Series : EF3GH

SET~1

रोल नं.
Roll No.

प्रश्न-पत्र कोड
Q.P. Code **430/3/1**

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 $p = 2^3 \times 3^2 \times 5$ और $q = 2^2 \times 3^3$ है, तो p और q का LCM है :

(A) $2^3 \times 3^3$

(B) $2^2 \times 3^2$

(C) $2^2 \times 3^2 \times 5$

(D) $2^3 \times 3^3 \times 5$

2. 3^n, जहाँ n एक प्राकृत संख्या है, जिस अंक पर कभी-भी समाप्त नहीं होता है, वह अंक है :

(A) 3 (B) 5

(C) 7 (D) 9

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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 $p = 2^3 \times 3^2 \times 5$ and $q = 2^2 \times 3^3$, then the LCM of p and q is :

(A) $2^3 \times 3^3$

(B) $2^2 \times 3^2$

(C) $2^2 \times 3^2 \times 5$

(D) $2^3 \times 3^3 \times 5$

2. 3^n, where n is a natural number, cannot end with the digit :

(A) 3 (B) 5

(C) 7 (D) 9

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3. एक अभाज्य संख्या के :

(A) केवल दो ही अभाज्य गुणनखंड होते हैं

(B) केवल एक ही अभाज्य गुणनखंड होता है

(C) कम-से-कम एक अभाज्य गुणनखंड होता है

(D) कम-से-कम दो अभाज्य गुणनखंड होते हैं

4. k के किस/किन मान के लिए, समीकरण निकाय $kx + 2y = 3$ और $2x + y = 5$ का एक अद्वितीय हल है ?

(A) k = एक वास्तविक संख्या

(B) $k \neq 8$

(C) $k \neq 4$

(D) $k = 4$

5. यदि $x = \sqrt{x}$, $(x \neq 0)$ को एक द्विघात समीकरण $ax^2 + bx + c = 0$ के रूप में व्यक्त किया जाए, तो $a + b + c$ का मान है :

(A) 0 (B) 1

(C) 2 (D) 3

6. यदि बिंदुओं (3, 5) और (2a, b) को जोड़ने वाले रेखाखंड का मध्य-बिन्दु (1, 2) है, तो (a, b) =

(A) $(-1, -1)$ (B) $\left(-\frac{1}{2}, -\frac{1}{2}\right)$

(C) $\left(-\frac{1}{2}, -1\right)$ (D) $\left(-1, -\frac{1}{2}\right)$

7. y-अक्ष से बिंदु $(-3, 4)$ की दूरी है :

(A) -3 (B) 3

(C) 4 (D) 5

8. $\frac{\sec^2 30^\circ + \tan^2 30^\circ}{\sin^2 45^\circ + \cos^2 45^\circ}$ का मान है :

(A) 1 (B) $\frac{5}{3}$

(C) $\frac{13}{3}$ (D) 7

• • •

3. A prime number has :

(A) exactly two prime factors

(B) exactly one prime factor

(C) at least one prime factor

(D) at least two prime factors

4. For what value(s) of k does the system of equations $kx + 2y = 3$ and $2x + y = 5$ have a unique solution ?

(A) k = a real number

(B) $k \neq 8$

(C) $k \neq 4$

(D) $k = 4$

5. If $x = \sqrt{x}$, $(x \neq 0)$ is expressed as a quadratic equation in the form $ax^2 + bx + c = 0$, then the value of $a + b + c$ is :

(A) 0 (B) 1

(C) 2 (D) 3

6. If point (1, 2) is the mid-point of the line segment joining the points (3, 5) and (2a, b), then (a, b) =

(A) $(-1, -1)$ (B) $\left(-\frac{1}{2}, -\frac{1}{2}\right)$

(C) $\left(-\frac{1}{2}, -1\right)$ (D) $\left(-1, -\frac{1}{2}\right)$

7. The distance of point $(-3, 4)$ from y-axis is :

(A) -3 (B) 3

(C) 4 (D) 5

8. The value of $\frac{\sec^2 30^\circ + \tan^2 30^\circ}{\sin^2 45^\circ + \cos^2 45^\circ}$ is :

(A) 1 (B) $\frac{5}{3}$

(C) $\frac{13}{3}$ (D) 7

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9. निम्नलिखित में से किस प्रकार के त्रिभुज सदैव समरूप होते हैं ?

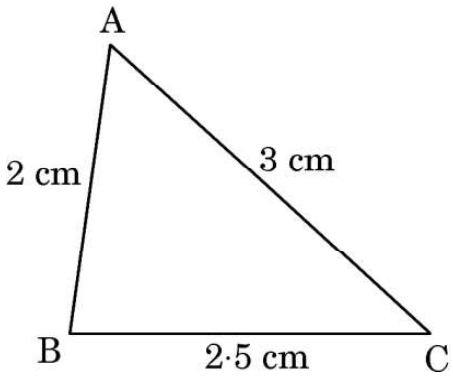
(A) समकोण त्रिभुज

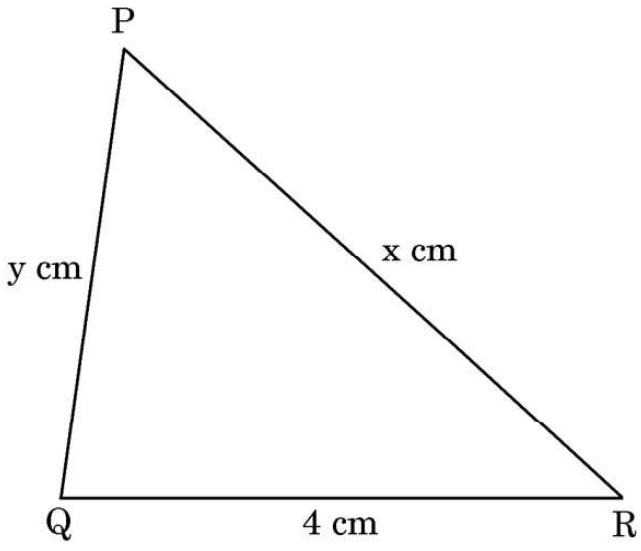
(B) न्यूनकोण त्रिभुज

(C) समद्विबाहु त्रिभुज

(D) समबाहु त्रिभुज

10. नीचे दी गई आकृतियों में, x और y के किन मानों के लिए Δ ABC और Δ QRP समरूप होंगे ?





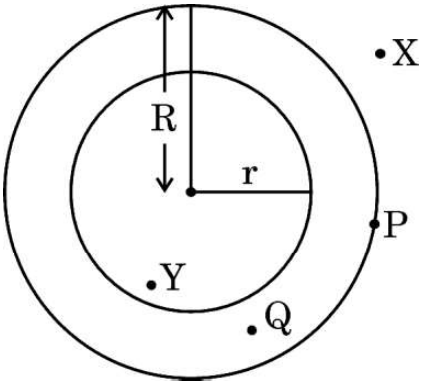
(A) x = 6, y = 5

(B) x = 5, y = 6

(C) x = 6, y = 6

(D) x = 12, y = 3·2

11. दी गई आकृति में, किस बिंदु से त्रिज्या r वाले वृत्त पर स्पर्श-रेखा ***नहीं*** बनाई जा सकती है ?



(A) X (B) P

(C) Q (D) Y

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9. Which types of triangles are always similar ?

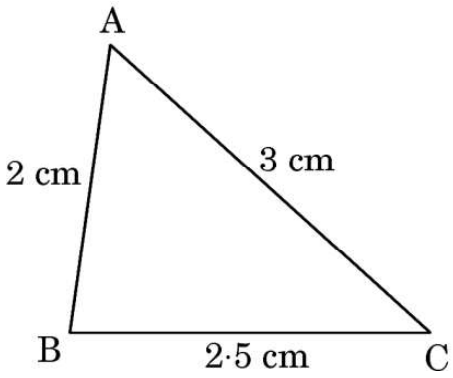
(A) Right-angled triangles

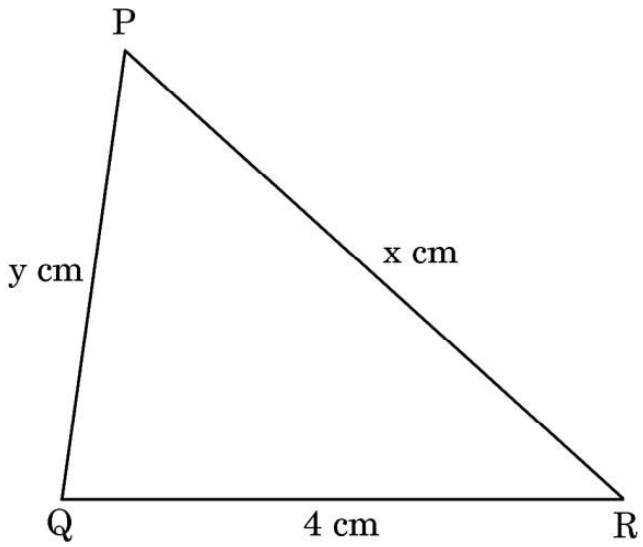
(B) Acute-angled triangles

(C) Isosceles triangles

(D) Equilateral triangles

10. What values of x and y will make Δ ABC similar to Δ QRP in the figures given below ?





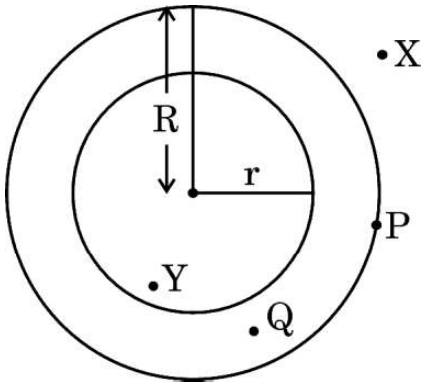
(A) x = 6, y = 5

(B) x = 5, y = 6

(C) x = 6, y = 6

(D) x = 12, y = 3·2

11. In the given figure, from which point can the tangent ***not*** be drawn to the circle with radius r ?



(A) X (B) P

(C) Q (D) Y

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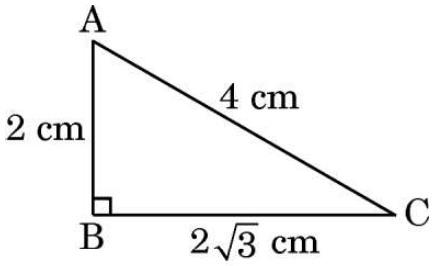
12. दी गई आकृति में, बिंदु C से बिंदु A का उन्नयन कोण क्या है ?



(A) 30° (B) 45°

(C) 60° (D) ज्ञात नहीं किया जा सकता है

13. किसी वृत्त के एक त्रिज्यखंड का कोण जिसका क्षेत्रफल, वृत्त के क्षेत्रफल का एक-आठवाँ भाग है, है :

(A) $22\frac{1}{2}^{\circ}$ (B) 45°

(C) 60° (D) 90°

14. एक वृत्त, जिसकी परिधि 22 cm है, के एक चतुर्थांश का परिमाप है :

(A) 29 cm

(B) 22 cm

(C) 12·5 cm

(D) 5·5 cm

15. एक शंकु और एक बेलन एक ही ऊँचाई और एक ही त्रिज्या के हैं। शंकु के आयतन का अनुपात बेलन के आयतन से है :

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

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

16. निम्नलिखित सारणी में एक कक्षा के 23 विद्यार्थियों द्वारा प्राप्त अंकों को दर्शाया गया है।

प्राप्तांक	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
विद्यार्थियों की संख्या	5	3	4	8	3

बहुलक वर्ग की निचली सीमा है :

(A) 10 (B) 20

(C) 30 (D) 40

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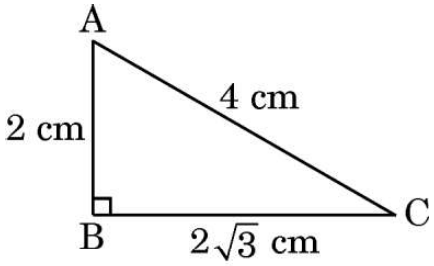
12. In the given figure, the angle of elevation of point A from point C is :



(A) 30° (B) 45°

(C) 60° (D) Cannot be determined

13. The angle of the sector of a circle whose area is one-eighth of the area of the circle is :

(A) $22\frac{1}{2}^{\circ}$ (B) 45°

(C) 60° (D) 90°

14. The perimeter of a quadrant of a circle of circumference 22 cm is :

(A) 29 cm

(B) 22 cm

(C) 12·5 cm

(D) 5·5 cm

15. A cone and cylinder have same height and same radius. The volume of the cone and the volume of the cylinder are in the ratio :

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

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

16. The following table shows the marks scored by 23 students of a class.

Marks	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
Number of Students	5	3	4	8	3

The lower limit of the modal class is :

(A) 10 (B) 20

(C) 30 (D) 40

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17. किसी बंटन के लिए, यदि माध्य = 15 और बहुलक = 12 है, तो उसका माध्यक होगा :

(A) 12

(B) 13

(C) 14

(D) 15

18. पासों का एक युग्म एक साथ उछाला जाता है। माना E घटना ''दोनों पासों पर आई संख्याओं का योगफल कम-से-कम 9 है'' को निरूपित करती है। घटना E के संभव परिणामों की संख्या है :

(A) 4

(B) 6

(C) 10

(D) 26

*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) :* $\sin\theta = 1$ के लिए, $\cos\theta$ को 0 होना चाहिए।

तर्क (R) : $\sin^2\theta - \cos^2\theta = 1$.

20. *अभिकथन (A) :* प्रत्येक द्विघात समीकरण के दो वास्तविक मूल होते हैं।

तर्क (R) : एक द्विघात बहुपद के अधिक-से-अधिक दो शून्यक हो सकते हैं।

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17. For a distribution, if mean = 15 and mode = 12, then its median is :

(A) 12

(B) 13

(C) 14

(D) 15

18. A pair of dice is thrown simultaneously. Let E denote the event that "The sum of numbers obtained on both dice is at least 9." The number of outcomes in favour of event E is :

(A) 4

(B) 6

(C) 10

(D) 26

*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 $\sin \theta = 1$, $\cos \theta$ must be 0.

Reason (R) : $\sin^2 \theta - \cos^2 \theta = 1$.

20. *Assertion (A) :* Every quadratic equation has two real roots.

Reason (R) : A quadratic polynomial can have at most two zeroes.

• • •

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 ग्राफ़ विधि से हल कीजिए :

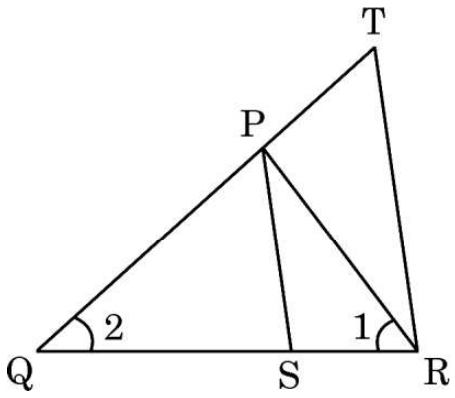
$2x - 3y = -6$ और $x = 3$

22. (क) 10 m ऊँचे एक ऊर्ध्वाधर खम्भे की धरती पर पड़ने वाली छाया की लम्बाई 15 m है और उसी समय पर, एक मीनार धरती पर 45 m की छाया बनाता है। मीनार की ऊँचाई ज्ञात कीजिए।

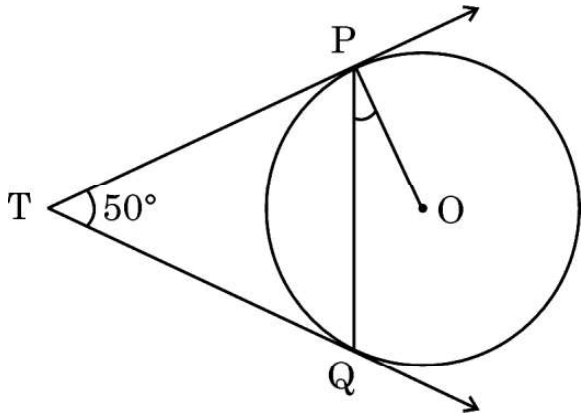
अथवा

(ख) दी गई आकृति में, $\frac{QR}{QS} = \frac{QT}{PR}$ और $\angle 1 = \angle 2$ है। सिद्ध कीजिए कि

$\Delta PQS \sim \Delta TQR$



23. दी गई आकृति में, TP और TQ दो स्पर्श-रेखाएँ हैं। यदि $\angle PTQ = 50°$ है, तो $\angle OPQ$ की माप 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*

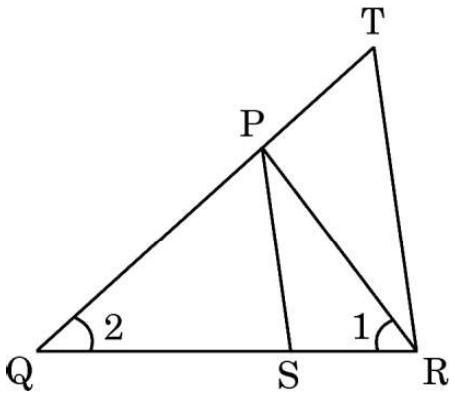
21. Solve the following system of equations graphically :

$2x - 3y = -6$ and $x = 3$

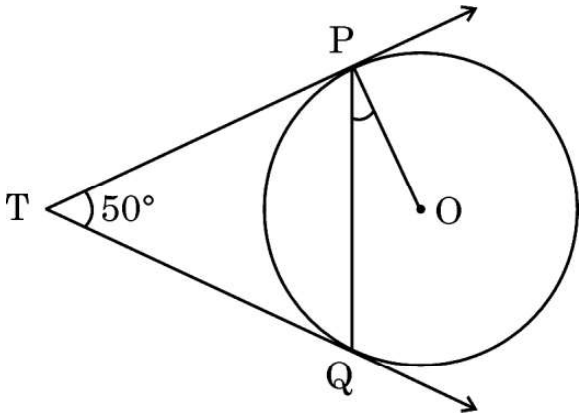
22. (a) A vertical pole of height 10 m casts a shadow of 15 m on the ground and at the same time, a tower casts a shadow of 45 m on the ground. Find the height of the tower.

