदु E के निर्देशांक ज्ञात कीजिए। *1*

(ii) बिंदुओं B और C के बीच की दूरी ज्ञात कीजिए। *1*

(iii) (क) बिंदु D के निर्देशांक और दूरी BD ज्ञात कीजिए। *2*

अथवा

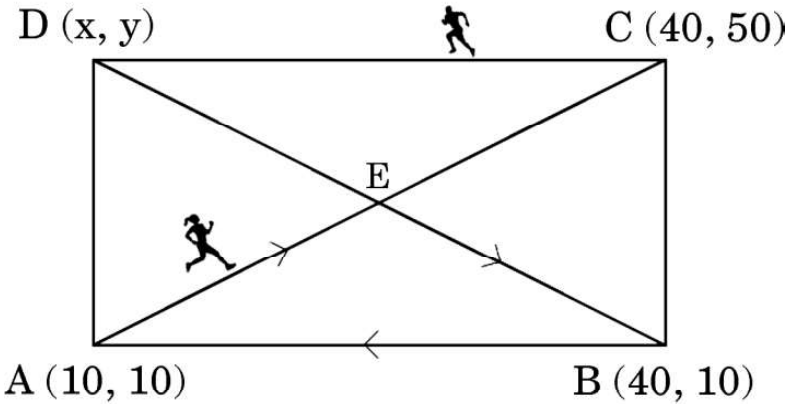
(ख) अनिता द्वारा तय की गई कुल दूरी ज्ञात कीजिए। *2*

• • •

Case Study – 3

38. A field is in the form of a rectangle. The coordinates of the rectangular field ABCD are A(10, 10), B(40, 10), C(40, 50) and D(x, y). Anil and Anita, two friends decided to have a race. Anita started from point A and moved to point E along the diagonal AC, where E is the point of intersection of both the diagonals of ABCD. From point E, she moved to point B along the other diagonal DB and then moved back to point A along BA. While Anil started from point C and ran to point A via D along the boundary of the field.





Based on the above information, answer the following questions :

(i) Find the coordinates of point E. *1*

(ii) Find the distance between the points B and C. *1*

(iii) (a) Find the coordinates of point D and the distance BD. *2*

OR

(b) Find the total distance travelled by Anita. *2*

Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2026
SUBJECT NAME MATHEMATICS (BASIC) (Q.P. CODE/Set No. 241/430/2/1)

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 totaled up and written in the left-hand margin and encircled. This may be followed strictly.
8	If a question does not have any parts, marks must be awarded in the left-hand margin and encircled. This may also be followed strictly.
9	If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note **"Extra Question"**.
10	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
11	A full scale of marks _(example 0 to 80/70/60/50/40/30 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.
12	Every examiner has to necessarily do evaluation work for full working hours i.e., 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other

	subjects (Details are given in Spot Guidelines).This is in view of the reduced syllabus and number of questions in question paper.
13	Ensure that you do not make the following common types of errors committed by the Examiner in the past:- ● Leaving answer or part thereof unassessed in an answer book. ● Giving more marks for an answer than assigned to it. ● Wrong totaling of marks awarded on an answer. ● Wrong transfer of marks from the inside pages of the answer book to the title page. ● Wrong question wise totaling on the title page. ● Wrong totaling 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 totaled 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.

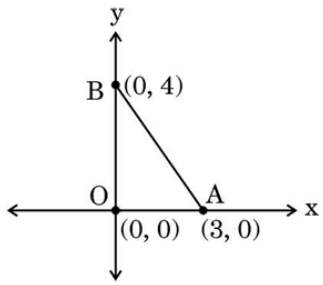
Set 430/2/1

MARKING SCHEME

MATHEMATICS (Basic)

Q. No.	EXPECTED ANSWERS/VALUE POINTS	Marks
	SECTION A	
	*This section has **20** Multiple Choice Questions (MCQs) carrying **1** mark each. 20×1=20*	
1.	The HCF of the smallest prime number and the smallest 3-digit number is $2^m 5^n$. The respective values of m and n are : (A) 0, 0 (B) 1, 0 (C) 0, 1 (D) 1, 1	
Ans. (B) 1, 0		1
2.	Which of the following statements is true for HCF and LCM of two distinct natural numbers a and b ? (i) HCF is always greater than LCM. (ii) HCF is a factor of LCM. (iii) LCM is a factor of HCF. (A) (i) only (B) (i) and (iii) (C) (i) and (ii) (D) (ii) only	
Ans. (D) (ii) only		1
3.	Which of the following system of equations has a unique solution ? (A) $x = 0, x = 1$ (B) $x + y = 0, 2x + 2y = 0$ (C) $x + y = 2, x - y = 3$ (D) $x + y = 5, x + y = 10$	
Ans. (C) $x + y = 2, x - y = 3$		1
4.	If the equation $qx^2 + px - r = 0$ $(q \neq 0)$ has real and equal roots, then which of the following is true ? (A) $p^2 = qr$ (B) $p^2 = -4qr$ (C) $q^2 = 4pr$ (D) $q^2 = -4pr$	
Ans. (B) $p^2 = -4qr$		1
5.	If $x = -1$ is a root of the equation $ax^2 - bx + 3 = 0$, then : (A) $-a + b - 3 = 0$ (B) $a - b - 3 = 0$ (C) $-a - b + 3 = 0$ (D) $a + b + 3 = 0$	
Ans. (D) $a + b + 3 = 0$		1

