Series : GE1FH

SET~1

रोल नं.
Roll No.

प्रश्न-पत्र कोड
Q.P. Code **430/1/1**

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 **27** हैं।

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

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

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

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

NOTE

(I) Please check that this question paper contains **27** printed pages.

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

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

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

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

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गणित (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. यदि दो धनात्मक पूर्णांकों a और b का महत्तम समापवर्तक (HCF) 1 है, तो उनका लघुतम समापवर्त्य (LCM) होगा :

(A) a + b (B) a

(C) b (D) ab

2. संख्या $3 + \sqrt{2}$ एक :

(A) परिमेय संख्या है (B) अपरिमेय संख्या है

(C) पूर्णांक है (D) प्राकृत संख्या है

3. द्विघात समीकरण $x^2 - 3x - 2 = 0$ का विविक्तकर (discriminant) है :

(A) 1 (B) 17

(C) $\sqrt{17}$ (D) $-\sqrt{17}$

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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. If the HCF of two positive integers a and b is 1, then their LCM is :

(A) a + b (B) a

(C) b (D) ab

2. The number $3 + \sqrt{2}$ is :

(A) a rational number (B) an irrational number

(C) an integer (D) a natural number

3. The discriminant of the quadratic equation $x^2 - 3x - 2 = 0$ is :

(A) 1 (B) 17

(C) $\sqrt{17}$ (D) $-\sqrt{17}$

• • •

4. समीकरण $x + \frac{1}{x} = 3$ $(x \neq 0)$ को एक द्विघात समीकरण $ax^2 + bx + c = 0$ के रूप में व्यक्त किया जाता है। $a - b + c$ का मान है :

(A) 5 (B) 2

(C) 1 (D) – 1

5. बिंदु (3, – 5) के लिए (भुज – कोटि) का मान है :

(A) – 8 (B) – 2

(C) 2 (D) 8

6. किसी रेखाखंड का मध्य-बिंदु उस रेखाखंड को जिस अनुपात में विभाजित करता है, वह है :

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

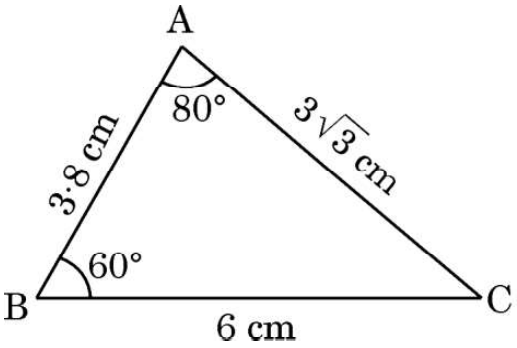
(C) 1 : 1 (D) $\frac{1}{2} : 2$

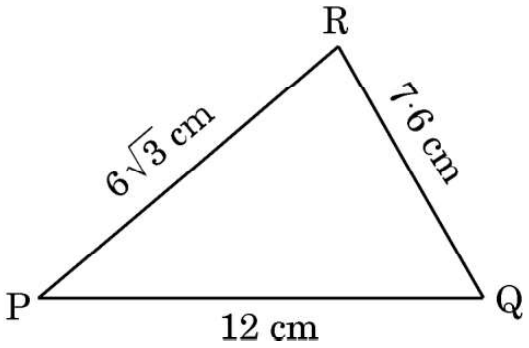
7. निम्नलिखित में से कौन-सी त्रिभुजों की समरूपता की कसौटी ***नहीं*** है ?

(A) AAA (B) SSS

(C) SAS (D) RHS

8. नीचे दी गई आकृतियों से, $\angle P$ के माप के लिए निम्नलिखित में से कौन-सा सही है ?





(A) $\angle P = 60°$

(B) $\angle P = 80°$

(C) $\angle P = 40°$

(D) $\angle P$ की माप ज्ञात नहीं की जा सकती

• • •

4. The equation $x + \frac{1}{x} = 3$ $(x \neq 0)$ is expressed as a quadratic equation in the form of $ax^2 + bx + c = 0$. The value of $a - b + c$ is :

(A) 5 (B) 2

(C) 1 (D) – 1

5. For a point (3, – 5), the value of (abscissa – ordinate) is :

(A) – 8 (B) – 2

(C) 2 (D) 8

6. The mid-point of a line segment divides the line segment in the ratio :

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

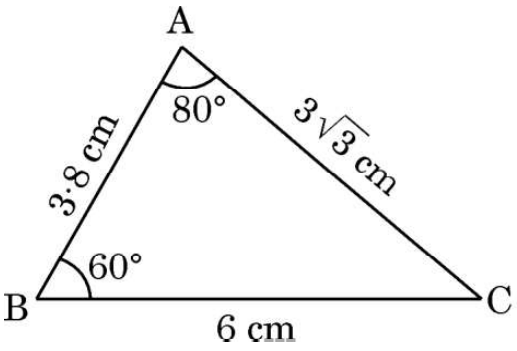
(C) 1 : 1 (D) $\frac{1}{2}$: 2

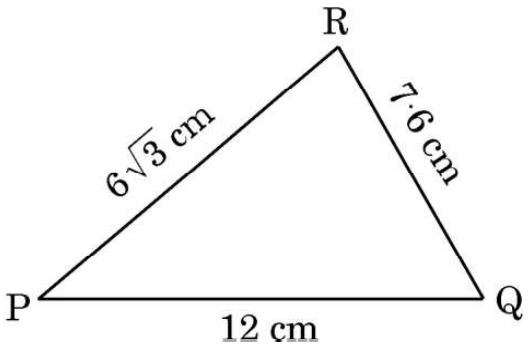
7. Which of the following is ***not*** the criterion for similarity of triangles ?

(A) AAA (B) SSS

(C) SAS (D) RHS

8. From the figures given below, which of the following is true about the measure of $\angle P$?





(A) $\angle P = 60°$

(B) $\angle P = 80°$

(C) $\angle P = 40°$

(D) The measure of $\angle P$ cannot be determined

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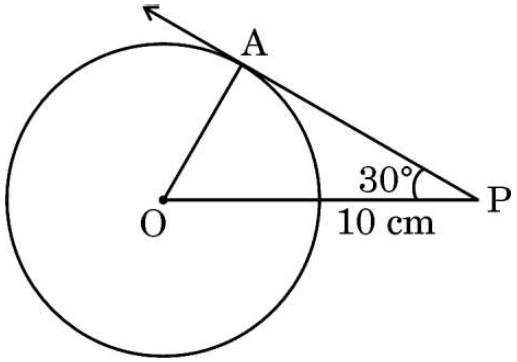
9. दी गई आकृति में, केन्द्र O वाले वृत्त पर PA एक स्पर्श-रेखा है। यदि OP = 10 cm है, तो AP की लम्बाई होगी :



(A) $10\sqrt{3}$ cm

(B) 20 cm

(C) 5 cm

(D) $5\sqrt{3}$ cm

10. निम्नलिखित में से कौन-सा कथन ***असत्य*** है ?

(A) $\tan 45° = \cot 45°$

(B) $\sin 90° = \tan 45°$

(C) $\sin 30° = \cos 30°$

(D) $\sin 45° = \cos 45°$

11. $\left(\tan^2 A - \frac{1}{\cos^2 A}\right)$ का मान है :

(A) 1 से ज्यादा

(B) 1

(C) 0

(D) – 1

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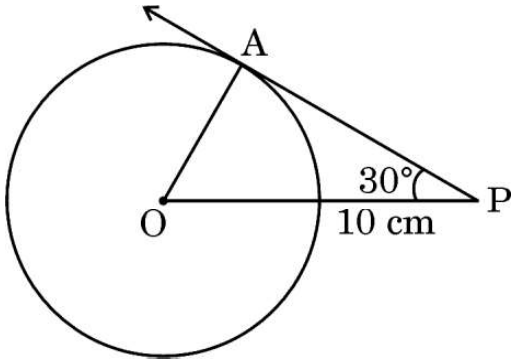
9. In the given figure, PA is a tangent to a circle with centre O. If OP = 10 cm, then the length of AP is :



(A) $10\sqrt{3}$ cm

(B) 20 cm

(C) 5 cm

(D) $5\sqrt{3}$ cm

10. Which of the following statements is ***false*** ?

(A) $\tan 45° = \cot 45°$

(B) $\sin 90° = \tan 45°$

(C) $\sin 30° = \cos 30°$

(D) $\sin 45° = \cos 45°$

11. The value of $\left(\tan^2 A - \frac{1}{\cos^2 A}\right)$ is :

(A) more than 1

(B) 1

(C) 0

(D) – 1

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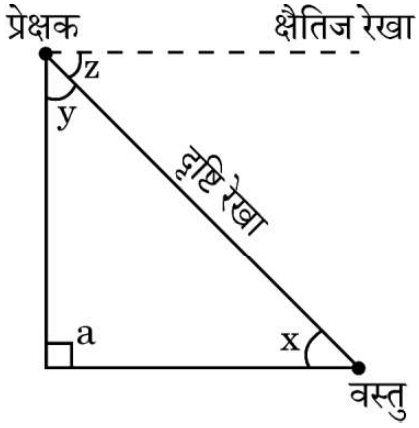
12. दी गई आकृति में, निम्नलिखित में से कौन-सा कोण अवनमन कोण है ?