OR

(b) In the given figure, $\frac{QR}{QS} = \frac{QT}{PR}$ and $\angle 1 = \angle 2$. Prove that $\Delta PQS \sim \Delta TQR$.



23. In the given figure, TP and TQ are two tangents. If $\angle PTQ = 50°$, then find the measure of $\angle OPQ$.



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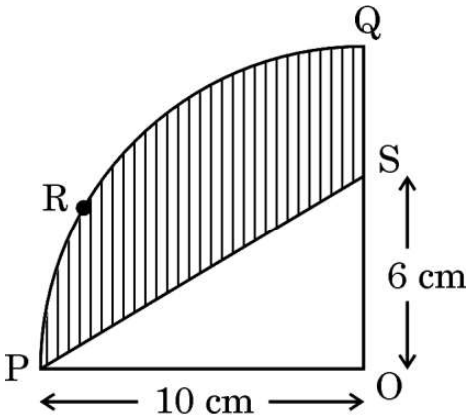
24. (क) यदि $\sin 3A = 1$ है, तो $\cos 2A - \tan^2 45°$ का मान ज्ञात कीजिए।

अथवा

(ख) यदि $(\sec A + \tan A)(1 - \sin A) = k \cos A$ है, तो k का मान ज्ञात कीजिए।

25. दी गई आकृति में, OPRQ, एक वृत्त जिसका केन्द्र O और त्रिज्या 10 cm है, का एक चतुर्थांश है। यदि OP = 10 cm और OS = 6 cm हो, तो छायांकित भाग का क्षेत्रफल ज्ञात कीजिए। ($\pi = 3{\cdot}14$ प्रयोग कीजिए)



खण्ड ग

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

26. (क) सिद्ध कीजिए कि $\sqrt{2}$ एक अपरिमेय संख्या है।

अथवा

(ख) ज्ञात कीजिए कि निम्नलिखित संख्याओं a, b और c में से कौन-सी भाज्य संख्या/संख्याएँ है/हैं।

$a = 7 \times 11 \times 13 + 13$

$b = 6 \times 5 \times 4 + 4$

$c = 7 \times 13 + 6$

27. बहुपद $9s^2 - 6s + 1$ के शून्यक ज्ञात कीजिए और दिए गए बहुपद के शून्यकों तथा गुणांकों के बीच संबंध की सत्यता की जाँच कीजिए।

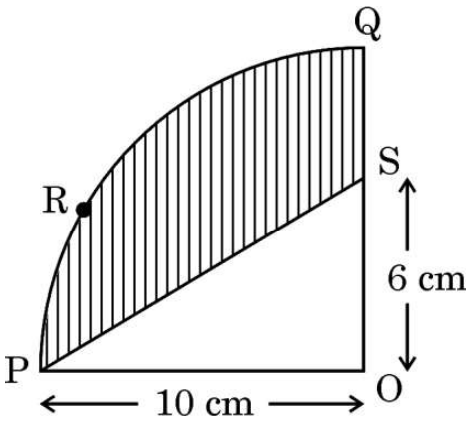
• • •

24. (a) If $\sin 3A = 1$, then find the value of $\cos 2A - \tan^2 45°$.

OR

(b) If $(\sec A + \tan A)(1 - \sin A) = k \cos A$, then find the value of k.

25. In the given figure, OPRQ is a quadrant of a circle with centre O and radius 10 cm. If OP = 10 cm and OS = 6 cm, find the area of the shaded region. (Use $\pi = 3{\cdot}14$)



SECTION C

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

26. (a) Prove that $\sqrt{2}$ is an irrational number.

OR

(b) Find which among the following numbers a, b and c is/are composite numbers.

$a = 7 \times 11 \times 13 + 13$

$b = 6 \times 5 \times 4 + 4$

$c = 7 \times 13 + 6$

27. Find the zeroes of the polynomial $9s^2 - 6s + 1$ and verify the relationship between the zeroes and the coefficients of the given polynomial.

• • •

28. (क) एक भिन्न $\frac{1}{3}$ हो जाता है, जब उसके अंश से 1 घटाया जाता है और वह $\frac{1}{4}$ हो जाता है, जब उसके हर में 8 जोड़ दिया जाता है। वह भिन्न ज्ञात कीजिए।

अथवा

(ख) k का वह मान ज्ञात कीजिए जिससे निम्नलिखित रैखिक समीकरणों के युग्म के अपरिमित रूप से अनेक हल हैं :

$$kx + 3y - (k - 3) = 0 \text{ और } 12x + ky - k = 0$$

इस प्रकार प्राप्त समीकरण युग्म के कोई दो हल ज्ञात कीजिए।

29. सिद्ध कीजिए कि :

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

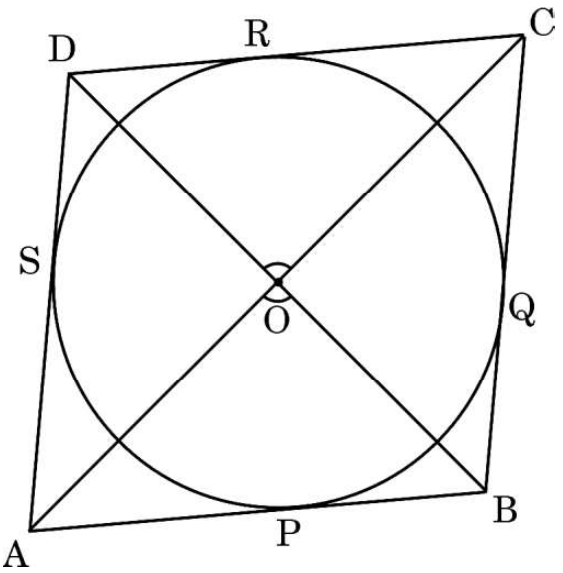
30. एक डिब्बे में 6 नीले, 4 सफेद और 8 लाल कंचे हैं। एक कंचा इस डिब्बे से यादृच्छया निकाला जाता है। प्रायिकता ज्ञात कीजिए कि निकाला गया कंचा :

(i) सफेद है

(ii) सफेद या लाल है

(iii) लाल नहीं है

31. दी गई आकृति में, एक चतुर्भुज ABCD में एक वृत्त बना है जो चतुर्भुज की भुजाओं AB, BC, CD और DA को क्रमश: बिन्दुओं P, Q, R तथा S पर स्पर्श करता है । सिद्ध कीजिए कि $\angle AOB + \angle COD = 180°$.



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28. (a) A fraction becomes $\frac{1}{3}$, when 1 is subtracted from the numerator and it becomes $\frac{1}{4}$, when 8 is added to its denominator. Find the fraction.

OR

(b) Find the value of k for which the following pair of linear equations will have infinitely many solutions :

$kx + 3y - (k - 3) = 0$ and $12x + ky - k = 0$

Hence, find any two solutions of the given pair of equations.

29. Prove that :

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

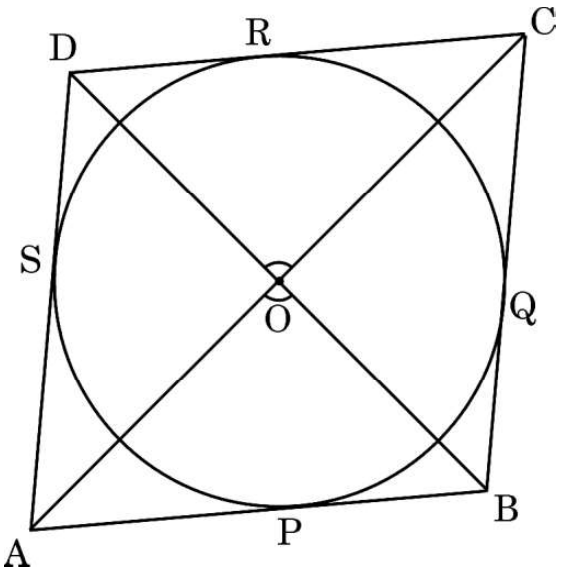
30. A box contains 6 blue, 4 white and 8 red marbles. A marble is drawn at random from this box. Find the probability that the marble so drawn is :

(i) white

(ii) white or red

(iii) not red

31. In the given figure, a circle is inscribed in a quadrilateral ABCD which touches the sides AB, BC, CD and DA at P, Q, R and S respectively. Prove that $\angle AOB + \angle COD = 180°$.



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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 क्रमागत विषम पूर्णांक ज्ञात कीजिए जिनके वर्गों का योगफल 290 है।

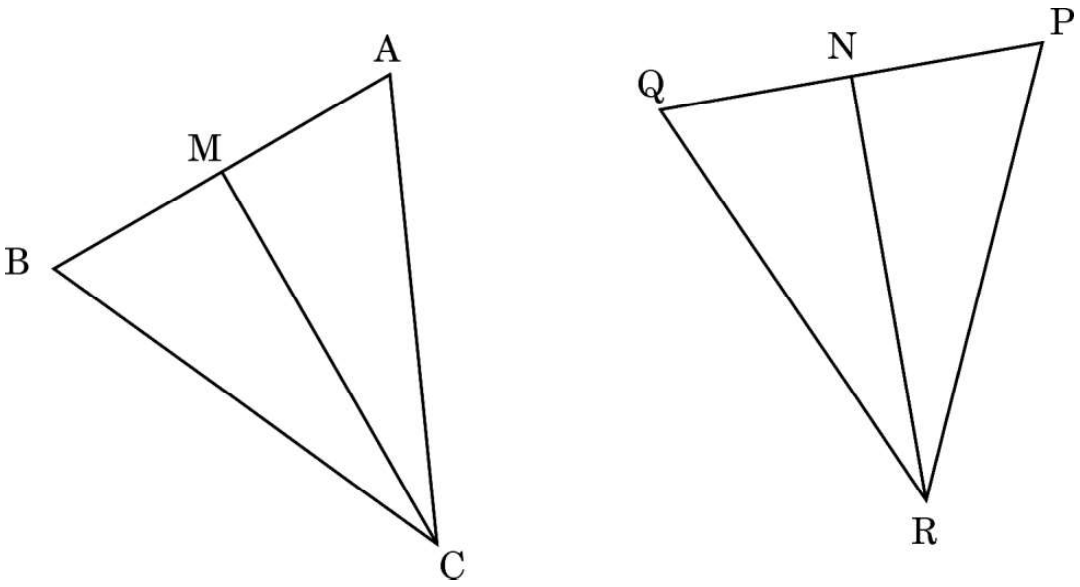
अथवा

(ख) एक दानी (चैरीटी) ट्रस्ट फैसला करता है कि उन्हें एक आयताकार हॉल, जिसका क्षेत्रफल 300 m^2 हो, बनाना है। हॉल की लम्बाई, इसकी चौड़ाई के दुगुने से एक मीटर अधिक होनी है। हॉल की लम्बाई और चौड़ाई ज्ञात कीजिए।

33. (क) ''आधारभूत समानुपातिकता प्रमेय'' लिखिए और उसे सिद्ध भी कीजिए।

अथवा

(ख) दी गई आकृति में, CM और RN क्रमश: त्रिभुजों ABC और PQR की माध्यिकाएँ हैं। यदि $\Delta ABC \sim \Delta PQR$ है, तो सिद्ध कीजिए कि :



(i) $\Delta AMC \sim \Delta PNR$

(ii) $\angle BCM = \angle QRN$

(iii) $\Delta BMC \sim \Delta QNR$

• • •

SECTION D

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

32. (a) Find two consecutive odd integers, sum of whose squares is 290.

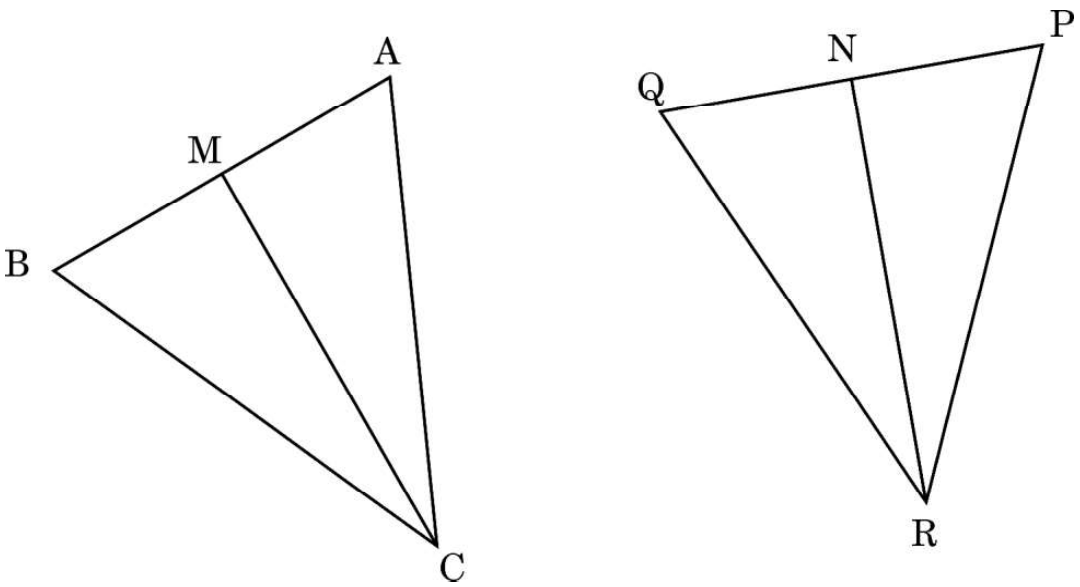
OR

(b) A charity trust decides to build a rectangular hall having an area of 300 m^2. The length of the hall is one metre more than twice its width. Find the length and breadth of the hall.

33. (a) State and Prove "Basic Proportionality Theorem".