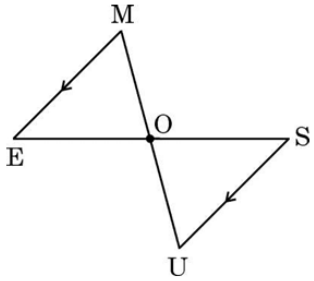
6. In the given figure, the length of hypotenuse of the right Δ AOB is :



(A) 3 units (B) 4 units
(C) 5 units (D) 25 units

Ans. (C) 5 units | 1

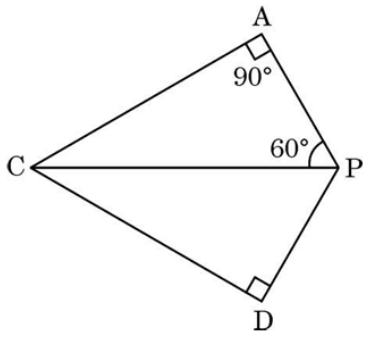
7. In the given figure, if ME || SU, then which of the following statements is correct ?



(A) Δ MOE ~ Δ SOU (B) Δ MOE ~ Δ SUO
(C) Δ OEM ~ Δ USO (D) Δ OEM ~ Δ OSU

Ans. (D) ΔOEM ~ ΔOSU | 1

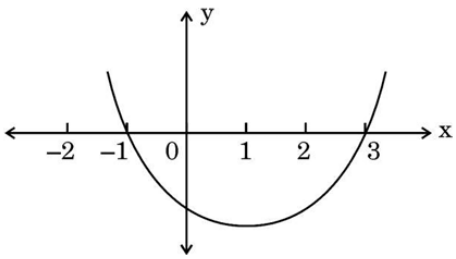
8. In the given figure, if Δ ACP ~ Δ DCP, then :



(A) ∠ DCP = 60° (B) ∠ DCP = 30°
(C) ∠ DCP = 90° (D) ∠ DPC = 30°

Ans. (B) ∠DCP = 30° | 1

9. The graph of a quadratic polynomial is shown in the figure. The sum and product of zeroes of the polynomial respectively are :



(A) 2 and 3 (B) 2 and – 3
(C) – 2 and 3 (D) – 2 and – 3

Ans. (B) 2 and −3 | 1

10. The sum of the age (in years) of a father and three times the age of his daughter is 59. If the age of the father is x years and that of his daughter is y years, the equation representing the given information is :

(A) $3x + y = 59$ (B) $x + y = 59$

(C) $x + 3y = 59$ (D) $x + y = 56$

Ans. (C) $x + 3y = 59$ | 1

11. The 10^{th} term of the A.P. $\sqrt{2}$, $\sqrt{8}$, $\sqrt{18}$, ... is :

(A) $\sqrt{162}$ (B) $\sqrt{200}$

(C) $\sqrt{54}$ (D) $\sqrt{94}$

Ans. (B) $\sqrt{200}$ | 1

12. The value of $(\cos 90° - \sin 90°)$ is :

(A) -1

(B) greater than 0

(C) equal to the value of tan 45°

(D) 0

Ans. (A) -1 | 1

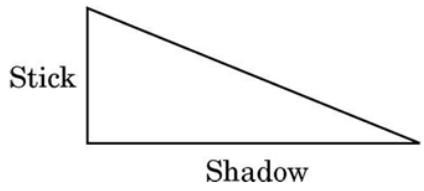
13. One of the possible values of A, for which $\cos 2A = \cos A$, is :

(A) 0° (B) 30°

(C) 45° (D) 90°

Ans. (A) 0° | 1

14. At an instant, the length of shadow of a stick is found to be $\sqrt{3}$ times the length of the stick as shown in the figure below. The Sun's altitude at that instant is :

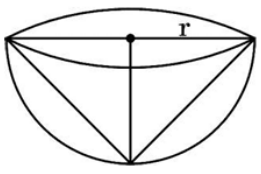


(A) 30° (B) 45°

(C) 60° (D) 90°

Ans. (A) 30° | 1

15. The largest possible right circular cone is carved out of a solid hemisphere of radius 'r' as shown in the figure below. The slant height of the cone is :