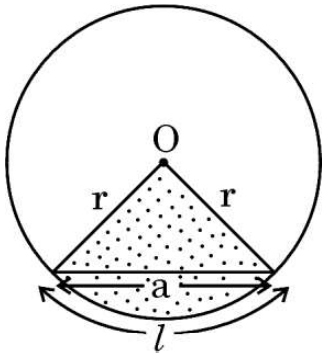
(A) x

(B) y

(C) z

(D) a

13. दी गई आकृति में छायांकित क्षेत्र का परिमाप है :



(A) l

(B) $l + a$

(C) $l + 2r$

(D) $l + 2r + a$

14. एक वृत्त के चतुर्थांश (quadrant) के क्षेत्रफल का अनुपात, उसी वृत्त के क्षेत्रफल से होता है :

(A) 1 : 2

(B) 2 : 1

(C) 1 : 4

(D) 4 : 1

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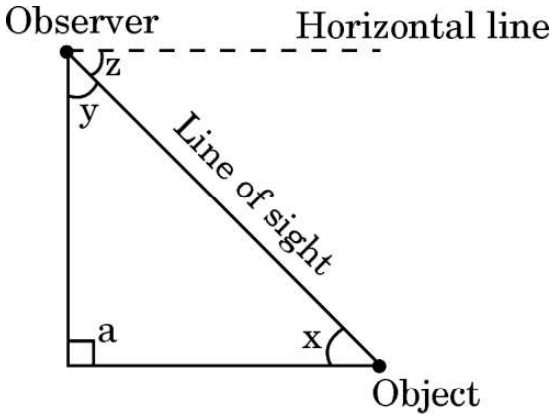
12. In the given figure, which of the following angles represents the angle of depression ?



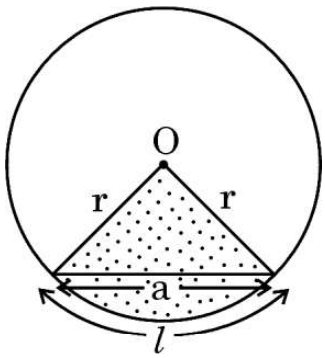
(A) x

(B) y

(C) z

(D) a

13. The perimeter of the shaded region in the given figure is :



(A) l

(B) l + a

(C) l + 2r

(D) l + 2r + a

14. The ratio of the area of a quadrant of a circle to the area of the same circle is :

(A) 1 : 2

(B) 2 : 1

(C) 1 : 4

(D) 4 : 1

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15. निम्नलिखित में से किस ठोस का पार्श्वीय/वक्र पृष्ठीय क्षेत्रफल और संपूर्ण पृष्ठीय क्षेत्रफल एक समान है ?

(A) घन

(B) घनाभ

(C) अर्धगोला

(D) गोला

16. निम्नलिखित आँकड़ों के माध्यक वर्ग का वर्ग-चिह्न है :

वर्ग-अन्तराल	10 – 25	25 – 40	40 – 55	55 – 70	70 – 85	85 – 100
बारंबारता	2	3	7	6	6	6

(A) 40

(B) 55

(C) 47·5

(D) 62·5

17. टेस्ट मैचों में कुछ बल्लेबाजों द्वारा बनाए गए रनों की संख्या निम्नलिखित बंटन में दर्शाई गई है :

बनाए गए रनों की संख्या	3000 – 4000	4000 – 5000	5000 – 6000	6000 – 7000
बल्लेबाजों की संख्या	5	10	9	8

बहुलक वर्ग की निचली वर्ग सीमा है :

(A) 3000

(B) 4000

(C) 5000

(D) 6000

18. पासा फेंकने के एक यादृच्छिक प्रयोग में, निम्नलिखित में से कौन-सी घटना निश्चित है ?

(A) 1 से 6 के बीच की संख्या प्राप्त होना

(B) 7 से कम एक विषम संख्या प्राप्त होना

(C) 7 से कम एक सम संख्या प्राप्त होना

(D) 7 से कम एक प्राकृत संख्या प्राप्त होना

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15. For which of the following solids is the lateral/curved surface area and total surface area the same ?

(A) Cube

(B) Cuboid

(C) Hemisphere

(D) Sphere

16. The class mark of the median class of the following data is :

Class Interval	10 – 25	25 – 40	40 – 55	55 – 70	70 – 85	85 – 100
Frequency	2	3	7	6	6	6

(A) 40

(B) 55

(C) 47·5

(D) 62·5

17. The following distribution shows the number of runs scored by some batsmen in test matches :

Runs Scored	3000 – 4000	4000 – 5000	5000 – 6000	6000 – 7000
Number of Batsmen	5	10	9	8

The lower limit of the modal class is :

(A) 3000

(B) 4000

(C) 5000

(D) 6000

18. In a random experiment of throwing a die, which of the following is a sure event ?

(A) Getting a number between 1 and 6

(B) Getting an odd number < 7

(C) Getting an even number < 7

(D) Getting a natural number < 7

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*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) :* किन्हीं दो प्राकृत संख्याओं a और b के लिए, a और b का HCF, a और b के LCM का एक गुणनखंड होता है।

तर्क (R) : किन्हीं दो प्राकृत संख्याओं का HCF, दोनों संख्याओं को विभाजित करता है।

20. *अभिकथन (A) :* p का मान, जिसके लिए समीकरण निकाय $4x + py + 8 = 0$ और $2x + 2y + 2 = 0$ संगत है, 4 है।

तर्क (R) : समीकरण निकाय $a_1x + b_1y = c_1$ तथा $a_2x + b_2y = c_2$ संगत है जिसमें अपरिमित रूप से अनेक हल हैं, यदि $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$.

खण्ड ख

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

21. निम्नलिखित समीकरण निकाय को x और y के लिए हल कीजिए :

$$\frac{x}{2} + \frac{2y}{3} = -1 \text{ और } x - \frac{y}{3} = 3$$

• • •

*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) :* For any two natural numbers a and b, the HCF of a and b is a factor of the LCM of a and b.

Reason (R) : HCF of any two natural numbers divides both the numbers.

20. *Assertion (A) :* The value of p for which the system of equations $4x + py + 8 = 0$ and $2x + 2y + 2 = 0$ is consistent is 4.

Reason (R) : The system of equations $a_1x + b_1y = c_1$ and $a_2x + b_2y = c_2$ is consistent with infinitely many solutions, if $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$.

SECTION B

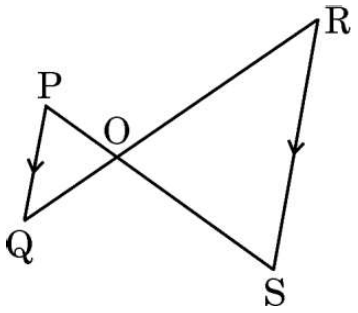
*This section has **5** Very Short Answer (VSA) type questions carrying **2** marks each.* *5×2=10*

21. Solve the following system of equations for x and y :

$$\frac{x}{2} + \frac{2y}{3} = -1 \text{ and } x - \frac{y}{3} = 3$$

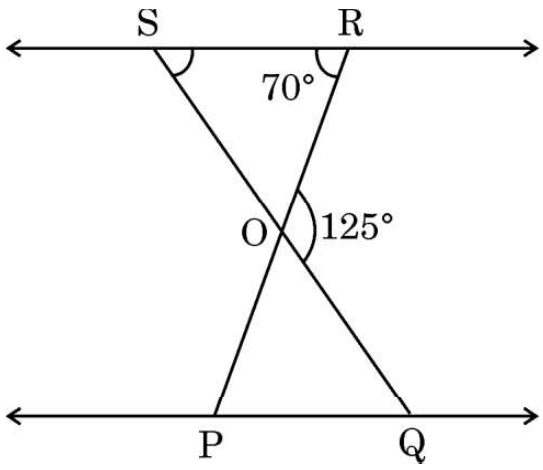
• • •

22. (क) दी गई आकृति में, यदि PQ ∥ RS है, तो सिद्ध कीजिए कि Δ POQ ~ Δ SOR.



अथवा

(ख) दी गई आकृति में, Δ OSR ~ Δ OQP, ∠ ROQ = 125° तथा ∠ ORS = 70°. ∠ OSR और ∠ OQP के माप ज्ञात कीजिए।



23. दो संकेंद्रीय वृत्तों की त्रिज्याएँ 6 cm और 10 cm हैं। बड़े वृत्त की जीवा, जो छोटे वृत्त को स्पर्श करती है, की लंबाई ज्ञात कीजिए।

24. (क) A और B ($0 \leq A < 90°$, $0 \leq B < 90°$) के मान ज्ञात कीजिए, यदि $\tan(A + B) = 1$ और $\tan(A - B) = \frac{1}{\sqrt{3}}$ हैं।

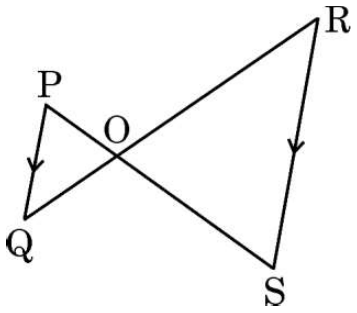
अथवा

(ख) ज्यामितीय विधि से सिद्ध कीजिए कि $\tan 45° = 1$.