OR

(b) In the given figure, CM and RN are respectively, the medians of Δ ABC and Δ PQR. If Δ ABC ~ Δ PQR, prove that :



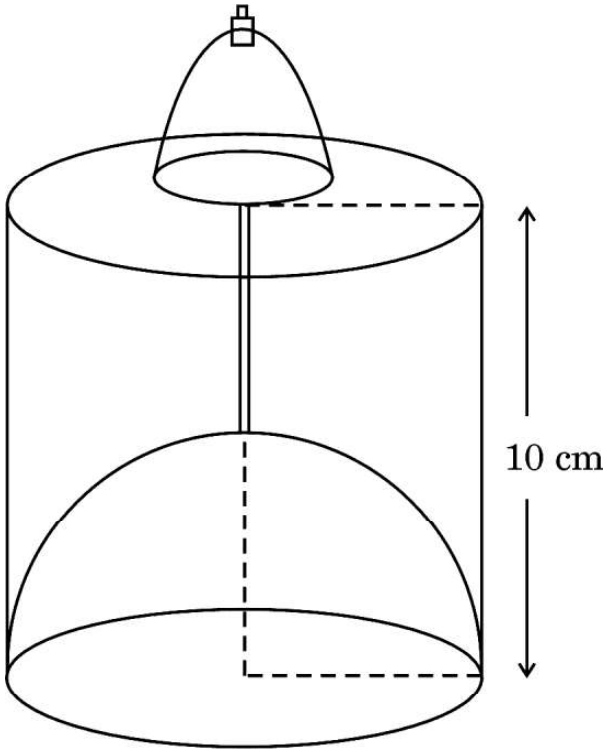
(i) Δ AMC ~ Δ PNR

(ii) $\angle$ BCM = $\angle$ QRN

(iii) Δ BMC ~ Δ QNR

• • •

34. एक इत्र की बोतल, एक बेलन के आकार की है परन्तु बोतल की क्षमता को कम करने के लिए बोतल के निचले भाग में एक अर्धगोलीय उठा हुआ भाग है। इस बोतल के अंदर का व्यास 5 cm और ऊँचाई 10 cm है। इस इत्र की बोतल की क्षमता mL में ज्ञात कीजिए। ($\pi = 3{\cdot}14$ और $1\ cm^3 = 1\ mL$ प्रयोग कीजिए)



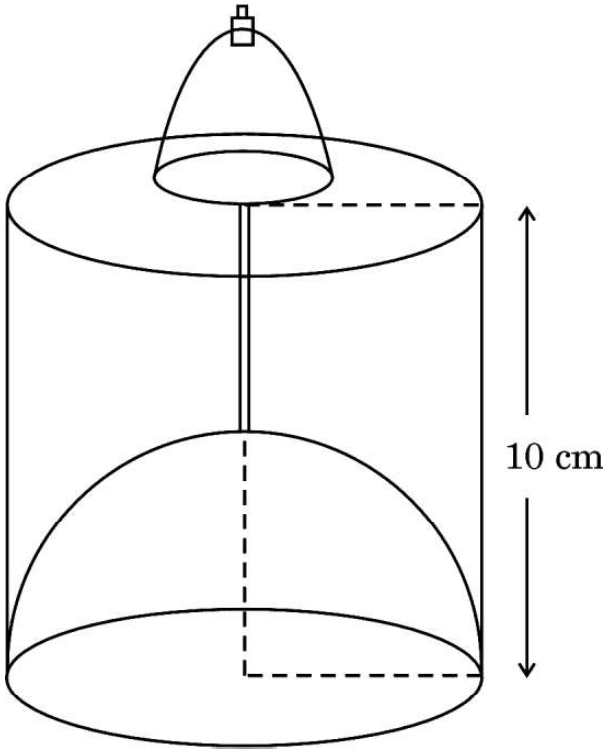
35. निम्नलिखित बंटन सारणी में एक कक्षा के 30 विद्यार्थियों का वज़न दिया गया है :

वज़न (kg में)	विद्यार्थियों की संख्या
40 – 45	2
45 – 50	5
50 – 55	8
55 – 60	6
60 – 65	6
65 – 70	3

विद्यार्थियों का माध्यक वज़न ज्ञात कीजिए।

• • •

34. A perfume bottle is in the form of a cylinder but the bottom of the bottle has a hemispherical raised portion to reduce the capacity of the bottle. The inner diameter of the bottle is 5 cm and the height of the bottle is 10 cm. Find the capacity of the perfume bottle in mL. (Use $\pi = 3{\cdot}14$ and $1\ cm^3 = 1\ mL$)



35. The weights of 30 students of a class are given in the following distribution table :

Weight (in kg)	Number of students
40 – 45	2
45 – 50	5
50 – 55	8
55 – 60	6
60 – 65	6
65 – 70	3

Find the median weight of the students.

• • •

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 सोसाइटी में लोगों को स्वस्थ जीवन शैली जीने के लिए प्रशिक्षित करने के लिए एक योग प्रशिक्षक को नियुक्त किया गया था। सोसाइटी पार्क में प्रतिदिन योग सत्र शाम 5 बजे से 7 बजे तक आयोजित किए जाते थे। पहले दिन, 5 व्यक्ति योग सत्र में शामिल हुए, दूसरे दिन 3 और व्यक्ति योग सत्र में शामिल हुए, तीसरे दिन 3 और व्यक्ति योग सत्र में शामिल हुए और इसी तरह हर दिन 3 और व्यक्ति शामिल होते चले गए।



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

(i) किस दिन, 59 व्यक्तियों ने योग सत्र में हिस्सा लिया ? *1*

(ii) 31वें दिन कितने व्यक्तियों ने योग सत्र में हिस्सा लिया ? *1*

(iii) (क) योग प्रशिक्षक को प्रति सत्र, प्रति व्यक्ति ₹ 100 दिए गए। किस दिन प्रशिक्षक को ₹ 5,000 प्राप्त होंगे ? *2*

अथवा

(ख) योग प्रशिक्षक ने पहले 16 दिनों में कुल कितने रुपए प्राप्त किए ? *2*

• • •

SECTION E

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

Case Study – 1

36. In a society, a yoga instructor was hired to train the people of the society to live a healthy lifestyle. Yoga sessions were held daily from 5 p.m. to 7 p.m. in the society park. On day one, 5 people joined the yoga session, on day two, 3 more people joined, on day three, another 3 people joined and in this manner every next day, 3 more people kept on joining.



Based on the given information, answer the following questions :

(i) On which day did 59 people join the yoga session ? *1*

(ii) How many people joined the yoga session on the 31st day ? *1*

(iii) (a) The yoga instructor was paid ₹ 100 for each person attending the yoga session. On which day would he earn ₹ 5,000 ? *2*

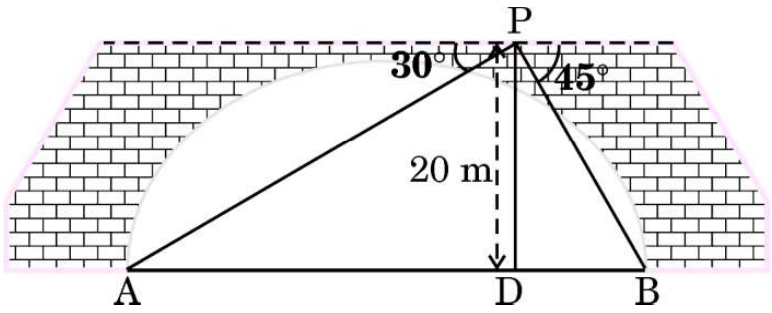
OR

(b) What was the total amount earned by the yoga instructor in 16 days ? *2*

• • •

प्रकरण अध्ययन – 2

37. दो मोटर नावें A और B नदी के विपरीत किनारों पर दूसरी ओर पहुँचने के लिए प्रतीक्षा कर रही हैं। नदी से 20 m ऊपर पुल पर एक बिन्दु P से, नावों के अवनमन कोण क्रमश: 30° और 45° हैं, जैसा कि चित्र में नीचे दिखाया गया है। दोनों नावें समान समय पर क्रमश: 10 m/s और 5 m/s की गति से रवाना होती हैं।



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

(i) बिन्दु P के ठीक नीचे नदी में बिन्दु D तक पहुँचने के लिए नाव A द्वारा तय की गई दूरी ज्ञात कीजिए। ($\sqrt{3}$ = 1·73 प्रयोग कीजिए) *1*

(ii) नदी की चौड़ाई कितनी है ? *1*

(iii) (क) कौन-सी नाव बिन्दु D पर पहले पहुँचेगी और वह दूसरी नाव से कितने समय पहले पहुँचेगी ? *2*

अथवा

(ख) 3 सेकण्ड पश्चात दोनों नावों के बीच की दूरी कितनी है ? *2*

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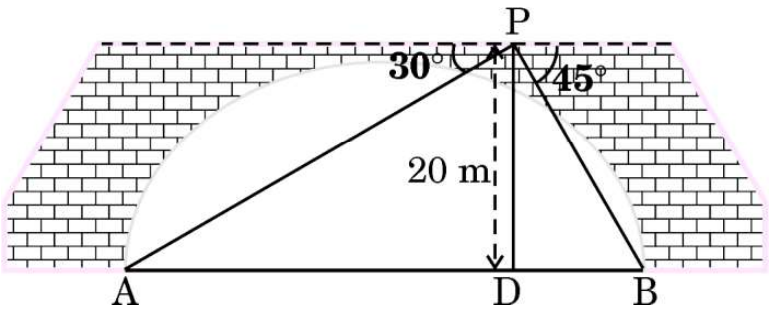
Case Study – 2

37. Two motorboats A and B are waiting at the opposite banks of a river in order to reach the opposite side. From a point P on the bridge, 20 m above the river, the angles of depression of the boats are 30° and 45° respectively, as shown in the figure given below. Both the boats leave at the same time at the speed of 10 m/s and 5 m/s, respectively



Based on the above information, answer the following questions :

(i) Find the distance travelled by boat A to reach point D in the river, vertically below the point P. (Use $\sqrt{3}$ =1·73) *1*

(ii) What is the width of the river ? *1*

(iii) (a) Which boat will reach point D first, and how much earlier, than the other boat ? *2*

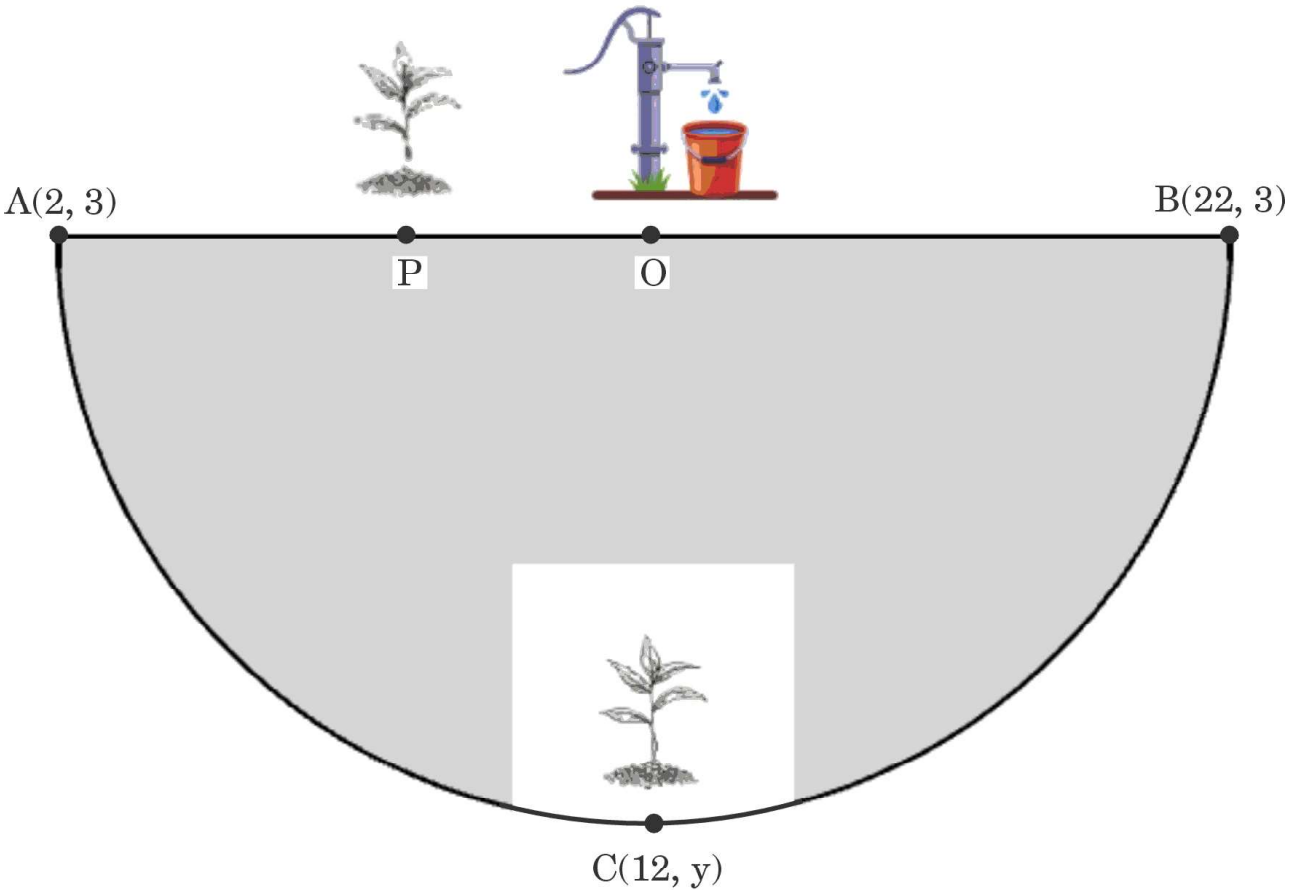
OR

(b) What is the distance between the two boats after 3 seconds ? *2*

• • •

प्रकरण अध्ययन – 3

38. अमन की सोसाइटी में एक अर्धवृत्ताकार पार्क है। वह इस पार्क की परिधि (परिसीमा) पर पौधे लगाना चाहता है। जैसा कि नीचे चित्र में दिखाया गया है, पार्क के केन्द्र O पर व्यास AB के अनुदिश एक बोरवेल है।



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

(i) बिन्दु O के निर्देशांक ज्ञात कीजिए। *1*

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

(iii) (क) एक पौधा बिन्दु C(12, y) पर लगाया गया है। C के निर्देशांक ज्ञात कीजिए। *2*

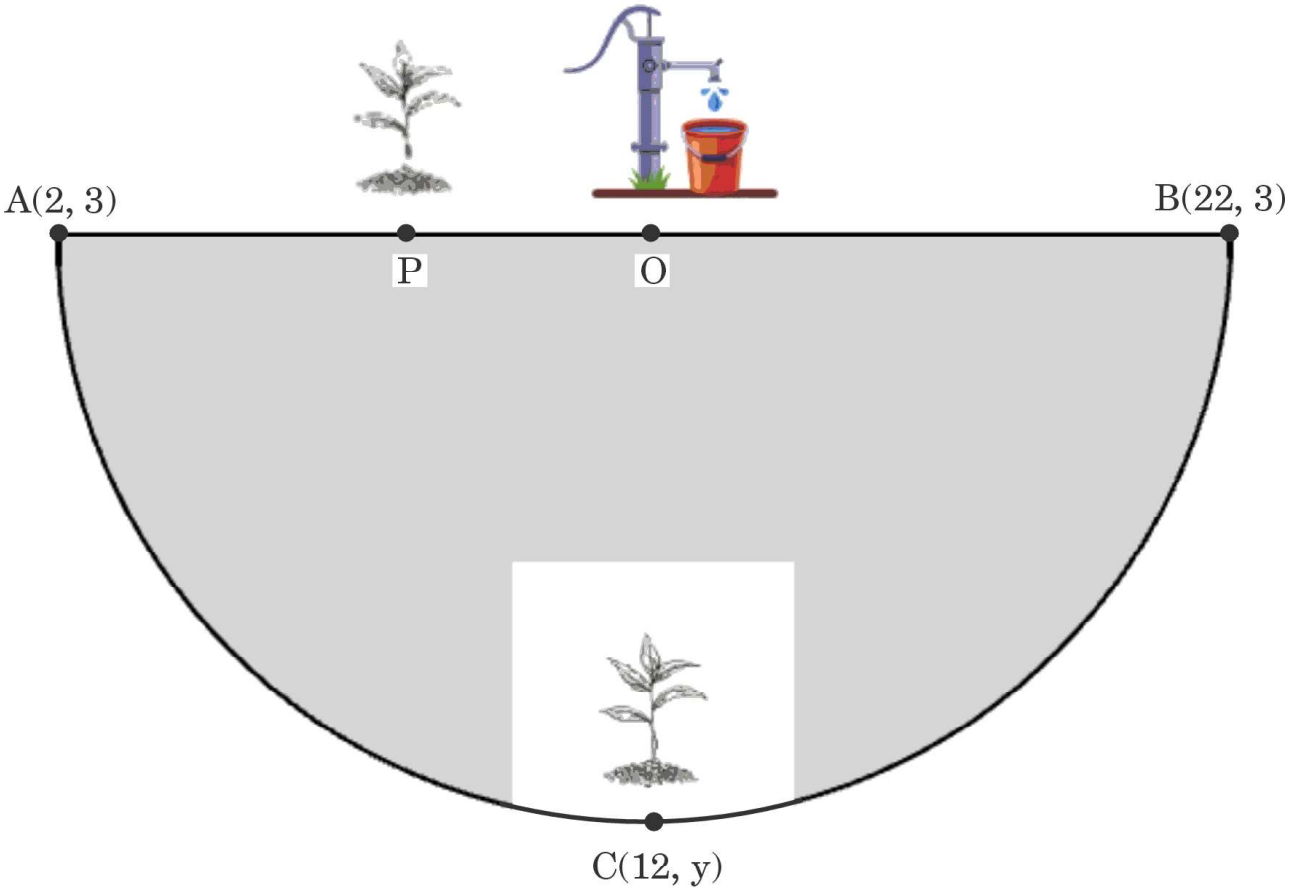
अथवा

(ख) व्यास AB के अनुदिश, एक पौधा बिन्दु P पर इस प्रकार लगाया गया है कि $PA = \frac{1}{3} PB$. बिंदु P के निर्देशांक ज्ञात कीजिए। *2*

• • •

Case Study – 3

38. There is a semicircular park in Aman's society. He wishes to plant saplings along the boundary of the park. There is a borewell at the centre O of the park along the diameter AB as shown in the figure below.