(A) r (B) 2r

(C) $\sqrt{2}$ r (D) $\sqrt{3}$ r

Ans. (C) $\sqrt{2}$r | 1

16. If for a frequency distribution, the mean is $\frac{3}{4}$ times the median, then mode is :

(A) equal to median (B) $\frac{3}{2}$ times the median

(C) equal to mean (D) 3 times the mean

Ans. (B) $\frac{3}{2}$ times the median | 1

17. Consider the given data :

Class	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100	100 – 120
Frequency	15	30	50	63	35	32

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

(A) 0 (B) 20

(C) 40 (D) 10

Ans. (B) 20 | 1

18. An unbiased die is thrown once. The probability of getting an even prime number greater than 2 is :

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

(C) $\frac{1}{6}$ (D) 0

Ans. (D) 0 | 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 Assertion (A).

(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is ***not*** the correct explanation of Assertion (A).

(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false, but Reason (R) is true.

19. *Assertion (A) :* The probability of a certain event E is 1.

Reason (R) : The sum of probabilities of all elementary events of an experiment is 1.

Ans. (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
Note: "**The probability of a certain event E is 1**" because certain event consists of all the elementary events and "**The sum of probabilities of all elementary events of an experiment is 1".** | 1

20. *Assertion (A) :* $(\sqrt{2} + \sqrt{3})$ is an irrational number.

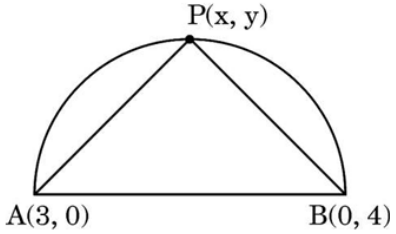
Reason (R) : The sum of two irrational numbers is always an irrational number.

Ans. (C) Assertion (A) is true, Reason (R) is false.	1

SECTION B

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

21. (a) The point P(x, y) lies on a semi-circular arc having diameter AB as shown in the given figure. The coordinates of points A and B are (3, 0) and (0, 4) respectively. Find the relation between x and y, if $PA^2 + PB^2 = AB^2$.



OR

(b) Find the coordinates of the points of trisection P and Q of the line-segment AB as shown in the given figure.

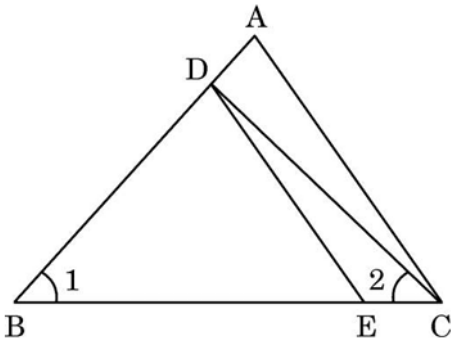


Solution: (a) $PA^2 + PB^2 = AB^2$	
$(x-3)^2 + y^2 + x^2 + (y-4)^2 = 25$	1
$2x^2 + 2y^2 - 6x - 8y = 0$ or $x^2 + y^2 - 3x - 4y = 0$	1
OR	
Solution: (b) P divides AB in 1 : 2	
Coordinates of P are $\left(\frac{1\times4 + 2\times(-1)}{1+2}, \frac{1\times8 + 2\times1}{1+2}\right) = \left(\frac{2}{3}, \frac{10}{3}\right)$	½+½
Q divides AB in 2 : 1	
Coordinates of Q are $\left(\frac{2\times4 + 1\times(-1)}{1+2}, \frac{2\times8 + 1\times1}{1+2}\right) = \left(\frac{7}{3}, \frac{17}{3}\right)$	½+½

22. Verify the relation between the zeroes and the coefficients of the quadratic polynomial $4x^2 - 9$.

Solution: Zeroes of $4x^2 - 9$ are $\frac{3}{2}, \frac{-3}{2}$	1
Sum of zeroes $= \frac{3}{2} + \left(\frac{-3}{2}\right) = \frac{0}{4} = -\frac{\text{Coefficient of x}}{\text{Coefficient of } x^2}$	½
Product of zeroes $= \frac{3}{2} \times \left(\frac{-3}{2}\right) = \frac{-9}{4} = \frac{\text{Constant term}}{\text{Coefficient of } x^2}$	½

23. In the figure given below, $\angle 1 = \angle 2$ and $\frac{BE}{BC} = \frac{CD}{AB}$. Prove that $\Delta BDE \sim \Delta BAC$.