25. 20 cm व्यास वाले वृत्त की एक जीवा वृत्त के केन्द्र पर 60° का कोण बनाती है। वृत्त के संगत लघु वृत्तखंड का क्षेत्रफल ज्ञात कीजिए। ($\pi = 3{\cdot}14$ और $\sqrt{3} = 1{\cdot}73$ प्रयोग कीजिए)

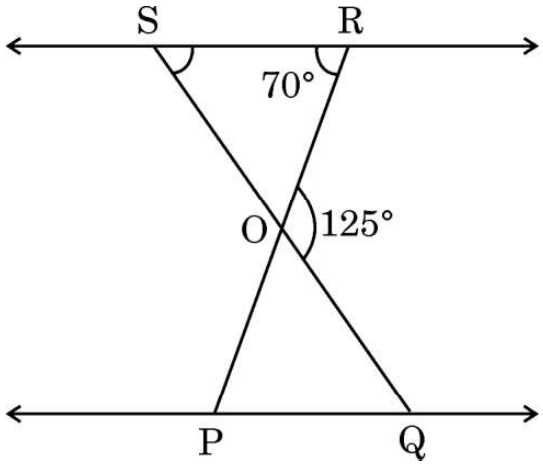
• • •

22. (a) In the given figure, if PQ ∥ RS, then prove that Δ POQ ~ Δ SOR.



OR

(b) In the given figure, Δ OSR ~ Δ OQP, ∠ ROQ = 125° and ∠ ORS = 70°. Find the measures of ∠ OSR and ∠ OQP.



23. Two concentric circles are of radii 6 cm and 10 cm. Find the length of the chord of the larger circle which touches the smaller circle.

24. (a) Find the values of A and B ($0 \leq A < 90°$, $0 \leq B < 90°$), if $\tan(A + B) = 1$ and $\tan(A - B) = \frac{1}{\sqrt{3}}$.

OR

(b) Prove that $\tan 45° = 1$ geometrically.

25. A chord of a circle of diameter 20 cm subtends an angle of 60° at the centre of the circle. Find the area of the corresponding minor segment of the circle. (Use $\pi = 3{\cdot}14$ and $\sqrt{3} = 1{\cdot}73$)

• • •

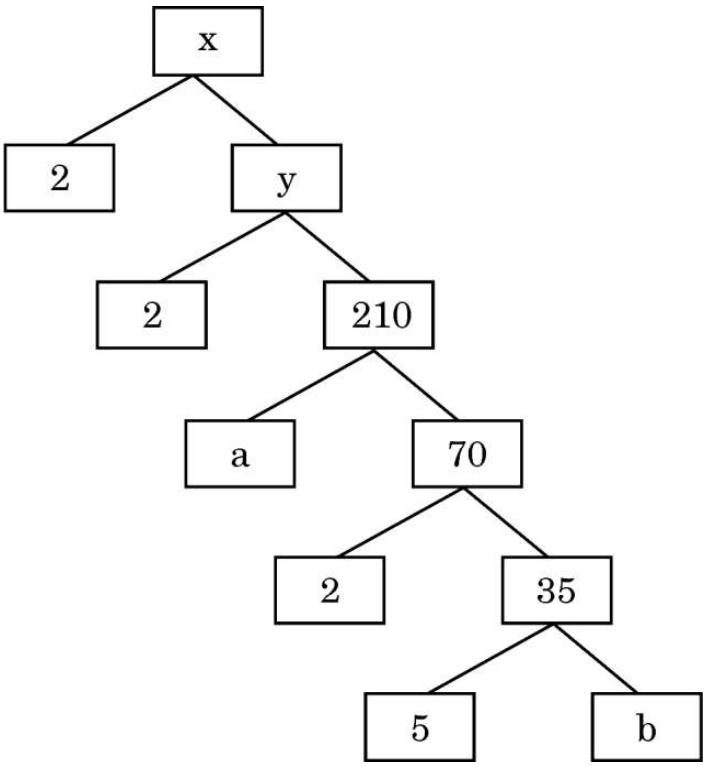
खण्ड ग

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

26. (क) सिद्ध कीजिए कि $\sqrt{3}$ एक अपरिमेय संख्या है।

अथवा

(ख) संख्या x का गुणनखंड वृक्ष नीचे दिखाया गया है :



x, y, a और b के मान ज्ञात कीजिए। अत: संख्या x को अभाज्य गुणनखंडों के गुणनफल के रूप में व्यक्त कीजिए।

27. एक द्विघात बहुपद ज्ञात कीजिए जिसमें इसके शून्यकों के योगफल तथा गुणनफल क्रमश: 0 और – 9 हों। प्राप्त बहुपद के शून्यक भी ज्ञात कीजिए।

28. (क) निम्नलिखित समीकरण निकाय को आलेख विधि से हल कीजिए :

$$x + 3y = 6; \quad 2x - 3y = 12$$

अथवा

(ख) x और y दो इस प्रकार के पूरक कोण हैं कि x : y = 1 : 2. दी गई सूचना को दो चरों वाले एक रैखिक समीकरण निकाय के रूप में व्यक्त कीजिए और तत्पश्चात् इसे हल कीजिए।

• • •

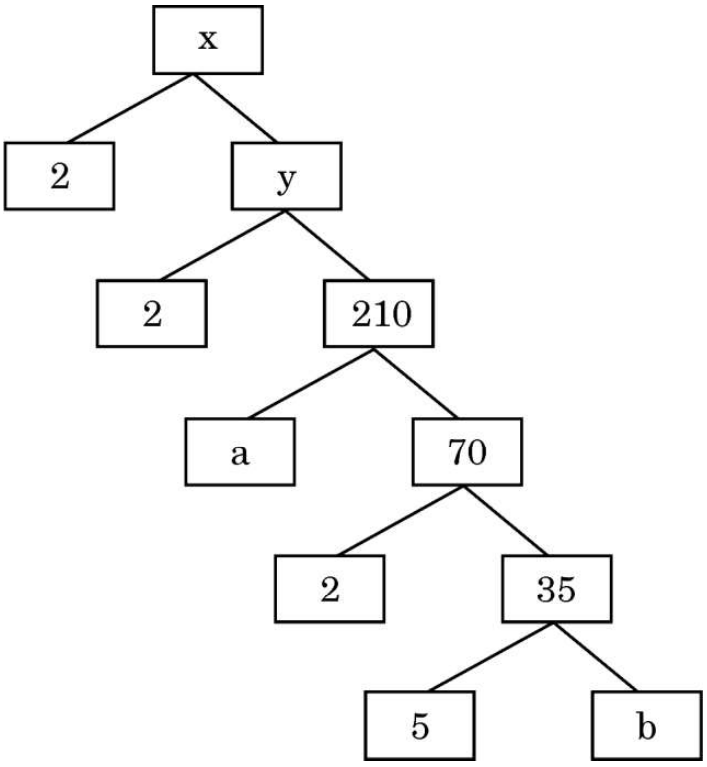
SECTION C

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

26. (a) Prove that $\sqrt{3}$ is an irrational number.

OR

(b) The factor tree of a number x is shown below :



Find the values of x, y, a and b. Hence, write the product of the prime factors of the number x so obtained.

27. Find a quadratic polynomial whose sum and product of zeroes are 0 and – 9, respectively. Also, find the zeroes of the polynomial so obtained.

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

$x + 3y = 6;\ 2x - 3y = 12$

OR

(b) x and y are complementary angles such that x : y = 1 : 2. Express the given information as a system of linear equations in two variables and hence solve it.

• • •

29. सिद्ध कीजिए कि वृत्त के परिगत बना आयत एक वर्ग होता है।

30. सिद्ध कीजिए कि :

$$\frac{1 + \cot^2 A}{1 + \tan^2 A} = \left(\frac{1 - \cot A}{1 - \tan A}\right)^2$$

31. 200 पेनों के एक समूह में 180 पेन अच्छे हैं और बाकी के पेन खराब हैं। एक ग्राहक पेन जब ही खरीदता है जब वह खराब न हो। दुकानदार एक पेन इस समूह से यादृच्छया निकालता है और ग्राहक को देता है। ग्राहक इस पेन को नहीं खरीदता है, इसकी प्रायिकता क्या है ? 100 पेनों का एक और समूह है जिसमें 80 पेन अच्छे हैं, उसको 200 पेनों के पहले वाले समूह में मिला दिया जाता है। तत्पश्चात् दुकानदार अब पूरे समूह से एक पेन यादृच्छया निकालता है और इस पेन को ग्राहक को देता है। ग्राहक इस पेन को खरीदेगा, इसकी प्रायिकता क्या है ?