Based on the above information, answer the following questions :

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

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

(iii) (a) One sapling is kept at point C(12, y). Find the coordinates of C. *2*

OR

(b) One sapling is kept at point P along AB so that PA = $\frac{1}{3}$ PB.

Find the coordinates of P. *2*

Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2026 (X^{th})
SUBJECT NAME: MATHEMATICS BASIC (Q.P. CODE /Set No. 241/430/3/1)

General Instructions : -

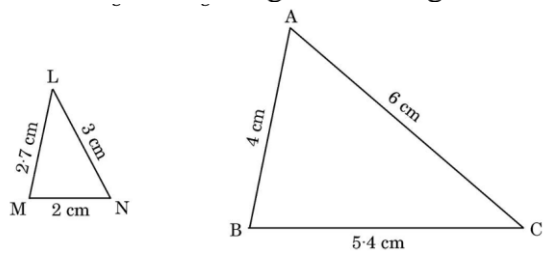
1	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested 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. Its 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 Newspaper/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 totalled and written in figures and words.
18	The candidates are entitled to obtain photocopy of the Answer Book on request on payment of the prescribed processing fee. All Examiners/Additional Head Examiners/Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme.

MARKING SCHEME -430/3/1
MATHEMATICS BASIC (Subject Code-241)

Q.No.	EXPECTED ANSWER /VALUE POINTS	Marks
	SECTION A	
	*This section has **20** Multiple Choice Questions (MCQs) carrying **1** mark each. 20×1=20*	
1.	The HCF of 2^3 and 3^2 is : (A) $2^0 . 3^0$ (B) $2^1 . 3^1$ (C) $2^3 . 3^2$ (D) $2^2 . 3^3$	
Ans.	(A) $2^0 . 3^0$	1
2.	The LCM of two consecutive natural numbers p and p + 1 is : (A) p (B) $p^2 + p$ (C) 1 (D) 2p + 1	
Ans.	(B) $p^2 + p$	1
3.	The system of equations 2x + ky = 4 and 3x – 6y = 6 has infinitely many solutions, if : (A) $k \neq 4$ (B) $k = 4$ (C) $k = -4$ (D) No value of k	
Ans.	(C) $k = -4$	1
4.	The value of 'm' for which the quadratic equation $x^2 - 2x + m = 0$ has real and equal roots is : (A) – 1 (B) 0 (C) 4 (D) 1	
Ans.	(D) 1	1
5.	Which of the following statements is true for the quadratic equation $ax^2 + x + a = 0$ $(a \neq 0)$? (A) The roots of the given equation are reciprocal of each other. (B) The roots of the given equation are always real. (C) The roots of the given equation are always positive. (D) The sum of roots of the given equation is 0.	
Ans.	(A) The roots of the given equation are reciprocal of each other.	1
6.	The co-ordinates of the mid-point of the line segment joining points A(p – 1, q + 1) and B(p + 1, q – 1) are given by : (A) (p, q) (B) (2p, 2q) (C) $\left(\frac{p+1}{2}, \frac{q+1}{2}\right)$ (D) $\left(\frac{p-1}{2}, \frac{q-1}{2}\right)$	
Ans.	(A) (p, q)	1

7. Observe the given triangles :



Which of the following statements is true ?

(A) Δ LMN ~ Δ ABC (B) Δ LMN ~ Δ ACB

(C) Δ NML ~ Δ ABC (D) Δ NML ~ Δ ACB

Ans.	(C) $\Delta NML \sim \Delta ABC$	1

8. Two isosceles triangles :

(A) are always similar, but not congruent.

(B) are always congruent, but not similar.

(C) may or may not be similar.

(D) are always similar and congruent.

Ans.	(C) may or may not be similar.	1

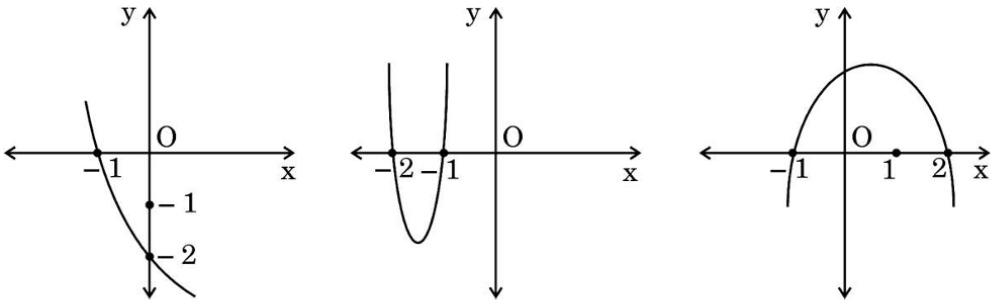
9. The number of solutions of the system of equations given by $x = -2$ and $y = 2$ is :

(A) 0 (B) 1

(C) 2 (D) infinite

Ans.	(B) 1	1

10. In which of the following graphs of the polynomials is one of the zeroes twice the other ?



(A) (i) only (B) (i) and (ii)

(C) (ii) and (iii) (D) (ii) only

Ans.	(D) (ii) only	1

11. If a, b and c are in A.P., then :

(A) 2a, 3b and 4c are also in A.P.

(B) $a - 2$, $b - 2$ and $c - 2$ are also in A.P.

(C) $\frac{a}{2}, \frac{b}{3}$ and $\frac{c}{4}$ are also in A.P.

(D) $a + 2$, $b + 3$ and $c + 4$ are also in A.P.

Ans.	(B) $a - 2$, $b - 2$ and $c - 2$ are also in A.P.	1

12. The value of $\frac{\tan^2 60^\circ - 1}{\tan^2 60^\circ + 1}$ is equal to the value of which of the following ?

(A) tan 60° (B) cos 60°

(C) sec 60° (D) sin 60°

Ans.	(B) cos 60°	1

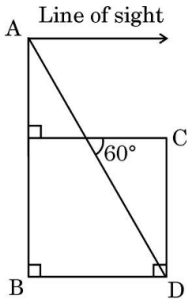
13. Which of the following is ***not*** defined for x = 90° ?

(A) cot x (B) cosec x

(C) $\tan\left(\frac{x}{2}\right)$ (D) sec x

Ans.	(D) sec x	1

14. In the given figure, the angle of depression of the foot of building CD from the top of tower AB is :



(A) 60° (B) 30°

(C) 45° (D) 90°

Ans.	(A) 60°	1

15. The radius of the largest sphere that can be carved out from a solid cube of side 14 cm is :

(A) 7 cm (B) 14 cm

(C) $14\sqrt{2}$ cm (D) $7\sqrt{2}$ cm

Ans.	(A) 7 cm	1

16. Let 'a' be the assumed mean and 'h' be the class size for a grouped data. Which of the following is ***not*** the correct formula to find the mean of the grouped data ?

(A) $\bar{x} = \frac{\Sigma f_i x_i}{\Sigma f_i}$

(B) $\bar{x} = a + \frac{\Sigma f_i d_i}{\Sigma f_i}$, where $d_i = x_i - a$

(C) $\bar{x} = a + \frac{\Sigma f_i u_i}{\Sigma f_i}$, where $u_i = \frac{x_i - a}{h}$

(D) $\bar{x} = a + \frac{\Sigma f_i y_i}{\Sigma f_i} \times h$, where $y_i = \frac{x_i - a}{h}$

Ans.	(C) $\bar{x} = a + \frac{\sum f_i u_i}{\sum f_i}$, where $u_i = \frac{x_i - a}{h}$	1

17. Which of the following is affected by the extreme values in a given data ?

(A) Mean only (B) Median only

(C) Mode only (D) Mean and Mode both

Ans.	(A) Mean only	1

18. From a bag containing yellow, red and green balls, the probability of drawing a yellow or red ball is equal to that of drawing a green ball. The probability of drawing a green ball from the bag is :

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

(C) 1 (D) Not possible to find

Ans.	(B) $\frac{1}{2}$	1

*Questions number **19** and **20** are Assertion and Reason based questions. Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.*

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

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

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

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

19. *Assertion (A) :* The events "getting 2" and "not getting 2" in a single throw of an unbiased die are not equally likely events.

Reason (R) : The probability of getting 2 in a single throw of an unbiased die is $\frac{1}{6}$.

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

20. *Assertion (A) :* $(\sqrt{3}+1)^2$ is a rational number.

Reason (R) : $(\sqrt{3})^2 = 3$ is a rational number.

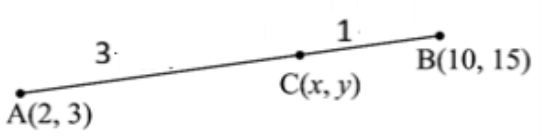
Ans.	(D) Assertion (A) is false but Reason (R) is true.	1

SECTION B

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

21. An ant started moving from the point A(2, 3) and moved along the line segment AB. It covered three-fourth of the distance AB and reached at a point C(x, y). If the coordinates of the point B are (10, 15), find the coordinates of the point C.

Solution



Point C divides AB in the ratio 3: 1 ½

$x = \frac{3(10)+1(2)}{3+1} = 8$ ½

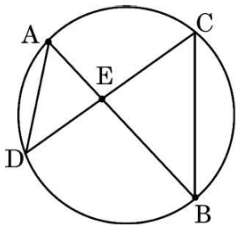
$y = \frac{3(15)+1(3)}{3+1} = 12$ ½

coordinates of the point C are (8,12) ½

22. Verify the relationship between the zeroes and the coefficients of the polynomial $p(x) = 3x^2 - 5x$.

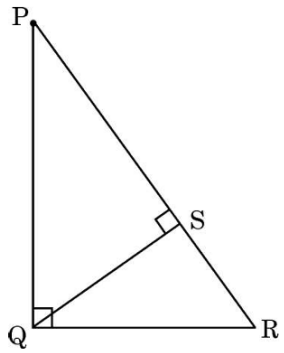
Solution		
	Zeroes are $0, \frac{5}{3}$	½+½
	Sum of zeroes $= 0 + \frac{5}{3} = \frac{5}{3} = \frac{-\text{ coefficient of } x}{\text{coefficient of } x^2}$	½
	Product of zeroes $= 0 \times \left(\frac{5}{3}\right) = \frac{0}{3} = \frac{\text{constant term}}{\text{coefficient of } x^2}$	½

23. (a) Two chords AB and CD intersect each other at the point E as shown in the given figure. Prove that Δ AED ~ Δ CEB.



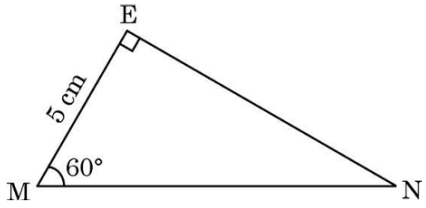
OR

(b) In the given figure, Δ PQR is a right triangle, right-angled at Q and QS ⊥ PR. Prove that Δ PQS ~ Δ QRS.



Solution (a)	In ΔAED and ΔCEB,	
	$\angle DAB = \angle DCB$ (angles in same segment of a circle)	1
	$\angle AED = \angle CEB$ (vertically opposite angles)	1
	ΔAED ~ ΔCEB (by AA similarity)	
	OR	
(b)	In ΔPQS and ΔQRS	
	$\angle PSQ = \angle QSR$ (each 90°)	1
	$\angle PQS = \angle QRS$ $\left(\text{each } (90^\circ - \angle \text{SQR})\right)$	1
	ΔPQS ~ ΔQRS (by AA similarity)	

24. (a) In the given figure, Δ MEN is a right triangle, right-angled at E. If ∠ EMN = 60° and ME = 5 cm, find the length of MN. Also, find the value of $\sin^2$ N.



OR

(b) It is given that sin(A – B) = sin A cos B – cos A sin B. Use it to evaluate sin 15°.

Solution (a)	In ΔMEN,	
	$\frac{EM}{MN} = \cos 60^\circ$	½
	$\frac{5}{MN} = \frac{1}{2} \quad \Rightarrow \quad MN = 10$ cm	½
	$\angle MNE = 30^\circ$	½
	$\sin^2 N = \sin^2 30^\circ = \left(\frac{1}{2}\right)^2 = \frac{1}{4}$	½
	OR	
(b)	$\sin 15^\circ = \sin(45^\circ - 30^\circ)$	½
	$= \sin 45^\circ \cos 30^\circ - \cos 45^\circ \sin 30^\circ$	
	$= \frac{1}{\sqrt{2}} \times \frac{\sqrt{3}}{2} - \frac{1}{\sqrt{2}} \times \frac{1}{2}$	1
	$= \frac{\sqrt{3}-1}{2\sqrt{2}}$ or $\frac{\sqrt{6}-\sqrt{2}}{4}$	½

25. A game of chance consists of spinning an arrow which comes to rest in one of the six equal sectors as shown in the given figure.



A person spins an arrow once. What is the probability that the person

(i) wins a laptop ?

(ii) does not get a chance to spin again ?

Solution	(i) P (the person wins a laptop) = $\frac{1}{6}$	1
	(ii) P (the person does not get a chance to spin again) = $\frac{5}{6}$	1

SECTION C

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

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

Solution

Let $\sqrt{5}$ be a rational number such that $\sqrt{5} = \frac{a}{b}$ where a and b are coprime, $b \neq 0$ — ½

$\sqrt{5}b = a$

$5b^2 = a^2$

5 divides $a^2 \Rightarrow$ 5 divides a as well — 1

$a = 5c$ for some integer c

$a^2 = 25c^2$

$5b^2 = 25c^2$

$b^2 = 5c^2$

5 divides b^2 and therefore 5 divides b as well — 1

i.e. 5 is a common factor of a and b which is a contradiction as a and b are coprime — ½

$\therefore$ Our assumption is wrong, hence $\sqrt{5}$ is an irrational number.

27. Each root of a quadratic equation $ax^2 + bx + c = 0$ is 2 more than each of the roots of the equation $3x^2 - 2x = 1$. Find the roots of the quadratic equation $ax^2 + bx + c = 0$.

Solution

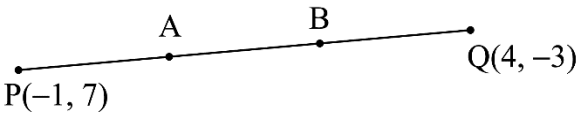
Roots of $3x^2 - 2x - 1 = 0$ are $\frac{-1}{3}, 1$ — 1+1

Roots of the quadratic equation $ax^2 + bx + c = 0$ are $\frac{5}{3}$ and 3 — ½+½

28. (a) Show that the quadrilateral ABCD formed by joining the points A(– 2, – 1), B(1, – 1), C(1, 2) and D(– 2, 2) in order is a square.

OR

(b) Find the coordinates of the points which divide the line segment joining points P(– 1, 7) and Q(4, – 3) into three equal parts.