Solution: In ΔDBC, $\angle 1 = \angle 2$ ½

$BD = CD$

In ΔBDE and ΔBAC,

As $\frac{BE}{BC} = \frac{CD}{AB}$ ½

$\therefore \frac{BE}{BC} = \frac{BD}{AB}$ ½

$\angle B = \angle B$ (Common) ½

$\therefore \Delta BDE \sim \Delta BAC$ (By SAS Similarity)

24. (a) Triangle ABC is an isosceles right triangle, right angled at B. Find the value of $\sin^2 A + \cos^2 C$.

OR

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

Solution: (a) ΔABC is an isosceles right triangle

$\therefore \angle A = \angle C = 45^\circ$ ½

$\sin^2 A + \cos^2 C = \sin^2 45^\circ + \cos^2 45^\circ$

$= \left(\frac{1}{\sqrt{2}}\right)^2 + \left(\frac{1}{\sqrt{2}}\right)^2$ ½ + ½

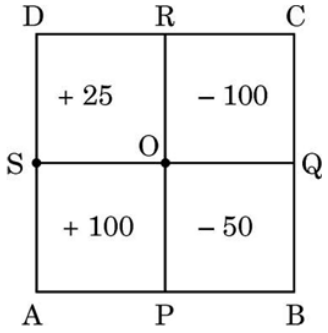
$= 1$ ½

OR

Solution: (b) $\frac{2\sin^2 60^\circ + \cos^2 60^\circ}{\tan^2 30^\circ} = \frac{2\left(\frac{\sqrt{3}}{2}\right)^2 + \left(\frac{1}{2}\right)^2}{\left(\frac{1}{\sqrt{3}}\right)^2}$ 3×½

$= \frac{21}{4}$ ½

25. A square dart board is divided into four equal squares as shown in the figure given below. If a dart hits square APOS, a player wins ₹ 100. If a dart hits square BPOQ, a player loses ₹ 50. If a dart hits square OQCR, a player loses ₹ 100 and if it hits square ORDS, the player will win ₹ 25. A player takes a turn and hits the dart board. What is the probability that



(i) the player loses money ?

(ii) the player wins ₹ 100 ?

Solution: (i) P(the player loses money) = $\frac{2}{4}$ or $\frac{1}{2}$ — 1

(ii) P(the player wins ₹ 100) = $\frac{1}{4}$ — 1

SECTION C

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

26. Neha claimed that there does not exist any irrational number between 1 and 2. Raunak claimed that $\sqrt{2}$ lies between 1 and 2 and $\sqrt{2}$ is an irrational number. Who do you think is correct ? Justify by proving either $\sqrt{2}$ as an irrational number or otherwise.

Solution:

Raunak is correct — ½

Let $\sqrt{2}$ be a rational number such that $\sqrt{2} = \frac{a}{b}$, where a and b are coprime and $b \neq 0$ — ½

$\sqrt{2}b = a$
$2b^2 = a^2$
2 divides a^2
2 divides a as well — ½

Let $a = 2p$ (for some integer p)
$a^2 = 4p^2$
$2b^2 = 4p^2$
$b^2 = 2p^2$
2 divides b^2
2 divides b as well — 1

∴ 2 is a common factor of a and b which is a contradiction as a and b are coprime. — ½

∴ Our assumption is wrong. Hence, $\sqrt{2}$ is an irrational number.

27. (a) Prove that the system of equations given as $2x - 3y = 7$ and $4x + ky = 9$, is inconsistent for $k = -6$. Also, obtain the solution of the system of equations, if $k = -1$.

OR

(b) Represent the following system of equations graphically and conclude whether the system is consistent or inconsistent.

$2x + 3y = 6$

$4x + 6y = 24$

Solution: (a) $\frac{a_1}{a_2} = \frac{2}{4} = \frac{1}{2}, \frac{b_1}{b_2} = \frac{-3}{k} = \frac{-3}{-6} = \frac{1}{2}, \frac{c_1}{c_2} = \frac{7}{9}$ — 1½