खण्ड घ

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

32. (क) दो धनात्मक संख्याओं के वर्गों का अन्तर 180 है। छोटी संख्या का वर्ग, बड़ी संख्या का 8 गुना है। दोनों संख्याएँ ज्ञात कीजिए।

अथवा

(ख) k का/के मान ज्ञात कीजिए जिसके/जिनके लिए समीकरण $2x^2 + kx + 3 = 0$ के वास्तविक और बराबर मूल हों। इस प्रकार प्राप्त हुए समीकरण के मूल भी ज्ञात कीजिए।

• • •

29. Prove that a rectangle circumscribing a circle is a square.

30. Prove that :

$$\frac{1 + \cot^2 A}{1 + \tan^2 A} = \left(\frac{1 - \cot A}{1 - \tan A}\right)^2$$

31. A lot consists of 200 pens of which 180 are good and the rest are defective. A customer will buy a pen if it is not defective. The shopkeeper draws a pen at random and gives it to the customer. What is the probability that the customer will not buy it ? Another lot of 100 pens containing 80 good pens is mixed with the previous lot of 200 pens. The shopkeeper now draws one pen at random from the entire lot and gives it to the customer. What is the probability that the customer will buy the pen ?

SECTION D

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

32. (a) The difference of the squares of two positive numbers is 180. The square of the smaller number is 8 times the greater number. Find the two numbers.

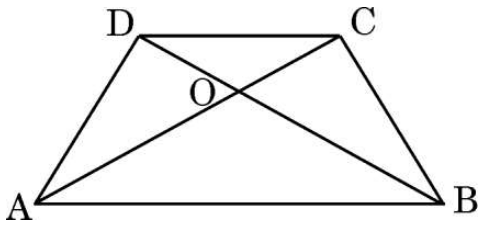
OR

(b) Find the value(s) of k for which the equation $2x^2 + kx + 3 = 0$ has real and equal roots. Hence, find the roots of the equations so obtained.

• • •

33. "आधारभूत समानुपातिकता प्रमेय" को लिखिए और इसका प्रयोग करके निम्नलिखित को सिद्ध कीजिए :

एक चतुर्भुज ABCD में, विकर्ण AC और BD परस्पर एक-दूसरे को O पर इस प्रकार प्रतिच्छेद करते हैं कि $\frac{AO}{BO} = \frac{CO}{DO}$ जैसा दी गई आकृति में दिखाया गया है । सिद्ध कीजिए कि ABCD एक समलम्ब है।



34. (क) एक खिलौना एक अर्धगोले पर खड़े एक शंकु के आकार का है । शंकु और अर्धगोले की त्रिज्याएँ बराबर हैं । खिलौने के शंक्वाकार भाग की ऊँचाई उसके आधार के व्यास के बराबर है। यदि शंक्वाकार भाग की त्रिज्या 5 cm है, तो खिलौने का आयतन ज्ञात कीजिए।

अथवा

(ख) एक घनाकार ब्लॉक के ऊपर 3·5 cm त्रिज्या का एक अर्धगोला रखा गया है। घन के किनारे की न्यूनतम संभव लम्बाई क्या है, ताकि गोलार्ध पूरी तरह से घन पर स्थित हो सके ? इस प्रकार बने ठोस का संपूर्ण पृष्ठीय क्षेत्रफल ज्ञात कीजिए।

35. निम्नलिखित आँकड़े 200 विद्युत घटकों के अवलोकित जीवन काल (घंटों में) के बारे में जानकारी देते हैं :

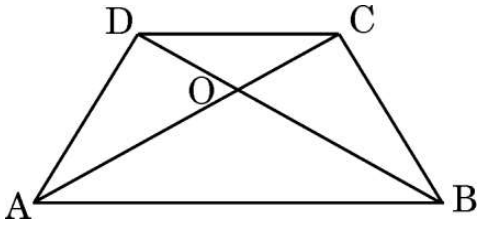
जीवन काल (घंटों में)	*विद्युत घटकों की संख्या*
0 – 20	10
20 – 40	35
40 – 60	50
60 – 80	60
80 – 100	30
100 – 120	15

विद्युत घटकों का माध्य जीवन काल (घंटों में) ज्ञात कीजिए।

• • •

33. State "Basic Proportionality Theorem" and use it to prove the following :

In a quadrilateral ABCD, diagonals AC and BD intersect each other at O such that $\frac{AO}{BO} = \frac{CO}{DO}$ as shown in the given figure. Prove that ABCD is a trapezium.



34. (a) A toy is in the form of a cone surmounted on a hemisphere. The cone and hemisphere have the same radii. The height of the conical part of the toy is equal to the diameter of its base. If the radius of the conical part is 5 cm, find the volume of the toy.

OR

(b) A cubical block is surmounted by a hemisphere of radius 3·5 cm. What is the smallest possible length of the edge of the cube so that the hemisphere can totally lie on the cube ? Find the total surface area of the solid so formed.

35. The following data gives the information on the observed lifetime (in hours) of 200 electrical components :

Lifetime (in hours)	*Number of electrical components*
0 – 20	10
20 – 40	35
40 – 60	50
60 – 80	60
80 – 100	30
100 – 120	15

Find the mean lifetime (in hours) of the electrical components.

• • •

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. एक इमारत की छत पर एक घायल पक्षी दिखाई देता है। यह इमारत 15 m ऊँची है। पक्षी को बचाने के उद्देश्य से, एक फायरमैन को बुलाया जाता है। फायरमैन ने छत तक पहुँचने के लिए एक समायोज्य सीढ़ी का उपयोग किया। उसने सीढ़ी को इस प्रकार रखा कि छत तक पहुँचने के लिए सीढ़ी भूमि से $60°$ का कोण बनाए।

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

(i) सीढ़ी की लम्बाई ज्ञात कीजिए, जिसे फायरमैन ने छत पर पहुँचने के लिए उपयोग किया था। *1*

(ii) इमारत के पाद से भूमि पर उस बिन्दु की दूरी ज्ञात कीजिए, जहाँ सीढ़ी को रखा गया था। *1*

(iii) फिसलन से बचने के लिए, फायरमैन ने सीढ़ी को इस तरह रखा कि सीढ़ी का निचला हिस्सा इमारत के विपरीत दीवार के आधार को छूए, जिससे जमीन से $30°$ का कोण बने।

(क) उपर्युक्त स्थिति को दर्शाने के लिए एक साफ-सुथरा चित्र बनाइए और इमारत व दीवार के बीच सड़क की चौड़ाई ज्ञात कीजिए। *2*

अथवा

(ख) इस प्रकरण में फायरमैन ने जिस सीढ़ी का उपयोग किया है, उसकी लम्बाई ज्ञात कीजिए। *2*

• • •

SECTION E

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

Case Study – 1

36. An injured bird was found on the roof of a building. The building is 15 m high. A fireman was called to rescue the bird. The fireman used an adjustable ladder to reach the roof. He placed the ladder in such a way that the ladder makes an angle of 60° with the ground in order to reach the roof.

Based on the above information, answer the following questions :

(i) Find the length of the ladder used by the fireman to reach the roof. *1*

(ii) Find the distance of the point on the ground at which the ladder was fixed from the bottom of the building. *1*

(iii) In order to avoid skidding, the fireman placed the ladder in such a way that the bottom of the ladder touches the base of the wall which is opposite to the building, making an angle of 30° with the ground.

(a) Draw a neat diagram to represent the above situation and hence find the width of the road between the building and the wall. *2*

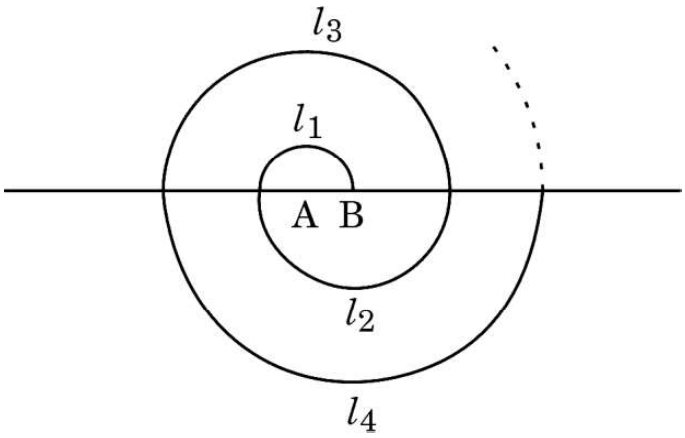
OR

(b) Find the length of the ladder used by the fireman in this case. *2*

• • •

प्रकरण अध्ययन – 2

37. एक बगीचे में, सर्पिल पैटर्न बनाने के लिए गुलाब के फूलों के पौधे समान अंतराल पर लगाए गए थे। सर्पिल क्रमिक अर्धवृत्तों से बना है, जिसका केन्द्र वैकल्पिक रूप से A और B पर है, जो त्रिज्याओं 50 cm, 100 cm, 150 cm, ... के केन्द्र A से शुरू होता है, जैसा नीचे दिए गए चित्र में दिखाया गया है। सर्पिल 1 में 10 फूल, सर्पिल 2 में 20 फूल, सर्पिल 3 में 30 फूल और इसी तरह।