Solution (a)	$AB=\sqrt{3^2+0^2}=3$; $BC=\sqrt{0^2+3^2}=3$ $CD=\sqrt{3^2+0^2}=3$; $AD=\sqrt{0^2+3^2}=3$ $AC=\sqrt{3^2+3^2}=\sqrt{18}$ or $3\sqrt{2}$ $BD=\sqrt{3^2+3^2}=\sqrt{18}$ or $3\sqrt{2}$ All sides are equal and diagonals are equal, hence ABCD is a square.	½×4=2 ½×2=1
	OR	
(b)	 Let A and B be required points such that PA = AB = BQ A divides PQ in the ratio 1 : 2 Coordinates of A are $\left(\frac{1\times4+2\times(-1)}{1+2},\ \frac{1\times(-3)+2\times7}{1+2}\right)=\left(\frac{2}{3},\ \frac{11}{3}\right)$ B divides PQ in the ratio 2 : 1 Coordinates of B are $\left(\frac{2\times4+1\times(-1)}{2+1},\ \frac{2\times(-3)+1\times7}{2+1}\right)=\left(\frac{7}{3},\ \frac{1}{3}\right)$	½ 1 ½ 1

29. (a) Prove that :

$(\sin A - \operatorname{cosec} A)^2 + (\cos A - \sec A)^2 = \tan^2 A + \cot^2 A - 1$

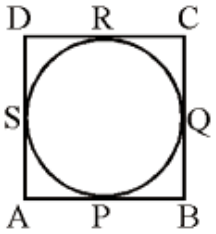
OR

(b) If $\sin(A + 2B) = 1$ and $\cos(2A + B) = \frac{1}{2}$, find the values of A and B.

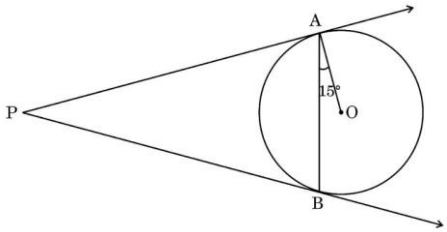
Hence, find the value of $\tan (B - A)$.

Solution (a)	LHS $= \sin^2A + \operatorname{cosec}^2A - 2\sin A.\operatorname{cosec}A + \cos^2A + \sec^2A - 2\cos A.\sec A$ $= (\sin^2A + \cos^2A) + 1 + \cot^2A + 1 + \tan^2A - 2 - 2$ $= 1 + \cot^2A + \tan^2A + 2 - 4$ $= \tan^2A + \cot^2A - 1 = RHS$	1 1 ½ ½
	OR	
(b)	$\sin(A + 2B) = 1 \Rightarrow A + 2B = 90^\circ$ --------(i)	½
	$\cos(2A + B) = \frac{1}{2} \Rightarrow 2A + B = 60^\circ$ --------(ii)	½
	Solving (i) and (ii) we get $A = 10^\circ$ and $B = 40^\circ$	1
	$\tan(B - A) = \tan(40^\circ - 10^\circ) = \tan 30^\circ = \frac{1}{\sqrt{3}}$	1

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

Solution	 Let ABCD be a rectangle circumscribing a circle with centre O. To prove: ABCD is a square AP = AS BP = BQ CR = CQ DR = DS } (Lengths of tangents from exterior point to a circle are equal) Adding all above equations $\Rightarrow$ AP + BP + CR + DR = AS + BQ + CQ + DS $\Rightarrow$ AB + CD = AD + CB But AB = CD and AD = CB $\therefore$ AB = AD Hence, ABCD is a square.	For correct figure ½ 1 ½ 1

31. Two tangents PA and PB are drawn from an external point P to a circle with centre O as shown in the given figure. If $\angle$ OAB = 15°, find the measures of each angle of Δ PAB.



Solution	$\angle PAO = 90^\circ$ (the tangent at any point of a circle is perpendicular to the radius through the point of contact) $\angle PAB = 90^\circ - 15^\circ = 75^\circ$ As PA = PB $\therefore \angle PAB = \angle PBA = 75^\circ$ $\angle PAB + \angle PBA + \angle APB = 180^\circ$ $\angle APB = 180^\circ - 150^\circ = 30^\circ$	½ ½ 1 1

SECTION D

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

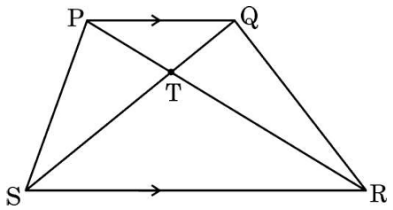
32. A fraction becomes $\frac{5}{6}$ when 3 is added to both the numerator and the denominator. If 2 is added to both the numerator and the denominator, the fraction becomes $\frac{9}{11}$. Express the given information algebraically as a system of linear equations in two variables. Hence, find the original fraction.

Solution	Let numerator be x and denominator be y	
	$\therefore$ fraction is $\frac{x}{y}$	½
	$\frac{x+3}{y+3}=\frac{5}{6}$	1
	$\Rightarrow 6x-5y=-3$ ---------- (i)	½
	Also $\frac{x+2}{y+2}=\frac{9}{11}$	1
	$\Rightarrow 11x-9y=-4$ ---------- (ii)	½
	Solving (i) and (ii) we get	
	$x=7$ and $y=9$	½+½
	Fraction is $\frac{7}{9}$	½

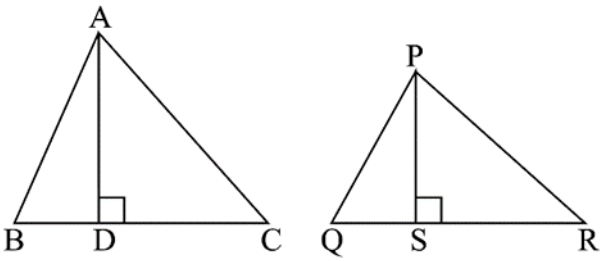
33. (a) Sides AB, AC and altitude AD of Δ ABC are proportional to sides PQ, PR and altitude PS of another triangle PQR. Prove that Δ ABC ~ Δ PQR.

OR

(b) In the given figure, PQRS is a trapezium with PQ || SR. Diagonals PR and QS intersect each other at a point T. Prove that $\frac{PT}{TR}=\frac{QT}{TS}$. Further, if TS = TR, prove that Δ PTS ~ Δ QTR.



Solution (a)



For correct figure 1

In ΔABD and ΔPQS, $\frac{AB}{PQ} = \frac{AD}{PS}$ (given)

$\Rightarrow \frac{AD}{AB} = \frac{PS}{PQ}$

$\sin B = \sin Q$

$\angle B = \angle Q$ 1

$\angle D = \angle S$ (*each* 90°)

$\Delta ABD \sim \Delta PQS$ (by AA similarity) 1½

$\angle BAD = \angle QPS$ -------(i) ½

Similarly, $\angle DAC = \angle SPR$ -----(ii)

Adding (i) and (ii) we get $\angle BAC = \angle QPR$

Also $\frac{AB}{PQ} = \frac{AC}{PR}$ 1

$\Delta ABC \sim \Delta PQR$ (by SAS similarity)

OR

(b)

In ΔPQT and ΔRST,

$\angle TPQ = \angle TRS$ (alternate interior angles)

$\angle PQT = \angle TSR$ (alternate interior angles) 1½

$\Delta PQT \sim \Delta RST$ (by AA similarity)

So $\frac{PT}{RT} = \frac{QT}{ST}$ ½

$\Rightarrow PT = QT$ $(RT = ST)$ ½

which gives $\frac{PT}{QT} = 1$ and $\frac{ST}{RT} = 1$ 1

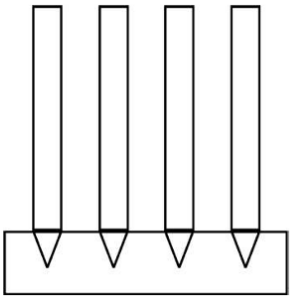
Now In ΔPTS and ΔQTR

$\frac{PT}{QT} = \frac{ST}{RT}$ ½

$\angle PTS = \angle QTR$ (vertically opposite angles) ½

$\Delta PTS \sim \Delta QTR$ (by SAS similarity) ½

34. (a) A pen stand is made up of wood and is in the shape of a cuboid with four conical depressions and cylindrical extensions to hold pens. The depressions are hollowed out from the wooden cuboidal stand and cylindrical extensions are made up of metal attached separately as shown in the figure given below :



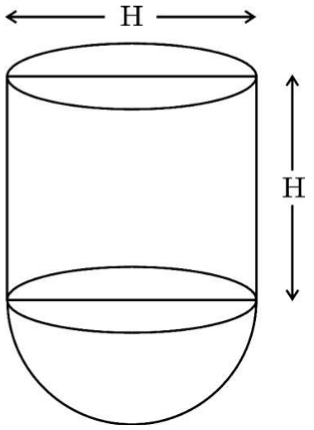
The dimensions of the cuboidal block of wood are 15 cm × 10 cm × 3·5 cm. The radius of each conical depression is 0·5 cm and depth is 1·4 cm. The radius and height of each cylindrical metal extension are 0·5 cm and 4·9 cm respectively.

(i) Find the volume of wood in the entire stand.

(ii) Find the inner surface area of a conical depression along with that of the cylindrical extension. (Use $\sqrt{221} = 14{\cdot}8$)

OR

(b) A solid is in the shape of a cylinder with a solid hemisphere attached to one of its ends as shown in the figure.



Let the height and diameter of the cylinder be same (say H). Prove that the volume of the solid shown in the figure is same as the volume of a cone of height H and diameter '2H'. Also find the total surface area of the solid in terms of H.

Solution(a)	(i) Volume of wood = volume of cuboid $-$ 4 $\times$ volume of cone	
	$=15 \times 10 \times 3.5 - 4\left(\frac{1}{3} \times \frac{22}{7} \times 0.5 \times 0.5 \times 1.4\right)$	2
	$= \frac{7853}{15}$ cm^3 or 523.53 cm^3	½
	(ii) $l = \sqrt{(1.4)^2 + (0.5)^2} = \sqrt{2.21} = 1.48$	1
	Required surface area = C.S.A. of cone + C.S.A. of cylinder	
	$= \frac{22}{7} \times 0.5 \times 1.48 + 2 \times \frac{22}{7} \times 0.5 \times 4.9$	1
	$= \frac{12408}{700}$ cm^2 or 17.72 cm^2	½
	OR	
(b)	Radius of cylinder/hemisphere $= R = \frac{H}{2}$	½
	Volume of the solid = Volume of cylinder + Volume of hemisphere	
	$= \pi R^2 H + \frac{2}{3}\pi R^3$	
	$= \pi\left(\frac{H}{2}\right)^2 H + \frac{2}{3}\pi\left(\frac{H}{2}\right)^3$	1
	$= \frac{\pi H^3}{3}$	½
	Volume of cone of height H and diameter 2H	
	$= \frac{1}{3}\pi \times H^2 \times H$	½
	$= \frac{\pi H^3}{3}$	½
	T.S.A. of the solid = C.S.A of cylinder + Area of circle +C.S.A of hemisphere	
	$= 2\pi \frac{H}{2} \times H + \pi \frac{H^2}{4} + 2\pi \frac{H^2}{4}$	1½
	$= \frac{7\pi}{4} H^2$	½

35. The following table shows the weight (in kg) of 40 students of class X :

Weight (in kg)	*Number of students*
40 – 45	3
45 – 50	4
50 – 55	10
55 – 60	8
60 – 65	8
65 – 70	4
70 – 75	3

Find the mean weight and median weight.

Solution

C.I.	f	cf	x_i	u_i	f_iu_i
40-45	3	3	42.5	– 3	– 9
45-50	4	7	47.5	– 2	– 8
50-55	10	17	52.5	– 1	– 10
55-60	8	25	A 57.5	0	0
60-65	8	33	62.5	1	8
65-70	4	37	67.5	2	8
70-75	3	40	72.5	3	9
Total	**40**				**– 2**

For Correct Table 2

$$\text{Mean} = A + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h$$

$$= 57.5 + \frac{(-2)}{40} \times 5 \quad \text{1}$$

$$= 57.25 \quad \text{½}$$

∴ The mean weight is 57.25 kg

$$\text{Median} = l + \frac{\frac{n}{2} - cf}{f} \times h$$

$$= 55 + \frac{20 - 17}{8} \times 5 \quad \text{1}$$

$$= 56.87 \quad \text{½}$$

∴ The median weight is 56.87 kg

SECTION E

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

Case Study – 1

36. A city based NGO is organising a competition to break 'Dahi Handi' by forming a human pyramid on the occasion of Janmashtami. One troop with 400 members decided to participate in the competition. They planned to build eleven level pyramid with level one being at the bottom and level eleven being at the top. Level one has 41 members, level two has 37 members, level three has 33 members and so on.



Based on the above information, answer the following questions :

(i) What is the number of members at level eleven ? *1*

(ii) Find the number of members at the third level from the top. *1*

(iii) (a) Find the total number of members who formed the human pyramid. *2*

OR

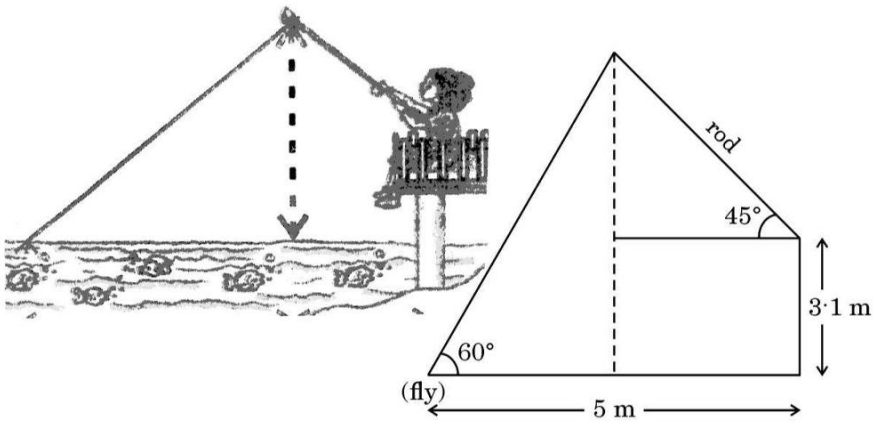
(iii) (b) At which level is the number of members 5 times the number of members at level ten ? *2*

Solution	(i) The number of members at the level eleven = a_{11} $= 1$	1
	(ii) The number of members at the third level from the top = a_3 $= 9$	1
	(iii) (a) The total number of members who formed the human pyramid $S_{11} = \frac{11}{2}[41 + 1]$	1½
	$= 231$	½
	OR	
	(iii) (b) Let n^{th} level be the required level	
	$a_n = 5\, a_{10}$	½
	$41 + (n - 1)(-4) = 5\,[41 + 9(-4)]$	1
	$n = 5$	½
	At 5th level the number of members is 5 times the number of members at level ten	

Case Study – 2

37. Jigyasa is fly fishing in a stream sitting at the height of 3·1 m above the surface of water. The fishing rod is $2\sqrt{2}$ m long and the fly at the end of the string resting on the surface of water is 5 m away from the base of the platform on which Jigyasa is sitting.

The fishing rod makes an angle of 45° with the horizontal and the string which is fully taut makes an angle of 60° with the horizontal as shown in the given figure.



Based on the above information, answer the following questions : (Use $\sqrt{3}$ = 1·7)

(i) What is the height of the top of the fishing rod above the surface of water ? *1*

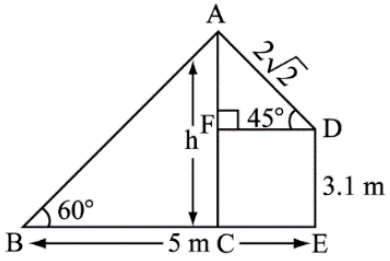
(ii) How far is the fly from the point on the surface of water directly below the top of the fishing rod ? *1*

(iii) (a) Find the length of the string when it is fully taut. *2*

OR

(iii) (b) A fish pulled the string such that it makes 30° angle with the horizontal now. What is the length of the string in this case ? *2*

Solution



(i) In ΔAFD,

$\sin 45° = \frac{h - 3.1}{2\sqrt{2}}$ gives $h = 5.1$ m 1

(ii) In ΔACB,

$\tan 60° = \frac{h}{BC}$ gives $BC = \frac{5.1}{1.7} = 3$ m 1

(iii) (a) Let AB be the length of the string

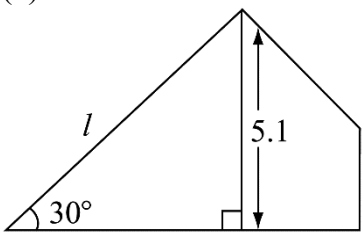
In ΔACB, $\sin 60° = \frac{h}{AB}$

$\frac{\sqrt{3}}{2} = \frac{5.1}{AB}$ 1

$\Rightarrow$ AB = 6 m 1

OR

(iii) (b)



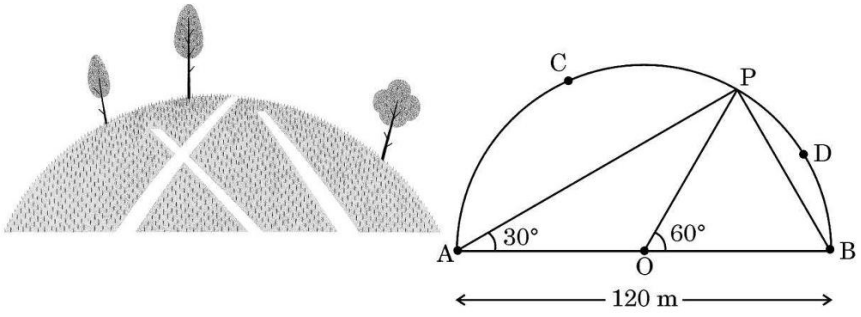
$\sin 30° = \frac{5.1}{l}$

$\frac{1}{2} = \frac{5.1}{l}$ 1

$l = 10.2$ m 1

Case Study – 3

38. A farmer has a semicircular field as shown in the figure given below :



In segment ACPA, he grows rice. In the triangular region APB, he grows vegetables. He allows his cows to graze in the segment BDPB. The diameter of the semicircular field with centre O is 120 m, $\angle$ PAO = 30° and $\angle$ POB = 60°.