As $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

$\therefore$ system of equations is inconsistent — ½

For $k = -1$, the system of equations is

$2x - 3y = 7$

$4x - y = 9$

On solving, we get $x = 2$ and $y = -1$ — ½+½

OR

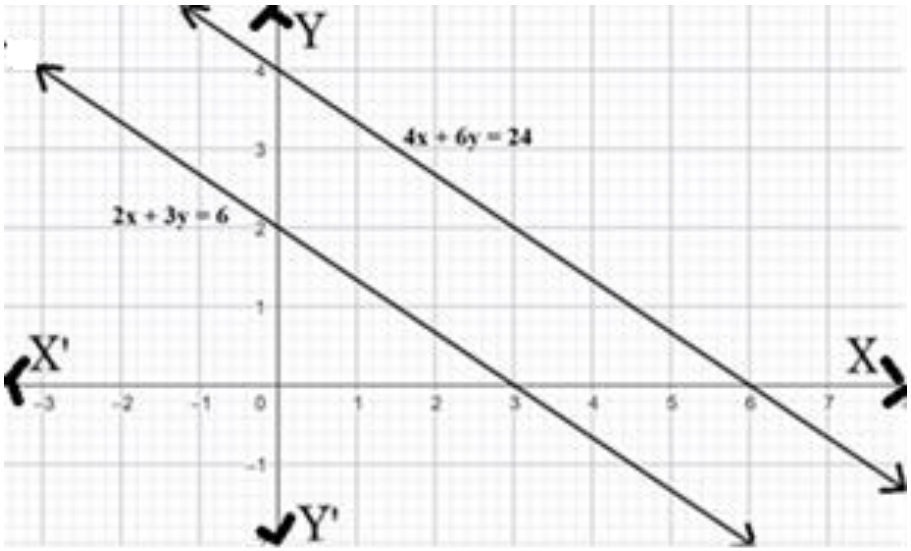
Solution: (b)

$2x + 3y = 6$

x	0	3
y	2	0

$4x + 6y = 24$

x	0	6
y	4	0



Correct Graph — 2

As lines are parallel, hence the system is **inconsistent**. — 1

28. Show that the quadrilateral ABCD with vertices A(0, 3), B(– 2, 0), C(0, – 5) and D(2, 0) is a kite. Also, find the length of each diagonal of the kite ABCD.

Solution: AB = $\sqrt{(0+2)^2 + (3-0)^2} = \sqrt{13}$ — ½

BC = $\sqrt{(-2-0)^2 + (0+5)^2} = \sqrt{29}$ — ½

CD = $\sqrt{(0-2)^2 + (-5-0)^2} = \sqrt{29}$ — ½

AD = $\sqrt{(2-0)^2 + (0-3)^2} = \sqrt{13}$ — ½

Since, AB = AD and BC = CD, so ABCD is a kite.

Length of diagonals

AC = $\sqrt{(0-0)^2 + (3+5)^2} = \sqrt{64} = 8$ — ½

BD = $\sqrt{(-2-2)^2 + (0-0)^2} = \sqrt{16} = 4$ — ½

29. (a) If $\sin A + \sin^2 A = 1$, find the value of $\cos^2 A + \cos^4 A$. Also, using the above, prove that $\tan^2 A \cdot \sec^2 A = 1$.

OR

(b) Prove that :

$$\frac{1+\text{cosec}\,\theta}{\text{cosec}\,\theta} = \frac{\cos^2\theta}{1-\sin\theta}$$

Solution: (a) $\sin A + \sin^2 A = 1$

$\Rightarrow \sin A = \cos^2 A$ ½

$\Rightarrow \sin^2 A = \cos^4 A$ (On squaring both sides) ½

$\Rightarrow 1 - \cos^2 A = \cos^4 A \Rightarrow \cos^2 A + \cos^4 A = 1$ 1

$\text{LHS} = \tan^2 A \cdot \sec^2 A = \frac{\sin^2 A}{\cos^2 A} \cdot \frac{1}{\cos^2 A} = \frac{\sin^2 A}{\sin^2 A} = 1 = \text{RHS}\ (\because\ \cos^4 A = \sin^2 A)$ 1

OR

Solution: (b)

$$\text{LHS} = \frac{1+\text{cosec}\,\theta}{\text{cosec}\,\theta}$$ 1

$$= 1 + \sin\theta$$

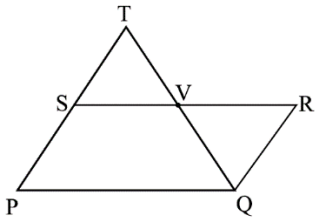
$$= (1+\sin\theta) \times \frac{1-\sin\theta}{1-\sin\theta}$$ 1

$$= \frac{1-\sin^2\theta}{1-\sin\theta}$$ ½

$$= \frac{\cos^2\theta}{1-\sin\theta} = \text{RHS}$$ ½

30. T is a point on the line PS produced of a parallelogram PQRS and QT intersects RS at V. Prove that Δ PQT ~ Δ RVQ.

Solution:



Correct Figure 1

In ΔPQT and ΔRVQ

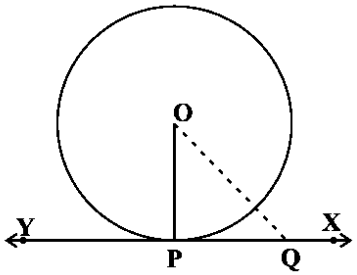
∠P = ∠R (opposite angles of a parallelogram) 1

∠T = ∠VQR (alternate interior angles) 1

ΔPQT ~ ΔRVQ (By AA similarity criterion)