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

(i) 13वीं सर्पिल की त्रिज्या क्या है ? *1*

(ii) यदि nवीं सर्पिल की त्रिज्या 500 cm है, तो n का मान ज्ञात कीजिए। *1*

(iii) (क) 11वीं सर्पिल तक कुल कितने पौधे लगाए गए ? *2*

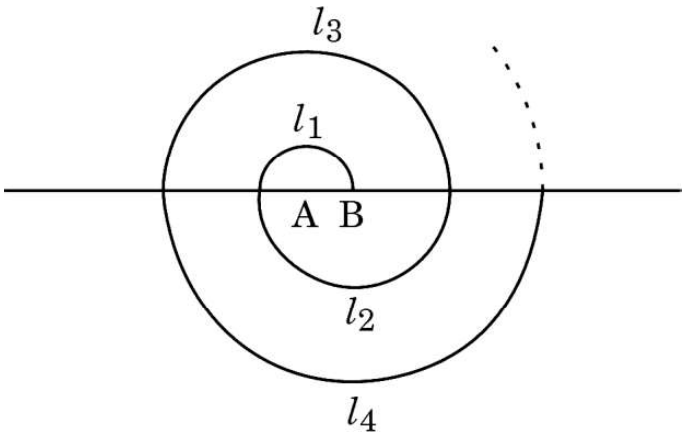
अथवा

(ख) कौन-सी सर्पिल तक, कुल 450 पौधे लगे होंगे ? *2*

• • •

Case Study – 2

37. In a garden, saplings of rose flowers were planted at equal intervals to form a spiral pattern. The spiral is made up of successive semicircles, with centres alternatively at A and B, starting with centre at A, of radii 50 cm, 100 cm, 150 cm, ... as shown in the figure given below. Spiral 1 has 10 flowers, Spiral 2 has 20 flowers, Spiral 3 has 30 flowers and so on.



Based on the above information, answer the following questions :

(i) What is the radius of the 13^{th} spiral ? *1*

(ii) If the radius of the n^{th} spiral is 500 cm, find the value of n. *1*

(iii) (a) Find the total number of saplings till the 11^{th} spiral. *2*

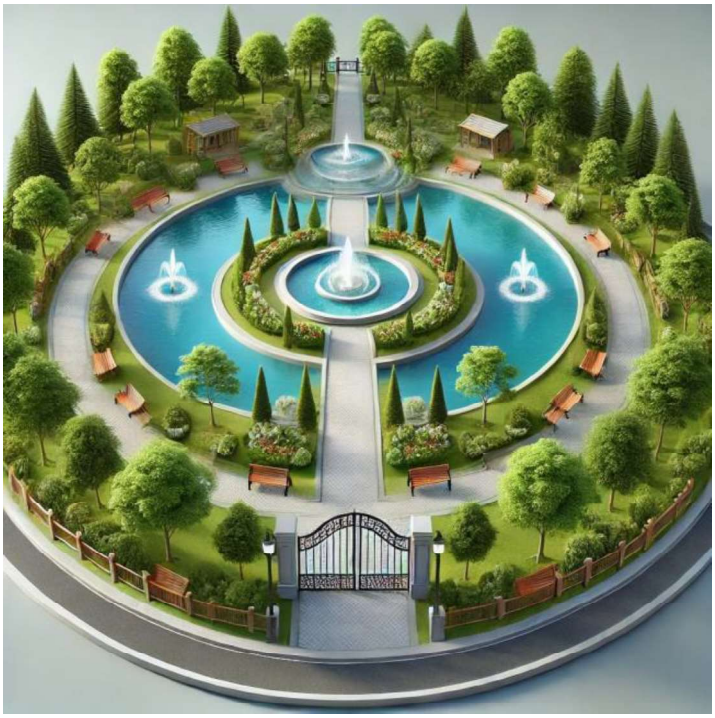
OR

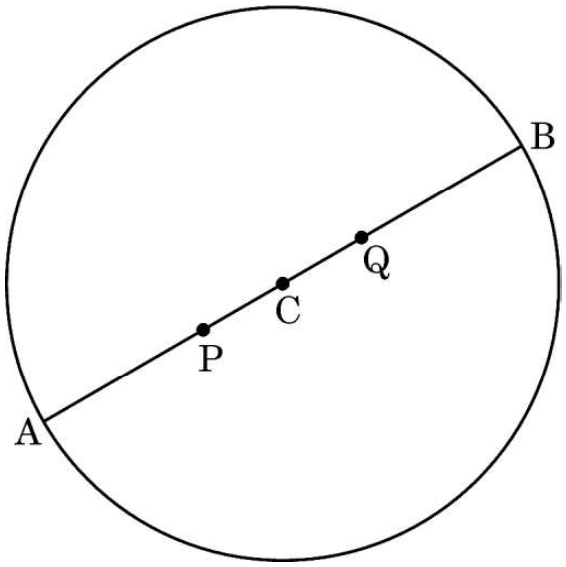
(b) Till which spiral, will there be a total of 450 saplings ? *2*

• • •

प्रकरण अध्ययन – 3

38. एक सोसाइटी में एक वृत्ताकार पार्क है जिसके दो गेट हैं । ये दोनों गेट बिन्दु A(10, 20) और B(50, 50) पर लगे हैं, जैसा की नीचे चित्र में दिखाया गया है । दो फव्वारे बिन्दु P और Q, जो रेखाखंड AB पर स्थित हैं, इस तरह लगाए गए हैं कि AP = PQ = QB.





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

(i) केन्द्र C के निर्देशांक ज्ञात कीजिए। *1*

(ii) वृत्ताकार पार्क की त्रिज्या ज्ञात कीजिए। *1*

(iii) (क) बिन्दु P के निर्देशांक ज्ञात कीजिए। *2*

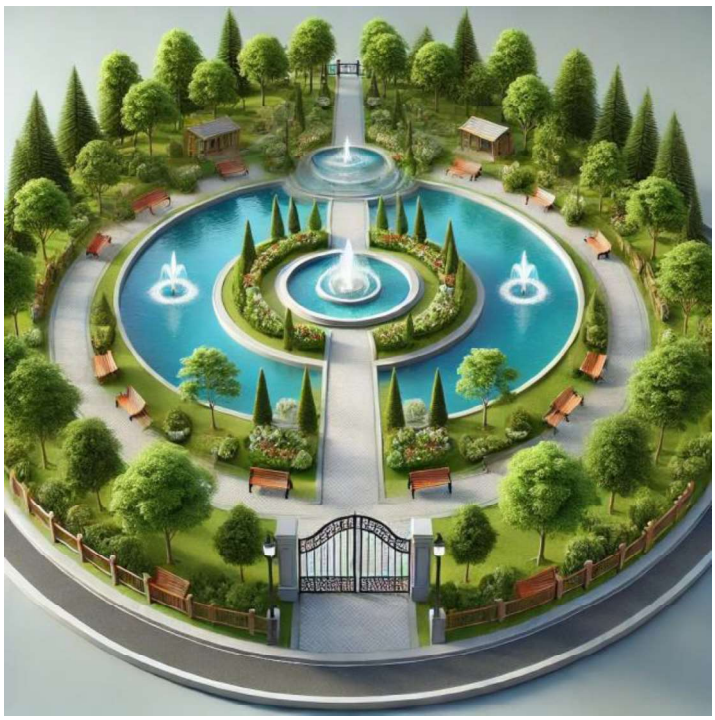
अथवा

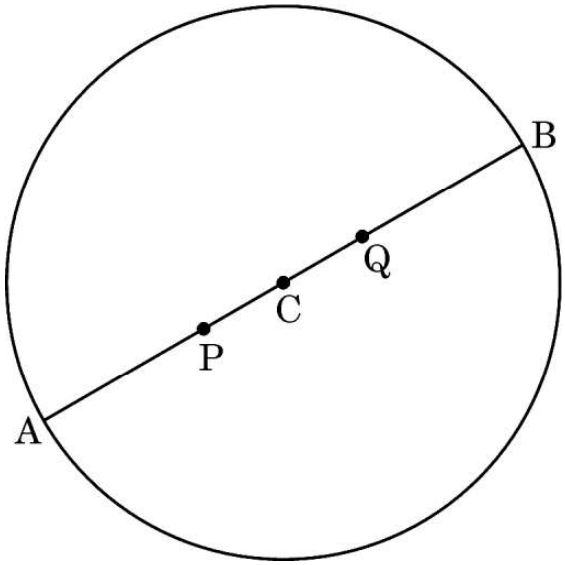
(ख) गेट A से Q पर लगे फव्वारे की दूरी ज्ञात कीजिए। *2*

• • •

Case Study – 3

38. In a society, there is a circular park having two gates. The gates are placed at points A(10, 20) and B(50, 50), as shown in the figure below. Two fountains are installed at points P and Q on AB such that AP = PQ = QB.





Based on the above information, answer the following questions :

(i) Find the coordinates of the centre C. *1*

(ii) Find the radius of the circular park. *1*

(iii) (a) Find the coordinates of the point P. *2*

OR

(b) Find the distance of the fountain at Q from gate A. *2*

Marking Scheme Strictly Confidential
(For Internal and Restricted use only) Secondary School Examination, 2025
SUBJECT NAME MATHEMATICS (BASIC) (Q.P. CODE 430/1/1)

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.