Based on the above information, answer the following questions :

(i) Find the radius of the field and the measure of $\angle$ ABP. *1*

(ii) Find the area of sector AOP in terms of π. *1*

(iii) (a) Find the area of the region in which cows are allowed to graze. (Use $\pi = 3{\cdot}14$) *2*

OR

(iii) (b) Find the area of the region in which vegetables are grown. *2*

Solution

(i) Radius of the field $= 60$ m ½

$\angle ABP = 60°$ ½

(ii) Area of sector $AOP = \frac{120}{360} \times \pi \times 60 \times 60$ ½

$= 1200\ \pi\ m^2$ ½

(iii) (a) Area of the region in which cows are allowed to graze

= Area of segment BDPB

$= \frac{60}{360} \times 3.14 \times (60)^2 - \frac{\sqrt{3}}{4} \times (60)^2$ 1

$= \left(1884 - 900\sqrt{3}\right) m^2$ 1

OR

(iii) (b) As ΔOPB is an equilateral Δ

$\therefore$ PB = 60 m

In right ΔAPB, $AP = \sqrt{(120)^2 - (60)^2} = 60\sqrt{3}$ m 1

Area of the region in which vegetables are grown

$= \text{Area of } \Delta APB = \frac{1}{2} \times 60 \times 60\sqrt{3} = 1800\sqrt{3}\ m^2$ 1

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

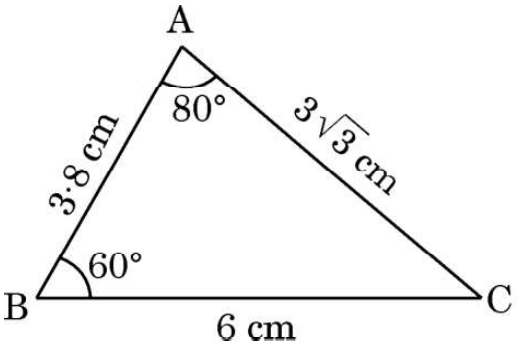
(C) 1 : 1 (D) $\frac{1}{2}$: 2

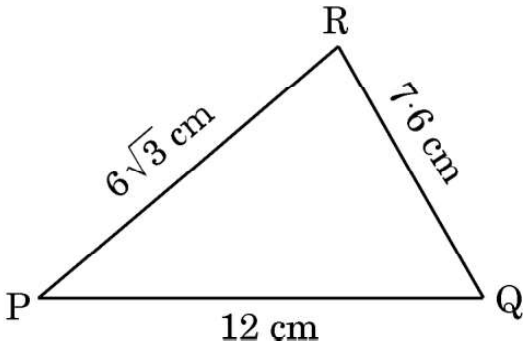
7. निम्नलिखित में से कौन-सी त्रिभुजों की समरूपता की कसौटी ***नहीं*** है ?

(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

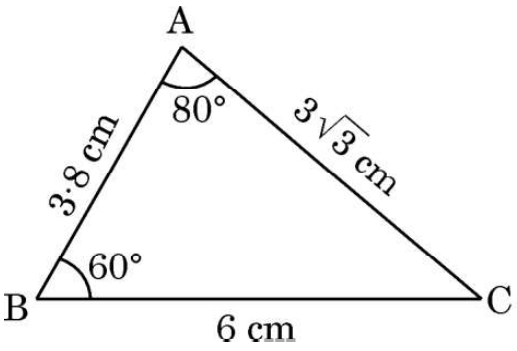
(C) 1 : 1 (D) $\frac{1}{2}$: 2

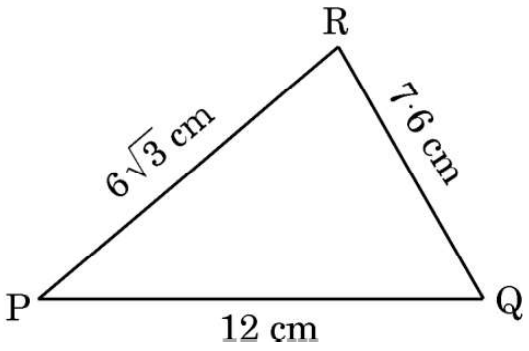
7. Which of the following is ***not*** the criterion for similarity of triangles ?

(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) $\angle P = 60°$

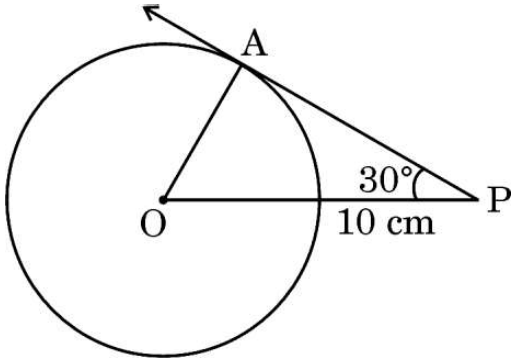
(B) $\angle P = 80°$

(C) $\angle P = 40°$

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

• • •

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

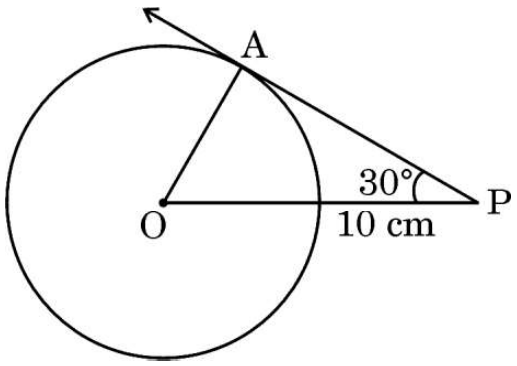
(B) 1

(C) 0

(D) – 1

• • •

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

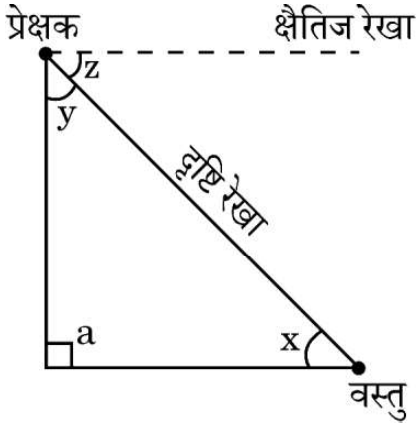
(B) 1

(C) 0

(D) – 1

• • •

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



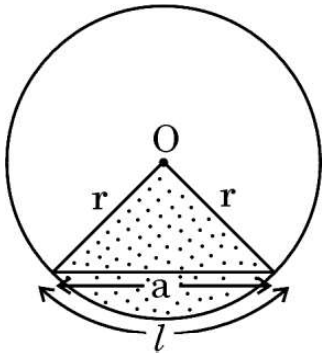
(A) x

(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

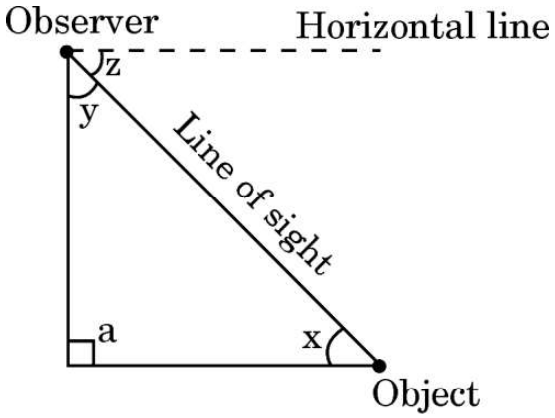
(B) 2 : 1

(C) 1 : 4

(D) 4 : 1

• • •

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



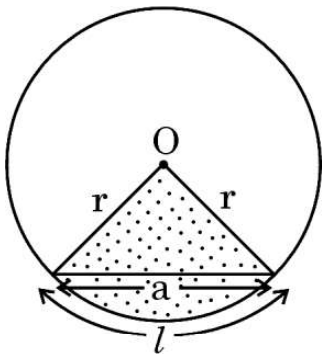
(A) x

(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

• • •

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

• • •

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

• • •

*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

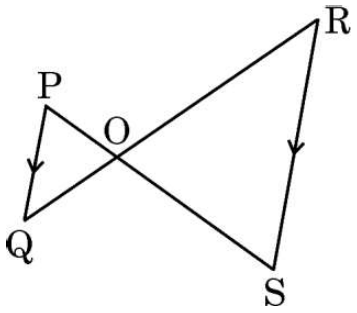
*This section has **5** Very Short Answer (VSA) type questions carrying **2** marks each.* *5×2=10*

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

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

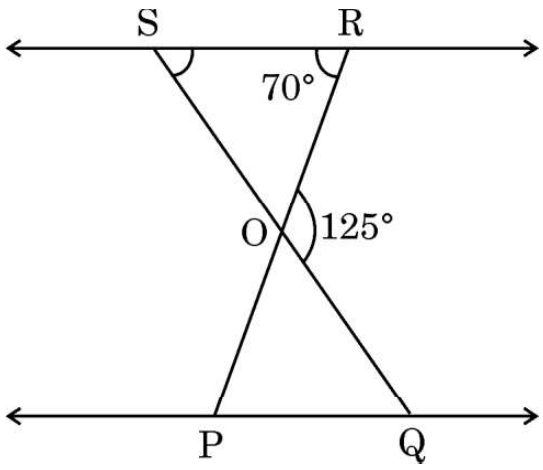
• • •

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।

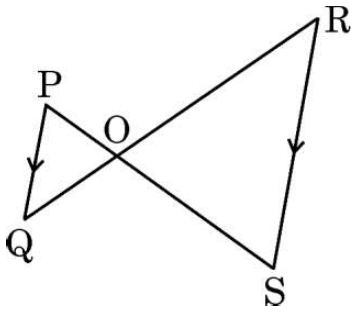
अथवा

(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)

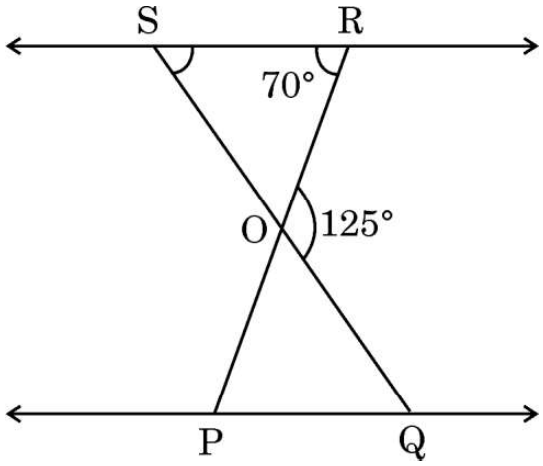
• • •

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 $\sqrt{3} = 1{\cdot}73$)

• • •

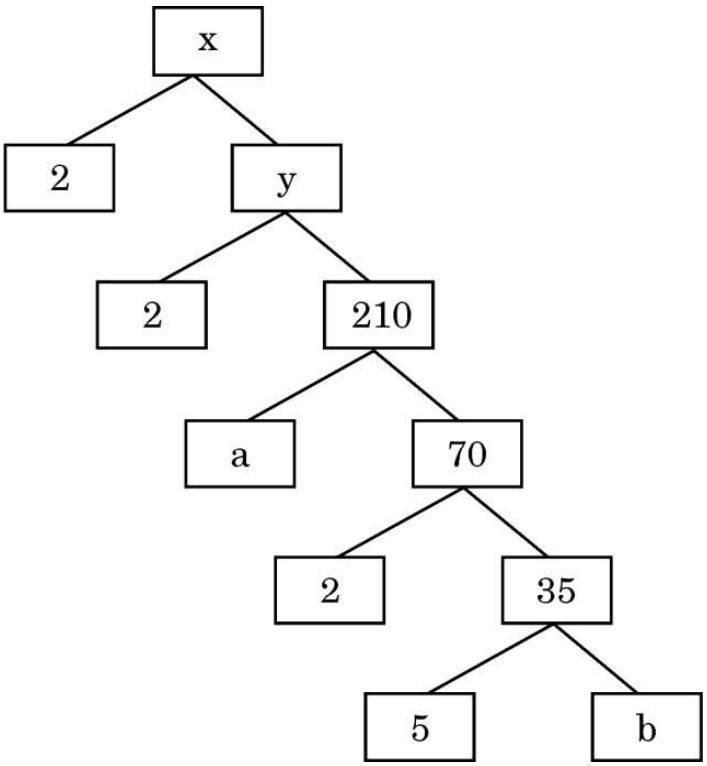
खण्ड ग

*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।

• • •

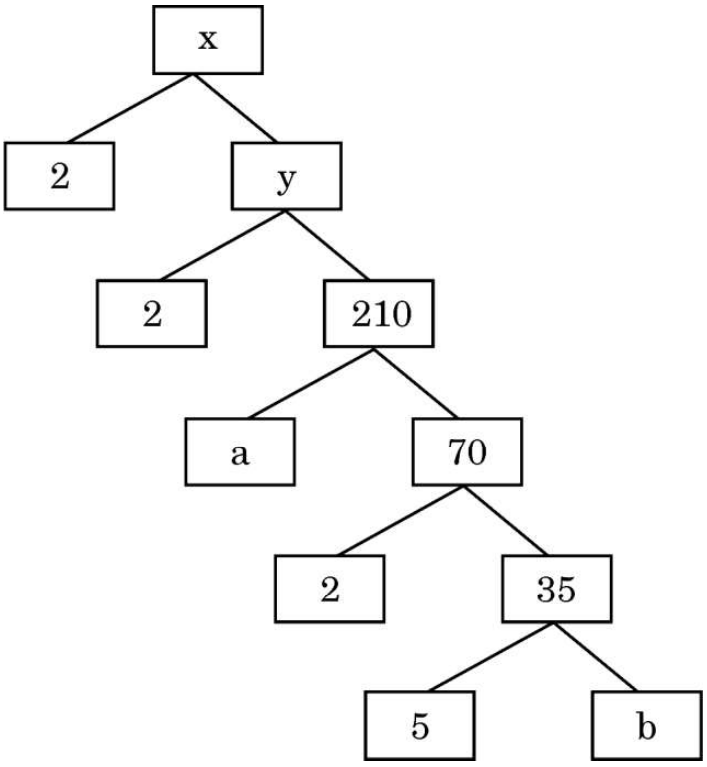
SECTION C

*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.