31. Prove that the tangent at any point of a circle is perpendicular to the radius through the point of contact.

Solution:



For Correct Figure ½

Given: A circle with centre O and tangent XY at a point P.
To Prove: OP ⊥ XY
Construction: Take a point Q on XY other than P. Join OQ. ½
Proof: Q must lie outside the circle (otherwise XY will become a secant)
∴ OQ > Radius
∴ OQ > OP 1
∴ OP is the shortest distance from O to XY ½
∴ OP ⊥ XY ½

SECTION D

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

32. (a) Express $x - \frac{1}{x} = 3$ as a quadratic equation in standard form and hence find its roots. Also, find the value of 'a' for which the equation $x + \frac{1}{x} = a$, when expressed as a quadratic equation, has real and equal roots.

OR

(b) Observe the following pattern in which each small square represents a unit square (square of side 1 unit).

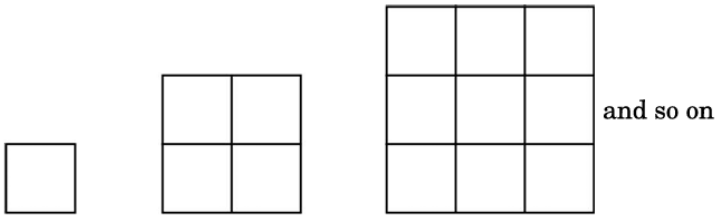


Fig (i) Fig (ii) Fig (iii)

If the sum of number of unit squares in the n^{th} figure and $(n + 2)^{th}$ figure is 290, find the value of n.

Solution: (a) $x - \frac{1}{x} = 3$ 1

$x^2 - 3x - 1 = 0$ 1

$D = (-3)^2 - 4(1)(-1) = 13$

Roots are $\frac{3+\sqrt{13}}{2}, \frac{3-\sqrt{13}}{2}$ 1

Now, $x + \frac{1}{x} = a$

$x^2 - ax + 1 = 0$ ½

Since roots are real and equal, $D = 0$ ½

$a^2 - 4 = 0$

$a = 2$ or -2 ½ + ½

OR

Solution: (b)

Number of unit squares in the n^{th} figure = n^2 — ½

Number of unit squares in the $(n+2)^{th}$ figure = $(n+2)^2$ — ½

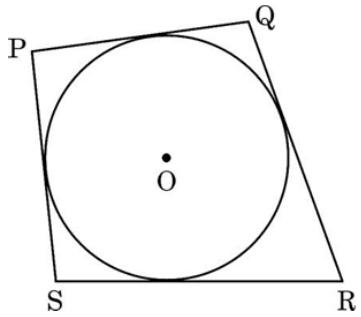
$n^2 + (n+2)^2 = 290$ — 1

$n^2 + 2n - 143 = 0$ — 1

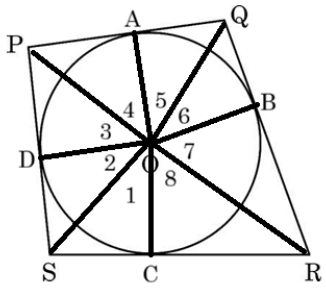
$(n+13)(n-11) = 0$ — 1

$n = 11, -13$ (rejected) — 1

33. In the given figure, quadrilateral PQRS circumscribes the circle with centre O. Prove that the opposite sides of the quadrilateral PQRS subtend supplementary angles at the centre O.



Solution:



For Correct Figure — 1

Let the circle touch the sides of the quadrilateral PQRS at A, B, C and D.

Construction: Join OA, OB, OC, OD, OP, OQ, OR and OS

$\Delta OCS \cong \Delta ODS$

$\therefore \angle 1 = \angle 2$ — 1

Similarly, $\angle 4 = \angle 3$

$\angle 5 = \angle 6$ } ½

$\angle 8 = \angle 7$

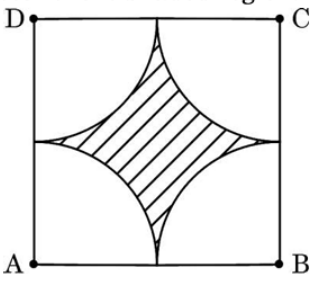
$\angle 1 + \angle 2 + \angle 3 + \angle 4 + \angle 5 + \angle 6 + \angle 7 + \angle 8 = 360°$ — ½

$2(\angle 1 + \angle 8 + \angle 4 + \angle 5) = 360°$ — 1

$\angle SOR + \angle POQ = 180°$ — ½

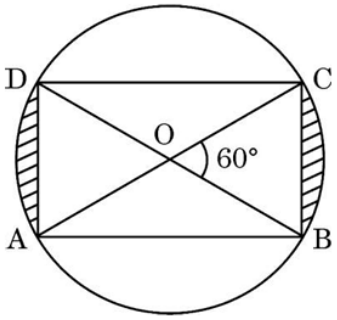
Similarly, $\angle POS + \angle ROQ = 180°$ — ½

34. (a) ABCD is a square. With centres A, B, C and D, four quadrants (each touching two of the remaining three) are drawn inside the square ABCD as shown in the figure. If the area of the shaded region is 42 cm^2, find the side of the square ABCD. Also, find the perimeter of the shaded region.