MARKING SCHEME
MATHEMATICS (BASIC)

SECTION A

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

1. If the HCF of two positive integers a and b is 1, then their LCM is :

(A) $a + b$ (B) a

(C) b (D) ab

Answer : (D) ab — 1

2. The number $3 + \sqrt{2}$ is :

(A) a rational number (B) an irrational number

(C) an integer (D) a natural number

Answer : (B) an irrational number — 1

3. The discriminant of the quadratic equation $x^2 - 3x - 2 = 0$ is :

(A) 1 (B) 17

(C) $\sqrt{17}$ (D) $-\sqrt{17}$

Answer : (B) 17 — 1

4. The equation $x + \frac{1}{x} = 3$ $(x \neq 0)$ is expressed as a quadratic equation in the form of $ax^2 + bx + c = 0$. The value of $a - b + c$ is :

(A) 5 (B) 2

(C) 1 (D) -1

Answer : (A) 5 — 1

5. For a point $(3, -5)$, the value of (abscissa – ordinate) is :

(A) -8 (B) -2

(C) 2 (D) 8

Answer : (D) 8 — 1

6. The mid-point of a line segment divides the line segment in the ratio :

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

(C) 1 : 1 (D) $\frac{1}{2} : 2$

Answer : (C) 1 : 1 — 1

7. Which of the following is ***not*** the criterion for similarity of triangles ?

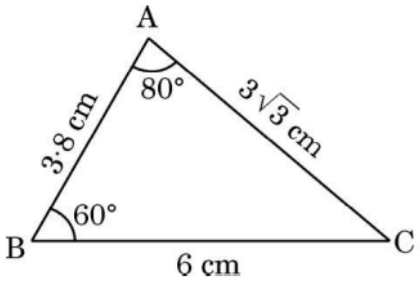
(A) AAA (B) SSS

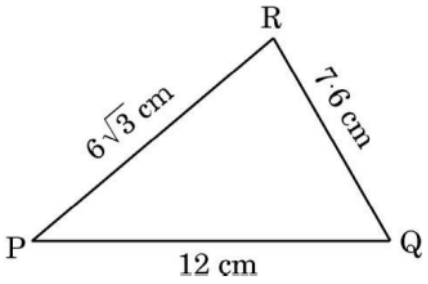
(C) SAS (D) RHS

Answer : None of the given options is correct. 1

Note – One mark to be given to all students who have attempted this question.

8. From the figures given below, which of the following is true about the measure of $\angle P$?





(A) $\angle P = 60°$

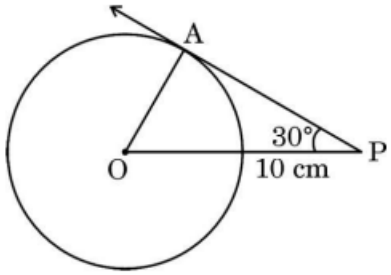
(B) $\angle P = 80°$

(C) $\angle P = 40°$

(D) The measure of $\angle P$ cannot be determined

Answer : (C) $\angle P = 40°$ 1

9. In the given figure, PA is a tangent to a circle with centre O. If OP = 10 cm, then the length of AP is :



(A) $10\sqrt{3}$ cm

(B) 20 cm

(C) 5 cm

(D) $5\sqrt{3}$ cm

Answer : (D) $5\sqrt{3}$ cm 1

10. Which of the following statements is ***false*** ?

(A) $\tan 45° = \cot 45°$

(B) $\sin 90° = \tan 45°$

(C) $\sin 30° = \cos 30°$

(D) $\sin 45° = \cos 45°$

Answer : (C) $\sin 30° = \cos 30°$ — 1

11. The value of $\left(\tan^2 A - \frac{1}{\cos^2 A}\right)$ is :

(A) more than 1

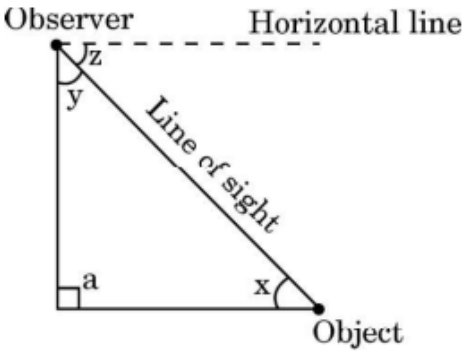
(B) 1

(C) 0

(D) – 1

Answer : (D) – 1 — 1

12. In the given figure, which of the following angles represents the angle of depression ?



(A) x

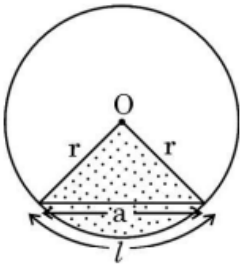
(B) y

(C) z

(D) a

Answer : (C) z — 1

13. The perimeter of the shaded region in the given figure is :



(A) l

(B) $l + a$

(C) $l + 2r$

(D) $l + 2r + a$

Answer : (C) $l + 2r$ — 1

14. The ratio of the area of a quadrant of a circle to the area of the same circle is :

(A) 1 : 2

(B) 2 : 1

(C) 1 : 4

(D) 4 : 1

Answer : (C) 1 : 4 — 1

15. For which of the following solids is the lateral/curved surface area and total surface area the same ?

(A) Cube

(B) Cuboid

(C) Hemisphere

(D) Sphere

Answer : (D) Sphere — 1

16. The class mark of the median class of the following data is :

Class Interval	10 – 25	25 – 40	40 – 55	55 – 70	70 – 85	85 – 100
Frequency	2	3	7	6	6	6

(A) 40

(B) 55

(C) 47·5

(D) 62·5

Answer : (D) 62·5 — 1

17. The following distribution shows the number of runs scored by some batsmen in test matches :

Runs Scored	3000 – 4000	4000 – 5000	5000 – 6000	6000 – 7000
Number of Batsmen	5	10	9	8

The lower limit of the modal class is :

(A) 3000

(B) 4000

(C) 5000

(D) 6000

Answer : (B) 4000 — 1

18. In a random experiment of throwing a die, which of the following is a sure event ?

(A) Getting a number between 1 and 6

(B) Getting an odd number < 7

(C) Getting an even number < 7

(D) Getting a natural number < 7

Answer : (D) Getting a natural number < 7 — 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) :* For any two natural numbers a and b, the HCF of a and b is a factor of the LCM of a and b.

Reason (R) : HCF of any two natural numbers divides both the numbers.

Answer : (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A). — 1

20. *Assertion (A) :* The value of p for which the system of equations $4x + py + 8 = 0$ and $2x + 2y + 2 = 0$ is consistent is 4.

Reason (R) : The system of equations $a_1x + b_1y = c_1$ and $a_2x + b_2y = c_2$ is consistent with infinitely many solutions, if $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$.

Answer : (D) Assertion (A) is false, but Reason (R) is true.	1

SECTION B

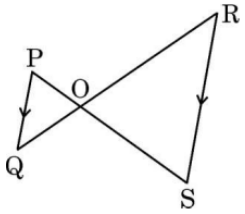
*This section has **5** Very Short Answer (VSA) type questions carrying **2** marks each.* *5×2=10*

21. Solve the following system of equations for x and y :

$$\frac{x}{2} + \frac{2y}{3} = -1 \quad \text{and} \quad x - \frac{y}{3} = 3$$

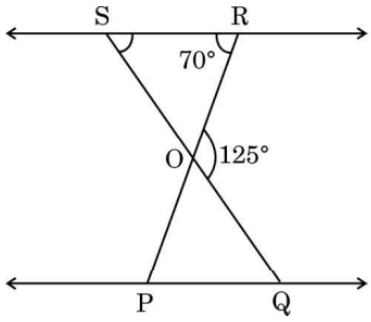
Solution : Solving the two equations to get x = 2, y = – 3	1 + 1

22. (a) In the given figure, if PQ ∥ RS, then prove that Δ POQ ~ Δ SOR.



OR

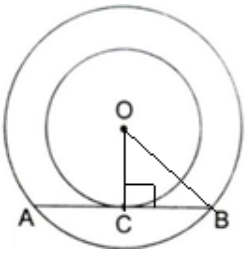
(b) In the given figure, Δ OSR ~ Δ OQP, ∠ ROQ = 125° and ∠ ORS = 70°. Find the measures of ∠ OSR and ∠ OQP.



Solution : (a) As PQ ∥ RS ∠ P = ∠ S ∠ Q = ∠ R } Alternate interior angles ∴ ΔPOQ ~ ΔSOR (by AA similarity criterion) **OR** (b) ∠ OSR = 125° – 70° = 55° [by exterior angle property] As Δ OSR ~ Δ OQP ∠ OSR = ∠ OQP (Corresponding angles of similar triangles) ∠ OQP = 55°	1 1 1 ½ ½

23. Two concentric circles are of radii 6 cm and 10 cm. Find the length of the chord of the larger circle which touches the smaller circle.

Solution:



Correct figure ½

$BC^2 = OB^2 - OC^2$

$\Rightarrow BC^2 = 10^2 - 6^2 = 64$ 1

$\Rightarrow BC = 8$ cm

$AB = 8 \times 2 = 16$ cm ½

24. (a) Find the values of A and B $(0 \le A < 90°,\ 0 \le B < 90°)$, if $\tan(A + B) = 1$ and $\tan(A - B) = \frac{1}{\sqrt{3}}$.