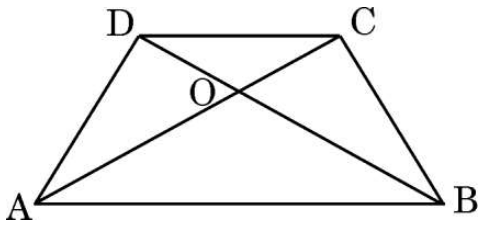
OR

(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 :

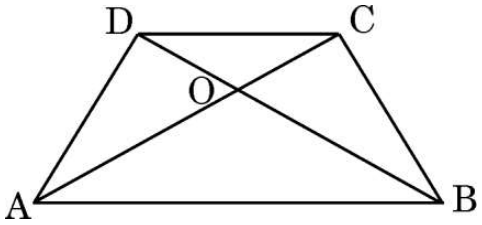
जीवन काल (घंटों में)	*विद्युत घटकों की संख्या*
0 – 20	10
20 – 40	35
40 – 60	50
60 – 80	60
80 – 100	30
100 – 120	15

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

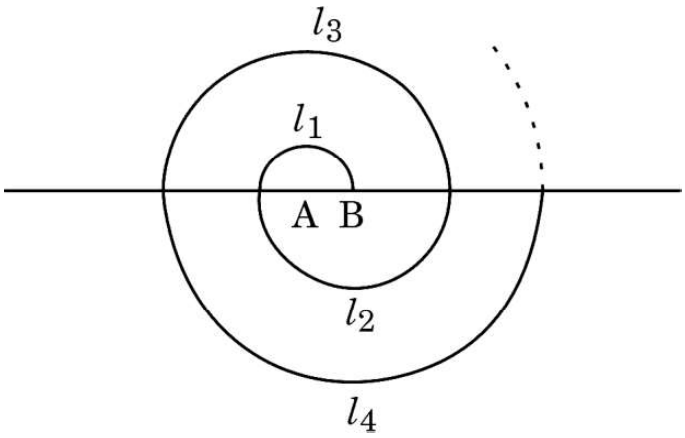
(b) Find the length of the ladder used by the fireman in this case. *2*

• • •

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

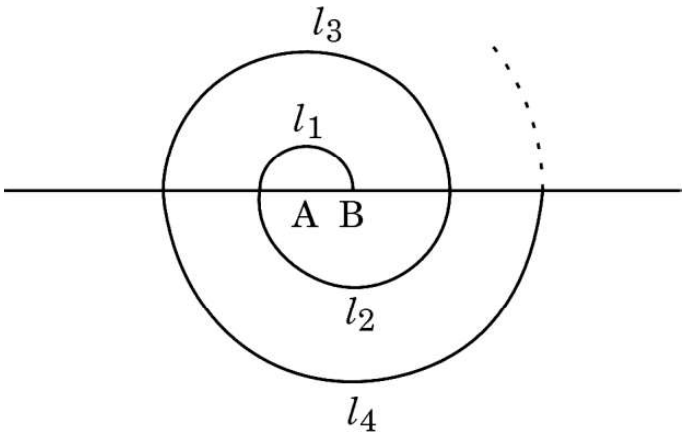
(ख) कौन-सी सर्पिल तक, कुल 450 पौधे लगे होंगे ? *2*

• • •

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 13th spiral ? *1*

(ii) If the radius of the nth spiral is 500 cm, find the value of n. *1*

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

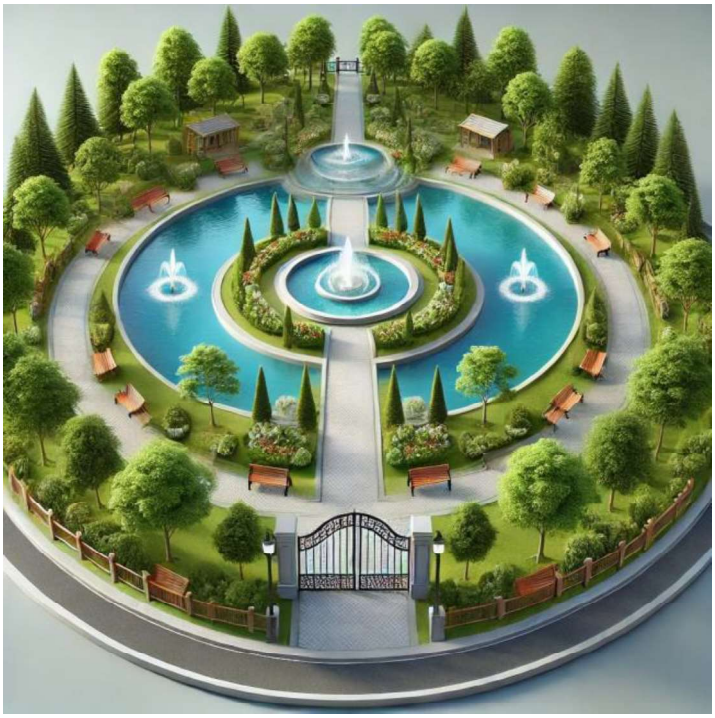
OR

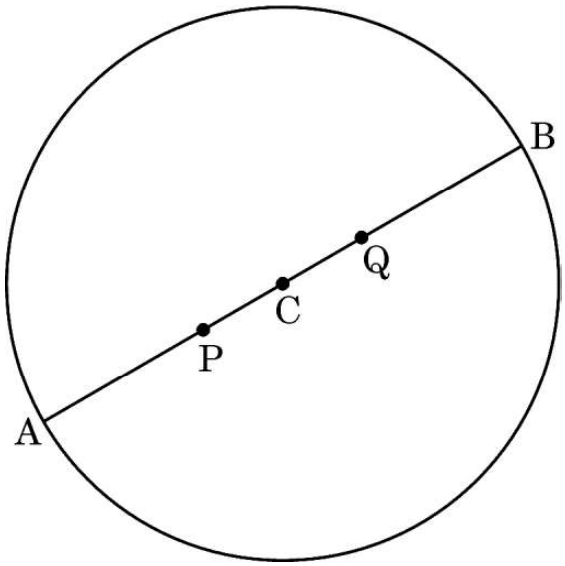
(b) Till which spiral, will there be a total of 450 saplings ? *2*

• • •

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*

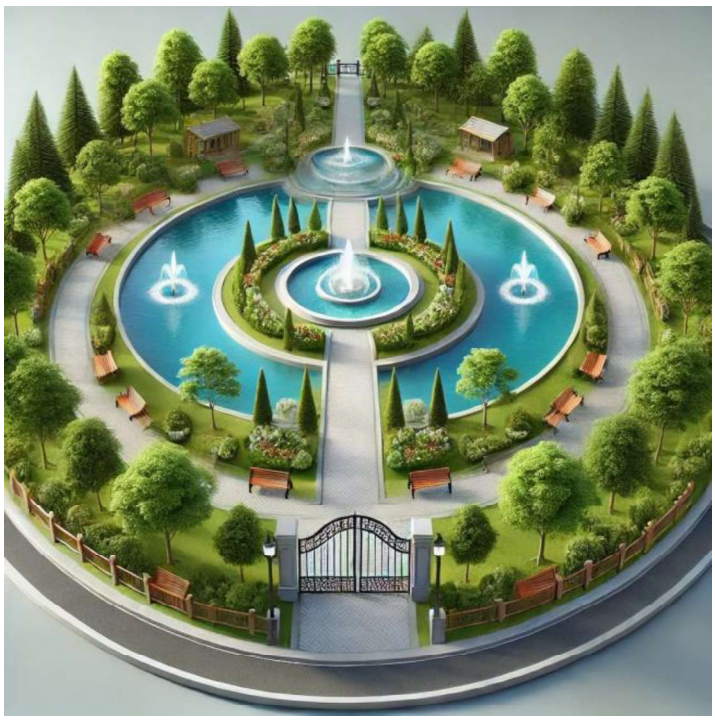
अथवा

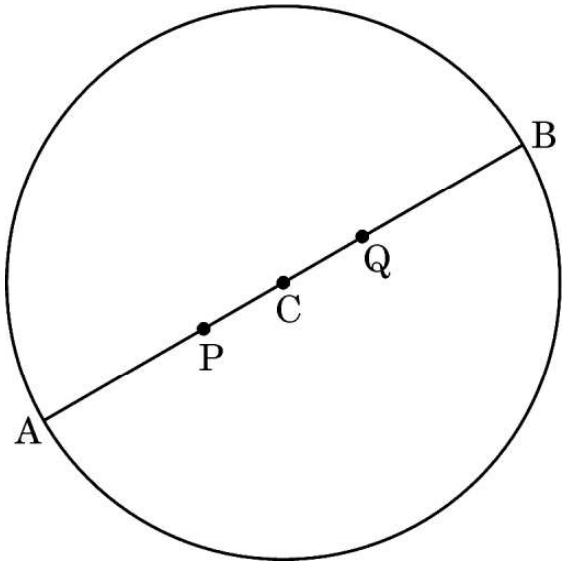
(ख) गेट A से Q पर लगे फव्वारे की दूरी ज्ञात कीजिए। *2*

• • •

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 ?

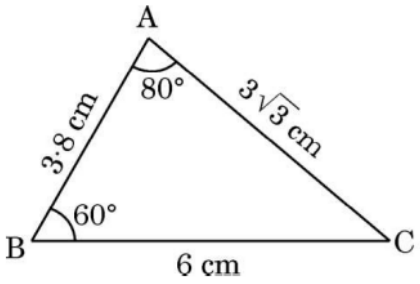
(A) AAA (B) SSS

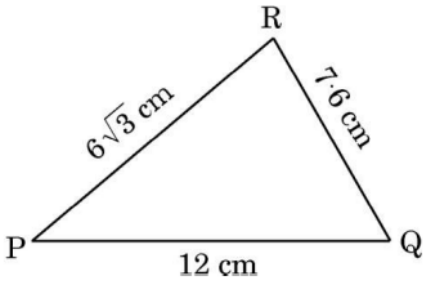
(C) SAS (D) RHS

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) $\angle P = 60°$

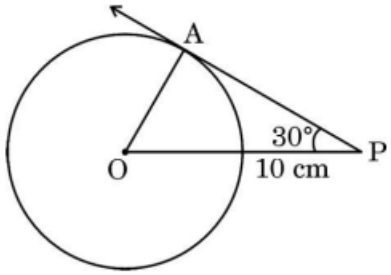
(B) $\angle P = 80°$

(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

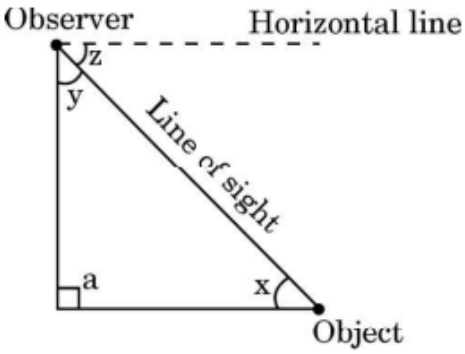
(B) 1

(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

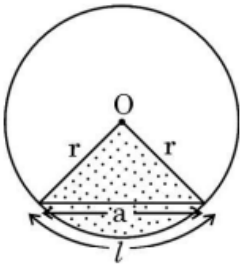
(B) y

(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

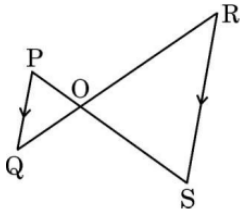
*This section has **5** Very Short Answer (VSA) type questions carrying **2** marks each.* *5×2=10*

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

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

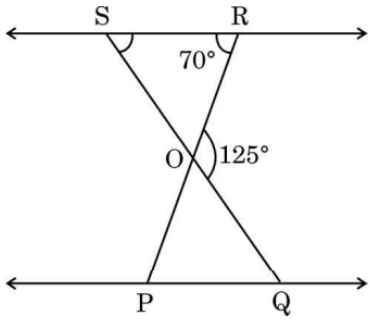
Solution : Solving the two equations to get x = 2, y = – 3	1 + 1

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



OR

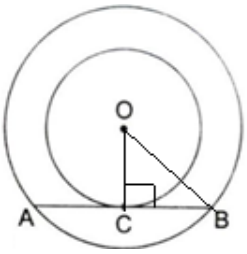
(b) In the given figure, Δ OSR ~ Δ OQP, ∠ ROQ = 125° and ∠ ORS = 70°. Find the measures of ∠ OSR and ∠ OQP.



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

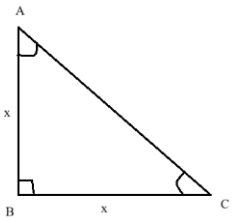
Solving and getting $A = 37{\cdot}5°$ and $B = 7{\cdot}5°$ 1

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



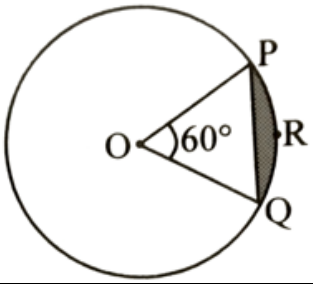
25. A chord of a circle of diameter 20 cm subtends an angle of 60° at the centre of the circle. Find the area of the corresponding minor segment of the circle. (Use $\pi = 3{\cdot}14$ and $\sqrt{3} = 1{\cdot}73$)

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



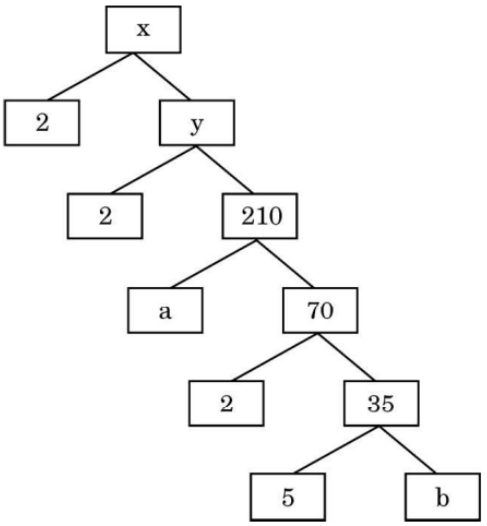
SECTION C

*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

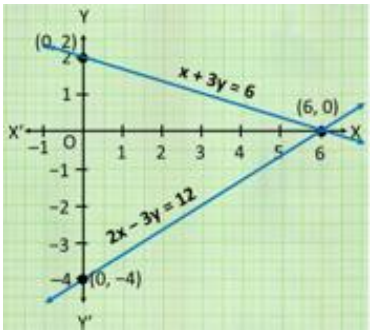
28. (a) Solve the following system of equations graphically :

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

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

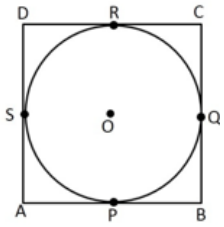
(b) x + y = 90° — 1

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

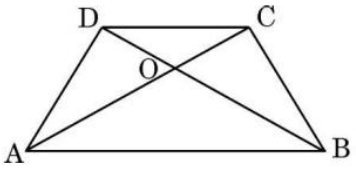
$2x^2 + 2\sqrt{6}x + 3 = 0$; $2x^2 - 2\sqrt{6}x + 3 = 0$

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.



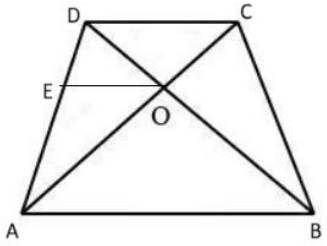
Solution: Statement: If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, the other two sides are divided in the same ratio. — 1

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

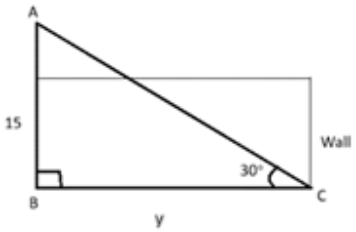
(ii) Let the distance of the point on the ground be 'x'

$\frac{15}{x} = \tan 60°$ 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

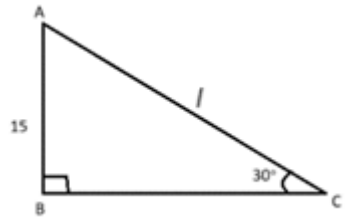
$\frac{15}{y} = \tan 30°$ ½

$y = 15\sqrt{3}$ 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

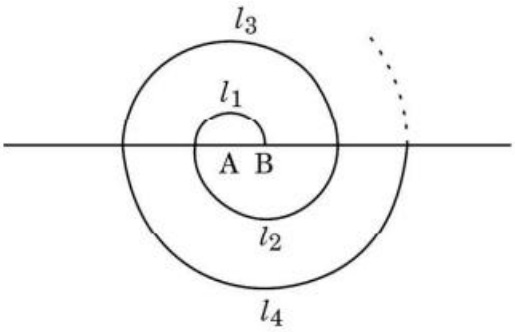
$l = 30$

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 13th spiral ? *1*

(ii) If the radius of the nth spiral is 500 cm, find the value of n. *1*

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

OR

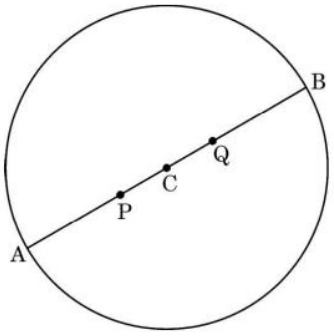
(b) Till which spiral, will there be a total of 450 saplings ? *2*

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

Series C4ABD/4 **SET~1**

प्रश्न–पत्र कोड **Q.P. Code 430/4/1**

रोल नं.