OR

(b) A rectangle ABCD with diagonal 14 cm is inscribed in a circle with centre O as shown in the given figure. If the area of the shaded portion is expressed as $a + b\sqrt{3}$, find the values of a and b. Also, find the perimeter of the sector OABO.



Solution: (a) Let the side of the square be x cm

Radius of each quadrant $= \frac{x}{2}$ ½

Area of shaded region $= x^2 - 4 \times \frac{90}{360} \times \frac{22}{7} \times \left(\frac{x}{2}\right)^2$ 1½

$\Rightarrow 42 = \frac{3}{14}x^2$ 1

$\Rightarrow x = 14$ ½

Perimeter of the shaded region $= 4 \times \frac{90}{360} \times 2 \times \frac{22}{7} \times 7$ 1

$= 44$ cm ½

OR

Solution: (b) $r = \frac{14}{2} = 7$ cm ½

Area of shaded region $= 2 \times \left(\frac{60}{360} \times \frac{22}{7} \times 7 \times 7 - \frac{\sqrt{3}}{4} \times 7 \times 7\right)$ 1

$= \frac{154}{3} - \frac{49\sqrt{3}}{2}$ cm^2 1

$a + b\sqrt{3} = \frac{154}{3} - \frac{49\sqrt{3}}{2}$

$a = \frac{154}{3}$ and $b = -\frac{49}{2}$ 1

Perimeter of the sector OABO $= 7 + 7 + \frac{120}{360} \times 2 \times \frac{22}{7} \times 7$ 1

$= \frac{86}{3}$ cm or 28.67 cm ½

35. The median of the following data is 525. If the sum of all the frequencies is 100, find the values of p and q.

Class	*Frequency*
0 – 100	2
100 – 200	p
200 – 300	9
300 – 400	12
400 – 500	17
500 – 600	20
600 – 700	15
700 – 800	9
800 – 900	q
900 – 1000	4

Solution:

Class	Frequency	Cumulative Frequency
0-100	2	2
100-200	p	2 + p
200-300	9	11 + p
300-400	12	23 + p
400-500	17	40 + p
500-600	20	60 + p
600-700	15	75 + p
700-800	9	84 + p
800-900	q	84 + p + q
900-1000	4	88 + p + q

Correct cf — 1

$p + q = 12$ _____(i) — 1

Median class = 500 – 600, N = 100

$$\text{Median} = 500 + \frac{50-(40+p)}{20} \times 100$$ — 2

$$525 = 500 + 5(10 - p)$$

$p = 5$ — ½

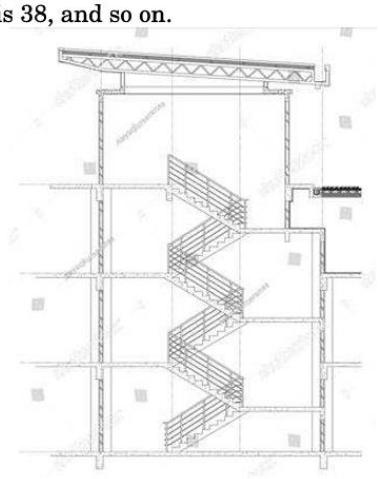
and $q = 7$ (From (i)) — ½

SECTION E

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

Case Study – 1

36. A multistorey building is constructed with stilt parking. There is a provision of lift, as well as staircase from the ground floor to the top floor. The number of stairs from the ground floor to the first floor is 10, from the first floor to the second floor is 24, from the second floor to the third floor is 38, and so on.





Based on the above information, answer the following questions :

(i) Does 10, 24, 38, ... form an A.P. ? Justify your answer.

(ii) What will be the total number of stairs from the ground floor to the eleventh floor ?

(iii) A person supplies water cans to people living in the building. As water cans are heavy, he supplies water cans on each floor, carrying one at a time. He supplied the water can from the ground floor to the first floor, came back and supplied water can to the second floor, again came back then supplied water can to the third floor, and so on.

(a) Find the total number of stairs he climbed up and down to supply water till the sixth floor, using A.P.

OR

(b) The next day, following the same process, if a person climbed up and down a total of 380 stairs, till which floor did he supply water cans ?