OR

(b) Prove that $\tan 45° = 1$ geometrically.

Solution: (a) $A + B = 45°$ ½

$A - B = 30°$ ½

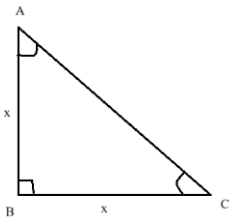
Solving and getting $A = 37{\cdot}5°$ and $B = 7{\cdot}5°$ 1

OR

(b) Consider an isosceles right Δ ABC ½

Using angle sum property $\angle A = \angle C = 45°$ ½

Clearly, $\tan 45° = \frac{AB}{BC} = \frac{x}{x} = 1$ 1



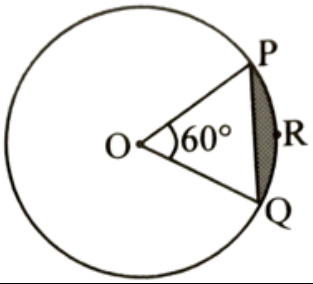
25. A chord of a circle of diameter 20 cm subtends an angle of 60° at the centre of the circle. Find the area of the corresponding minor segment of the circle. (Use $\pi = 3{\cdot}14$ and $\sqrt{3} = 1{\cdot}73$)

Solution: Radius of circle = 10 cm = r ½

Δ OPQ is an equilateral triangle.

Area of segment = $\frac{1}{6} \times (3.14) \times (10)^2 - \frac{\sqrt{3}}{4} \times (10)^2$ 1

$= \frac{109}{12}$ sq. cm or 9.08 sq. cm ½



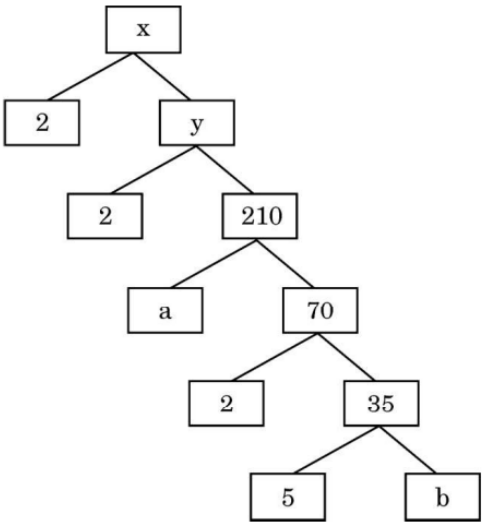
SECTION C

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

26. (a) Prove that $\sqrt{3}$ is an irrational number.

OR

(b) The factor tree of a number x is shown below :



Find the values of x, y, a and b. Hence, write the product of the prime factors of the number x so obtained.

Solution: (a) Let $\sqrt{3}$ be a rational number such that $\sqrt{3} = \frac{p}{q}$ (p and q are co-prime numbers, $q \neq 0$) ½

$\sqrt{3}q = p \Rightarrow 3q^2 = p^2$

3 divides $p^2 \Rightarrow$ 3 divides p as well 1

Let, $p = 3m$ (for some integer m)

$3q^2 = 9m^2 \Rightarrow q^2 = 3m^2$

3 divides $q^2 \Rightarrow$ 3 divides q as well 1

p and q have a common factor 3, which is a contradiction as p and q are co-prime.

$\therefore$ our assumption is wrong ½

Hence, $\sqrt{3}$ is an irrational number

OR

(b) $b = 7$ ½

$a = 3$ ½

$y = 420$ ½

$x = 840$ ½

$x = 840 = 2^3 \times 3 \times 5 \times 7$ 1

27. Find a quadratic polynomial whose sum and product of zeroes are 0 and – 9, respectively. Also, find the zeroes of the polynomial so obtained.

Solution: Polynomial is $x^2 - 0\,(x) + (-9) = x^2 - 9$ 1

For zeroes :

$x^2 - 9 = (x + 3)(x - 3)$ 1

Zeroes are $-3, 3$ 1

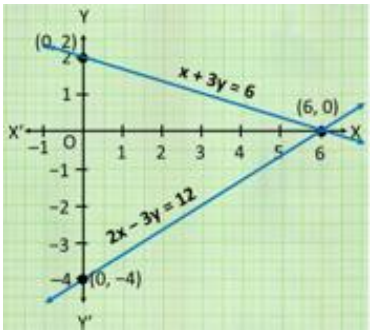
28. (a) Solve the following system of equations graphically :

$x + 3y = 6;\ 2x - 3y = 12$

OR

(b) x and y are complementary angles such that $x : y = 1 : 2$. Express the given information as a system of linear equations in two variables and hence solve it.

Solution: (a) Correct graph of each equation — 1+1



Solution is x = 6, y = 0 or (6, 0) — 1

OR

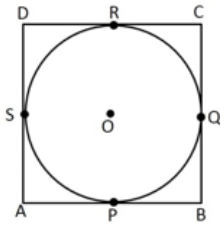
(b) x + y = 90° — 1

2x = y — 1

Solving to get x = 30°, y = 60° — ½ + ½

29. Prove that a rectangle circumscribing a circle is a square.

Solution:



Correct figure ½

As the length of tangents from an external point to a circle are equal

Thus,

AP = AS

BP = BQ

DR = DS

CR = CQ — 1

Adding the above equations,

AB+CD=BC+AD

As AB =CD & BC = AD (opp. sides of rectangle)

$\Rightarrow$ AB = AD — 1

$\therefore$ ABCD is a square — ½

30. Prove that :

$$\frac{1+\cot^2 A}{1+\tan^2 A} = \left(\frac{1-\cot A}{1-\tan A}\right)^2$$

Solution: $LHS = \frac{1+\frac{cos^2A}{sin^2A}}{1+\frac{sin^2A}{cos^2A}} = \frac{\frac{sin^2A+cos^2A}{sin^2A}}{\frac{cos^2A+sin^2A}{cos^2A}} = \frac{cos^2A}{sin^2A}$ — 1

$= \frac{cos^2A}{sin^2A}\left(\frac{sinA-cosA}{cosA-sinA}\right)^2 = \left(\frac{\frac{sinA-cosA}{sinA}}{\frac{cosA-sinA}{cosA}}\right)^2$ — 1½

$= \left(\frac{1-cotA}{1-tanA}\right)^2$ = RHS — ½

31. A lot consists of 200 pens of which 180 are good and the rest are defective. A customer will buy a pen if it is not defective. The shopkeeper draws a pen at random and gives it to the customer. What is the probability that the customer will not buy it ? Another lot of 100 pens containing 80 good pens is mixed with the previous lot of 200 pens. The shopkeeper now draws one pen at random from the entire lot and gives it to the customer. What is the probability that the customer will buy the pen ?

Solution:

P (customer will not buy the pen) = $\frac{20}{200} = \frac{1}{10}$ — 1

After mixing the two lots

Total pens = 200 + 100 = 300

Number of good pens = 180 + 80 = 260 — 1

P (customer will buy the pen) = $\frac{260}{300}$ or $\frac{13}{15}$ — 1

SECTION D

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

32. (a) The difference of the squares of two positive numbers is 180. The square of the smaller number is 8 times the greater number. Find the two numbers.

OR

(b) Find the value(s) of k for which the equation $2x^2 + kx + 3 = 0$ has real and equal roots. Hence, find the roots of the equations so obtained.

Solution: (a) Let the smaller number be y and greater number be x.

A.T.Q.

$x^2 - y^2 = 180$ — 1

$y^2 = 8x$ — 1

$\Rightarrow x^2 - 8x = 180$

$x^2 - 8x - 180 = 0$ — 1

$(x - 18)(x + 10) = 0$

$x = 18, x = -10$ (rejected) — 1

$\therefore$ The numbers are 18 and 12 — 1

OR

(b) For equal roots; $b^2 - 4ac = 0$

$k^2 - 24 = 0$ — 1

$\Rightarrow k = \pm 2\sqrt{6}$ — 1

Equations are

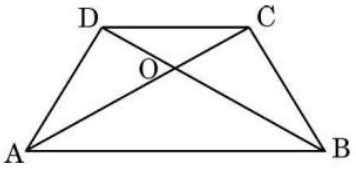
$2x^2 + 2\sqrt{6}x + 3 = 0$; $2x^2 - 2\sqrt{6}x + 3 = 0$

Roots are $x = -\sqrt{\frac{3}{2}}, -\sqrt{\frac{3}{2}}$; $x = \sqrt{\frac{3}{2}}, \sqrt{\frac{3}{2}}$ — ½ + ½

1 + 1

33. State "Basic Proportionality Theorem" and use it to prove the following :

In a quadrilateral ABCD, diagonals AC and BD intersect each other at O such that $\frac{AO}{BO} = \frac{CO}{DO}$ as shown in the given figure. Prove that ABCD is a trapezium.



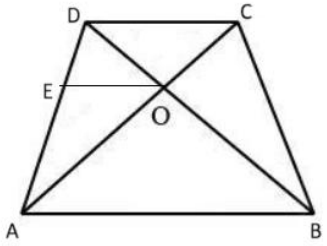
Solution: Statement: If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, the other two sides are divided in the same ratio. — 1

Given : ABCD is a quadrilateral in which $\frac{AO}{BO} = \frac{CO}{DO}$ — Correct figure, given, to prove and construction

To Prove : AB ∥ CD

Construction : Draw OE ∥ AB

Proof : In Δ DAB, OE ∥ AB — 1



$\therefore \frac{DE}{AE} = \frac{DO}{BO}$ (by BPT) — 1

Also $\frac{AO}{BO} = \frac{CO}{DO}$ (given)

$\Rightarrow \frac{DO}{BO} = \frac{CO}{AO}$

$\therefore \frac{DE}{AE} = \frac{CO}{AO}$ — ½

In Δ ADC,

$\frac{DE}{AE} = \frac{CO}{AO}$

$\therefore$ OE ∥ CD (by converse of BPT) — 1

As OE ∥ AB and OE ∥ CD

$\therefore$ AB ∥ CD — ½

Hence, ABCD is a trapezium

34. (a) A toy is in the form of a cone surmounted on a hemisphere. The cone and hemisphere have the same radii. The height of the conical part of the toy is equal to the diameter of its base. If the radius of the conical part is 5 cm, find the volume of the toy.

OR

(b) A cubical block is surmounted by a hemisphere of radius 3·5 cm. What is the smallest possible length of the edge of the cube so that the hemisphere can totally lie on the cube ? Find the total surface area of the solid so formed.

Solution: (a) Radius = r = 5 cm

Height of cone = h = 10 cm

Volume of toy = volume of hemisphere + volume of cone — 2+2

$= \frac{2}{3}\pi r^3 + \frac{1}{3}\pi r^2 h$

$= \frac{2}{3} \times \frac{22}{7} \times 5 \times 5 \times 5 + \frac{1}{3} \times \frac{22}{7} \times 5 \times 5 \times 10$

$= \frac{5500}{21} + \frac{5500}{21}$

$= \frac{11000}{21}$ cu. cm or 523.81 cu. cm — 1

OR

(b) Edge of cube = a = 3·5 × 2 = 7 cm — 1

Total surface area of solid

$= 6a^2 + 2\pi r^2 - \pi r^2$

$= 6a^2 + \pi r^2$

$= 6 \times 7 \times 7 + \frac{22}{7} \times 3{\cdot}5 \times 3{\cdot}5$ — 1½ + 1½

$= \frac{665}{2}$ sq. cm or 332·5 sq. cm — 1

35. The following data gives the information on the observed lifetime (in hours) of 200 electrical components :

Lifetime (in hours)	*Number of electrical components*
0 – 20	10
20 – 40	35
40 – 60	50
60 – 80	60
80 – 100	30
100 – 120	15

Find the mean lifetime (in hours) of the electrical components.

Solution:

CI	x_i	f_i	$u_i = \frac{x_i - a}{20}$	$f_i u_i$
0 – 20	10	10	– 2	– 20
20 – 40	30	35	– 1	– 35
40 – 60	50 = a	50	0	0
60 – 80	70	60	1	60
80 – 100	90	30	2	60
100 – 120	110	15	3	45
Total		200		110

Correct table 2

Mean = $50 + \frac{110}{200} \times 20$ — 2

Mean = 61 — 1

Thus the mean lifetime of the electrical components is 61 hours.

SECTION E

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

Case Study – 1

36. An injured bird was found on the roof of a building. The building is 15 m high. A fireman was called to rescue the bird. The fireman used an adjustable ladder to reach the roof. He placed the ladder in such a way that the ladder makes an angle of 60° with the ground in order to reach the roof.

Based on the above information, answer the following questions :

(i) Find the length of the ladder used by the fireman to reach the roof. *1*

(ii) Find the distance of the point on the ground at which the ladder was fixed from the bottom of the building. *1*

(iii) In order to avoid skidding, the fireman placed the ladder in such a way that the bottom of the ladder touches the base of the wall which is opposite to the building, making an angle of 30° with the ground.

(a) Draw a neat diagram to represent the above situation and hence find the width of the road between the building and the wall. *2*

OR

(b) Find the length of the ladder used by the fireman in this case. *2*

Solution: (i) Let the length of the ladder be 'a'

$\frac{15}{a} = \sin 60°$ ½

$a = \frac{30}{\sqrt{3}}$ or $10\sqrt{3}$ ½

Thus the length of the ladder is $\frac{30}{\sqrt{3}}$ m or $10\sqrt{3}$ m

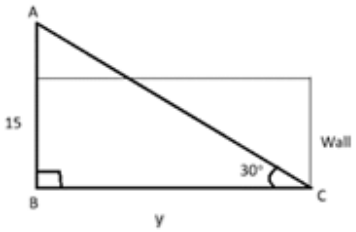
(ii) Let the distance of the point on the ground be 'x'

$\frac{15}{x} = \tan 60°$ ½

$x = \frac{15}{\sqrt{3}}$ or $5\sqrt{3}$ ½

Thus, the distance of the point on the ground is $\frac{15}{\sqrt{3}}$ m or $5\sqrt{3}$ m

(iii) (a) Let the width of the road be y.



Correct figure 1

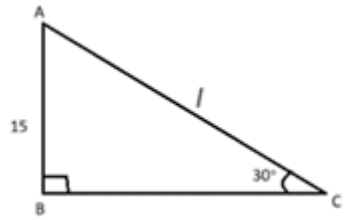
$\frac{15}{y} = \tan 30°$ ½

$y = 15\sqrt{3}$ ½

Thus, the width of the road is $15\sqrt{3}$ m.

OR

(b) Let the length of the ladder be l.



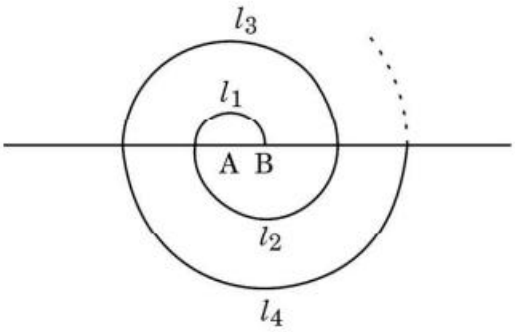
$\frac{15}{l} = \sin 30°$ 1

$l = 30$

Thus, the length of the ladder is 30 m. 1

Case Study – 2

37. In a garden, saplings of rose flowers were planted at equal intervals to form a spiral pattern. The spiral is made up of successive semicircles, with centres alternatively at A and B, starting with centre at A, of radii 50 cm, 100 cm, 150 cm, ... as shown in the figure given below. Spiral 1 has 10 flowers, Spiral 2 has 20 flowers, Spiral 3 has 30 flowers and so on.



Based on the above information, answer the following questions :

(i) What is the radius of the 13^{th} spiral ? *1*

(ii) If the radius of the n^{th} spiral is 500 cm, find the value of n. *1*

(iii) (a) Find the total number of saplings till the 11^{th} spiral. *2*

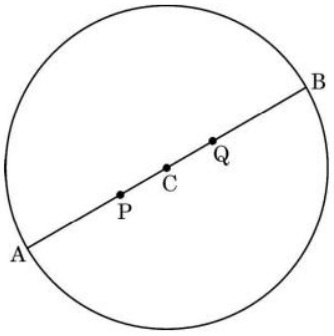
OR

(b) Till which spiral, will there be a total of 450 saplings ? *2*

Solution: (i) $a_{13} = 650$ cm		1
(ii) $a_n = 500$		
$50 + (n - 1)50 = 500$		
$n = 10$		1
(iii) (a) $a = 10, d = 10$		
$S_{11} = \frac{11}{2}[20 + 10 \times 10]$		1½
$= 660$		½
OR		
(b) $a = 10, d = 10$		
$450 = \frac{n}{2}[20 + (n - 1)\ 10]$		1
$n^2 + n - 90 = 0$		½
$n = 9$		½

Case Study – 3

38. In a society, there is a circular park having two gates. The gates are placed at points A(10, 20) and B(50, 50), as shown in the figure below. Two fountains are installed at points P and Q on AB such that AP = PQ = QB.



Based on the above information, answer the following questions :

(i) Find the coordinates of the centre C. *1*

(ii) Find the radius of the circular park. *1*

(iii) (a) Find the coordinates of the point P. *2*

OR

(b) Find the distance of the fountain at Q from gate A. *2*

Solution: (i) Co-ordinates of C are $\left(\frac{10 + 50}{2}, \frac{20 + 50}{2}\right)$ = C(30, 35)		1
(ii) Radius = $\sqrt{(30 - 10)^2 + (35 - 20)^2}$ = 25		1
(iii) (a) P divides AB in the ratio 1 : 2,		½

	co-ordinates of P are $\left(\frac{1 \times 50 + 2 \times 10}{3}, \frac{1 \times 50 + 2 \times 20}{3}\right)$	½ + ½
	i.e. $\left(\frac{70}{3}, 30\right)$	½
	OR	
(b)	Distance AB = 2 × 25 = 50	½
	AQ = $\frac{2}{3}$AB = $\frac{2}{3}$× 50	1
	AQ = $\frac{100}{3}$	½