Solution: (i) $24 - 10 = 14$ and $38 - 24 = 14$, so $d = 14$ ½

10, 24, 38, ….. form an A. P. ½

(ii) $S_{11} = \frac{11}{2}(2 \times 10 + 10 \times 14) = 880$ stairs 1

(iii) (a) Number of stairs to reach n^{th} floor = S_n

$=7n^2 + 3n$ 1

∴ Total number of stairs he climbed up and down to supply water till the sixth floor

$=2S_1 + 2S_2 + 2S_3 + 2S_4 + 2S_5 + 2S_6 = 20+68+144+248+380+540 = 1400$ 1

OR

(b) As $20+68+144+248 > 380$

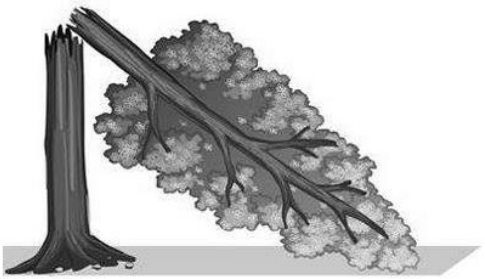
He supplied water till 3rd floor 2

Case Study – 2

37. Climate change and global warming are influencing storm behaviour, particularly in terms of intensity and rainfall. Strong winds and storms often cause uprooting and/or breaking of trees, which damage the vehicles standing underneath the trees.

On a particular day, during a high intensity storm, a tree broke such that its broken part formed an angle of 30° with the ground. The distance between the base of the tree to the point where the top touches the ground is found to be 10 m.





Based on the above information, answer the following questions :

(i) Represent the given information with the help of a neat and well labelled diagram.

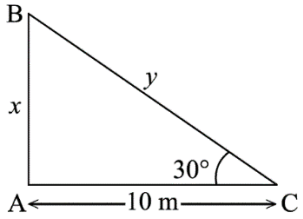
(ii) Find the height above the ground at which the tree is broken.

(iii) (a) Find the height of the tree before it broke. (Use $\sqrt{3} = 1{\cdot}732$)

OR

(iii) (b) If another tree broke from the same height as in part (ii), but the broken part made a 60° angle with the ground, find the total height of the tree.

Solution: (i) Let B be the point at which tree is broken.



For Correct Figure 1

(ii) In ΔBAC

$\tan 30° = \frac{x}{10}$

$x = \frac{10}{\sqrt{3}} m$ or $\frac{10\sqrt{3}}{3} m$ or $5.77\ m$ 1

∴The height above the ground at which the tree is broken $= x = \frac{10}{\sqrt{3}}m$ or $\frac{10\sqrt{3}}{3}m$ or $5.77\ m$

(iii) (a) In ΔBAC

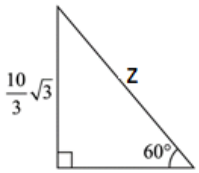
$$\cos 30° = \frac{10}{y}$$

$$y = \frac{20}{\sqrt{3}}m = \frac{20\sqrt{3}}{3}m$$ 1

∴The height of tree before it broke $= x + y = \frac{10\sqrt{3}}{3} + \frac{20\sqrt{3}}{3} = 10\sqrt{3} = 17.32$ m 1

OR

(iii) (b)



$$\sin 60° = \frac{\frac{10\sqrt{3}}{3}}{z}$$

$$z = \frac{20}{3}\ m$$ 1

∴The height of tree before it broke $= \left(z + \frac{10\sqrt{3}}{3}\right)$m $= \frac{10}{3}(2 + \sqrt{3})m$ or 12.44 m 1

Case Study – 3

38. For a cricket tournament involving 8 countries, a special trophy, as shown below, is designed.



The height and diameter of the cylindrical part are 14 cm and 6 cm respectively and the diameter of the spherical ball on the top is 7 cm.

Based on the above information, answer the following questions :

(i) Find the total height of the trophy excluding the wooden part.

(ii) Find the difference between the radius of sphere and that of cylinder.

(iii) (a) If the cylindrical part and spherical part are separated and gold plated overall, find the total surface area to be gold plated.

OR

(iii) (b) Find the volume of the metal used in making the trophy, assuming that the metal is completely filled in it.

Solution: (i)	Total height = $14 + 7 = 21$ cm	1
(ii)	Required difference = $3.5 - 3 = 0.5$ cm	1
(iii) (a)	Total surface area to be gold plated = $2\pi(3 \times 14 + 3^2 + 2 \times 3.5^2)$	1
	$= \frac{3322}{7}\text{cm}^2$ *or* $474.57\ \text{cm}^2$	1
	OR	
(iii) (b)	Volume of the metal used $= \pi\left(3^2 \times 14 + \frac{4}{3} \times 3.5^3\right)$	1
	$= \frac{1727}{3}\text{cm}^3$ *or* $575.67\ \text{cm}^3$	1