Roll No.

परीक्षार्थी प्रश्न-पत्र कोड को उत्तर-पुस्तिका के मुख-पृष्ठ पर अवश्य लिखें ।

Candidates must write the Q.P. Code on the title page of the answer-book.

नोट / NOTE :

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

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

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

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

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

गणित (बुनियादी)
MATHEMATICS (BASIC)

निर्धारित समय : 3 घण्टे *अधिकतम अंक : 80*

Time allowed : 3 hours *Maximum Marks : 80*

सामान्य निर्देश :

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

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

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

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

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

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

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

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

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

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

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

खण्ड क

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

1. बिन्दुओं $(2, -1)$ और $(-1, -5)$ के बीच की दूरी है :

(A) 15 इकाई (B) 5 इकाई

(C) 25 इकाई (D) 41 इकाई

2. बिन्दुओं A(4, x) और B(– 2, 4) को मिलाने वाले रेखा खंड AB का मध्य-बिन्दु यदि C(1, –1) है, तो x का मान है :

(A) 5 (B) – 5

(C) 6 (D) – 6

3. निम्नलिखित में से कौन-सा संबंध सही है ?

(A) $P(E) = 1 + P(\overline{E})$ (B) $P(\overline{E}) - P(E) = 1$

(C) $P(E) + P(\overline{E}) = 1$ (D) $P(E) = 2P(\overline{E})$

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

1. The distance between the points (2, – 1) and (– 1, – 5) is :

(A) 15 units (B) 5 units

(C) 25 units (D) 41 units

2. If C(1, –1) is the mid-point of the line segment AB joining points A(4, x) and B(– 2, 4), then value of x is :

(A) 5 (B) – 5

(C) 6 (D) – 6

3. Which of the following relationship is correct ?

(A) $P(E) = 1 + P(\overline{E})$ (B) $P(\overline{E}) - P(E) = 1$

(C) $P(E) + P(\overline{E}) = 1$ (D) $P(E) = 2P(\overline{E})$

4. निम्नलिखित बंटन एक फैक्टरी के 50 श्रमिकों की दैनिक आय दर्शाता है :

आय (₹ में)	400 – 424	425 – 449	450 – 474	475 – 499	500 – 524
श्रमिकों की संख्या	12	14	8	6	10

बहुलक वर्ग की निचली सीमा है :

(A) 425 (B) 449

(C) 424·5 (D) 425·5

5. 9 m ऊँचे बिजली के खंभे की ज़मीन पर $3\sqrt{3}$ m लम्बी छाया है । उस समय पर सूर्य का उन्नतांश है :

(A) $60°$ (B) $90°$

(C) $45°$ (D) $30°$

6. यदि द्विघात बहुपद $kx^2 + 4x + k$ का एक शून्यक 1 है, तो k का मान है :

(A) 2 (B) – 2

(C) 4 (D) – 4

7. द्विघात बहुपदों, जिनके शून्यक –1 और 3 हैं, की संख्या है :

(A) 1 (B) 2

(C) 3 (D) 3 से अधिक

8. द्विघात समीकरण $x^2 - 4 = 0$ का/के मूल है/हैं :

(A) केवल 2 (B) – 2, 2

(C) केवल 4 (D) – 4, 4

9. निम्नलिखित में से कौन-सा द्विघात समीकरण ***नहीं*** है ?

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

(B) $(2x - 1)(x - 3) = (x + 5)(x - 1)$

(C) $x(x + 1) + 8 = (x + 2)(x - 2)$

(D) $2x + \frac{3}{x} = 5$

4. The following distribution gives the daily income of 50 workers of a factory :

Income (in ₹)	400 – 424	425 – 449	450 – 474	475 – 499	500 – 524
Number of workers	12	14	8	6	10

The lower limit of the modal class is :

(A) 425 (B) 449

(C) 424·5 (D) 425·5

5. A lamp post 9 m high casts a shadow $3\sqrt{3}$ m long on the ground. The Sun's elevation at this moment is :

(A) 60° (B) 90°

(C) 45° (D) 30°

6. If one zero of a quadratic polynomial $kx^2 + 4x + k$ is 1, then the value of k is :

(A) 2 (B) – 2

(C) 4 (D) – 4

7. The number of quadratic polynomials having zeroes –1 and 3 is :

(A) 1 (B) 2

(C) 3 (D) more than 3

8. The roots of the quadratic equation $x^2 - 4 = 0$ is/are :

(A) 2 only (B) – 2, 2

(C) 4 only (D) – 4, 4

9. Which of the following is ***not*** a quadratic equation ?

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

(B) $(2x - 1)(x - 3) = (x + 5)(x - 1)$

(C) $x(x + 1) + 8 = (x + 2)(x - 2)$

(D) $2x + \frac{3}{x} = 5$

10. समांतर श्रेढ़ी का सार्व अंतर, यदि $a_{23} - a_{19} = 32$ है, है :

(A) 8 (B) – 8

(C) – 4 (D) 4

11. $\left(\frac{1}{\tan^2 \theta} - \frac{1}{\sin^2 \theta}\right)$ बराबर है :

(A) 1 (B) – 1

(C) $\sec^2 \theta$ (D) $\sin^2 \theta$

12. वृत्त की एक जीवा और दो चापों में से किसी एक के बीच का प्रत्येक क्षेत्र कहलाता है :

(A) एक चाप (B) एक त्रिज्यखंड

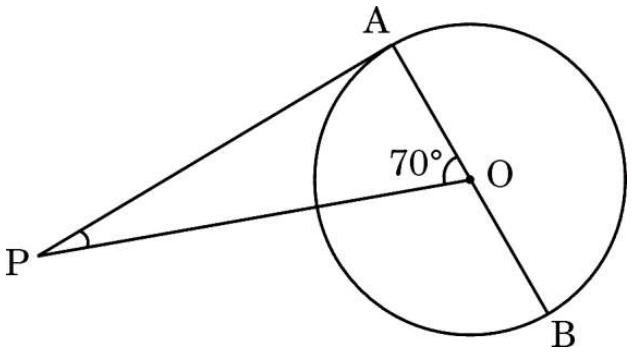
(C) एक वृत्तखंड (D) एक अर्धवृत्त

13. यदि $1080 = 2^x \times 3^y \times 5$ है, तो $(x - y)$ बराबर है :

(A) 6 (B) – 1

(C) 1 (D) 0

14. दी गई आकृति में, केन्द्र O वाले एक वृत्त पर बाह्य बिन्दु P से एक स्पर्श-रेखा PA बनी है । यदि $\angle AOP = 70°$ है, तो $\angle APO$ का माप है :



(A) 70° (B) 90°

(C) 110° (D) 20°

10. The common difference of an A.P., if $a_{23} - a_{19} = 32$, is :

(A) 8 (B) – 8

(C) – 4 (D) 4

11. $\left(\frac{1}{\tan^2 \theta} - \frac{1}{\sin^2 \theta}\right)$ is equal to :

(A) 1 (B) – 1

(C) $\sec^2 \theta$ (D) $\sin^2 \theta$

12. The region between a chord and either of the two arcs of a circle is called :

(A) an arc (B) a sector

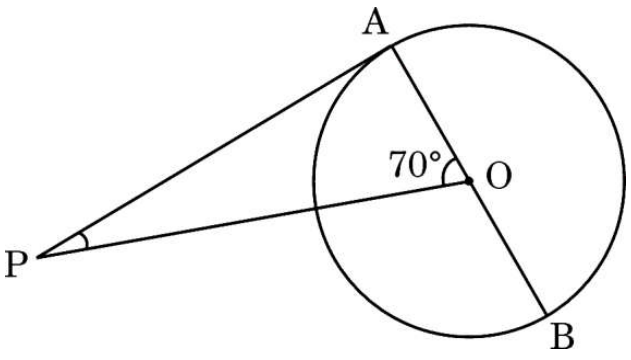
(C) a segment (D) a semicircle

13. If $1080 = 2^x \times 3^y \times 5$, then $(x - y)$ is equal to :

(A) 6 (B) – 1

(C) 1 (D) 0

14. In the given figure, PA is a tangent from an external point P to a circle with centre O. If $\angle AOP = 70°$, then the measure of $\angle APO$ is :



(A) 70° (B) 90°

(C) 110° (D) 20°

15. निम्नलिखित बारंबारता बंटन का माध्यक वर्ग है :

वर्ग	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
बारंबारता	5	8	20	15	7	5

(A) 10 – 20 (B) 20 – 30

(C) 30 – 40 (D) 40 – 50

16. 21 cm त्रिज्या के एक वृत्त में, यदि एक चाप वृत्त के केन्द्र पर 60° का कोण अंतरित करता है, तो इस चाप की लंबाई है :

(A) 11 cm (B) 44 cm

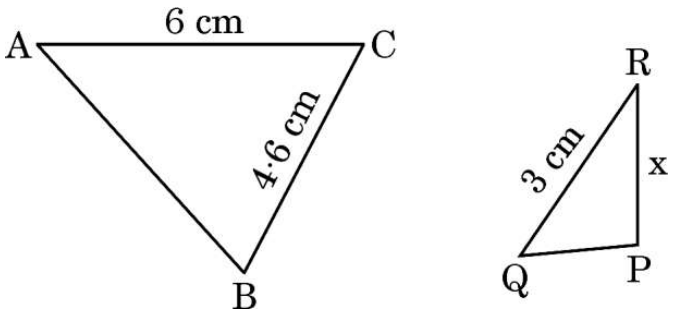
(C) $\frac{22}{7}$ cm (D) 22 cm

17. किसी वृत्त की स्पर्श-रेखा वह रेखा होती है जो वृत्त को स्पर्श करती है :

(A) केवल एक ही बिन्दु पर (B) दो बिन्दुओं पर

(C) तीन बिन्दुओं पर (D) अनंत बिन्दुओं पर

18. दी गई आकृति में, यदि $\Delta ABC \sim \Delta QPR$ है, तो x का मान है :



(A) 5·3 cm (B) 4·6 cm

(C) 2·3 cm (D) 4 cm

15. The median group in the following frequency distribution is :

Class	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
Frequency	5	8	20	15	7	5

(A) 10 – 20 (B) 20 – 30

(C) 30 – 40 (D) 40 – 50

16. In a circle of radius 21 cm, if an arc subtends an angle of 60° at the centre of the circle, then the length of the arc is :

(A) 11 cm (B) 44 cm

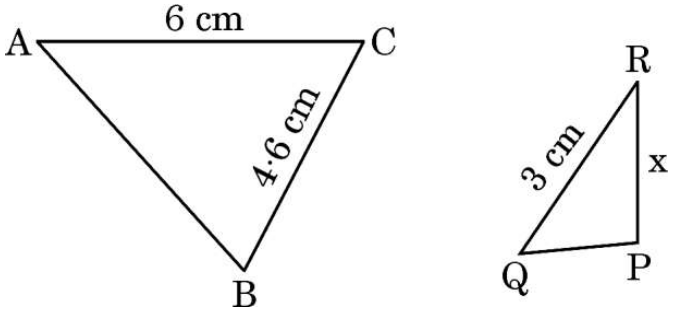
(C) $\frac{22}{7}$ cm (D) 22 cm

17. A tangent to a circle is a line that touches the circle at :

(A) one point only (B) two points

(C) three points (D) infinite number of points

18. In the given figure, if $\Delta ABC \sim \Delta QPR$, then the value of x is :



(A) 5·3 cm (B) 4·6 cm

(C) 2·3 cm (D) 4 cm

*प्रश्न संख्या **19** और **20** अभिकथन एवं तर्क आधारित प्रश्न हैं । दो कथन दिए गए हैं जिनमें एक को अभिकथन (A) तथा दूसरे को तर्क (R) द्वारा अंकित किया गया है । इन प्रश्नों के सही उत्तर नीचे दिए गए कोडों (A), (B), (C) और (D) में से चुनकर दीजिए ।*

(A) अभिकथन (A) और तर्क (R) दोनों सही हैं और तर्क (R), अभिकथन (A) की सही व्याख्या करता है ।

(B) अभिकथन (A) और तर्क (R) दोनों सही हैं, परन्तु तर्क (R), अभिकथन (A) की सही व्याख्या ***नहीं*** करता है ।

(C) अभिकथन (A) सही है, परन्तु तर्क (R) ग़लत है ।

(D) अभिकथन (A) ग़लत है, परन्तु तर्क (R) सही है ।

19. *अभिकथन (A) :* रैखिक समीकरण युग्म $5x + 2y + 6 = 0$ और $7x + 6y + 18 = 0$ के अपरिमित रूप से अनेक हल हैं ।

तर्क (R) : रैखिक समीकरण युग्म $a_1x + b_1y + c_1 = 0$ और $a_2x + b_2y + c_2 = 0$ के अपरिमित रूप से अनेक हल होंगे, यदि $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ है ।

20. *अभिकथन (A) :* एक पासा फेंकने पर, संख्या 8 प्राप्त होने की प्रायिकता शून्य (0) है ।

तर्क (R) : एक असंभव घटना की प्रायिकता शून्य (0) होती है ।

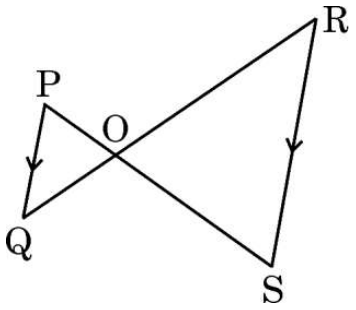
खण्ड ख

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

21. HCF (306, 1314) = 18 दिया गया है, तो LCM (306, 1314) ज्ञात कीजिए ।

22. किसी वृत्त के व्यास AB के सिरों पर दो स्पर्श-रेखाएँ XY और PQ खींची गई हैं । सिद्ध कीजिए कि XY || PQ है ।

23. (a) दी गई आकृति में, PQ || RS है । सिद्ध कीजिए कि $OP \times OR = OQ \times OS$.



अथवा

*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 pair of linear equations $5x + 2y + 6 = 0$ and $7x + 6y + 18 = 0$ have infinitely many solutions.

Reason (R) : The pair of linear equations $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ have infinitely many solutions, if $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$.

20. *Assertion (A) :* The probability of getting number 8 on rolling a die is zero (0).

Reason (R) : The probability of an impossible event is zero (0).

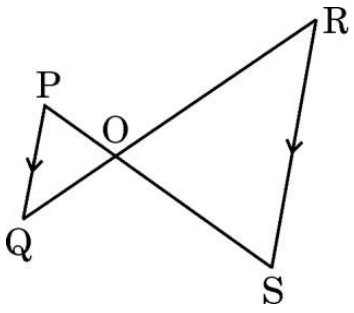
SECTION B

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

21. Given that HCF (306, 1314) = 18, find LCM of (306, 1314).

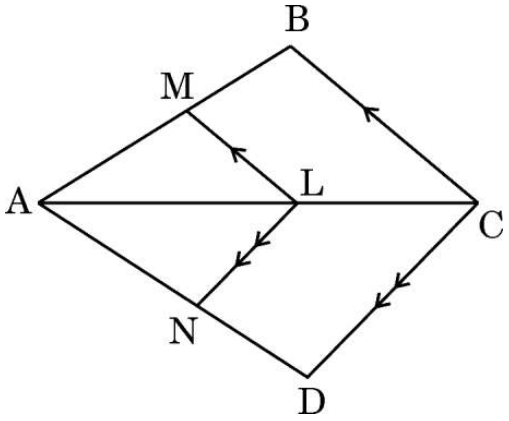
22. XY and PQ are two tangents drawn at the end points of the diameter AB of a circle. Prove that XY || PQ.

23. (a) In the given figure, PQ || RS. Prove that OP × OR = OQ × OS.



OR

(b) दी गई आकृति में, LM || CB और LN || CD है । सिद्ध कीजिए कि $\frac{AM}{AN} = \frac{AB}{AD}$.



24. (a) यदि बहुपद $8x^2 + 14x + 3$ के शून्यक α, β हैं, तो $\left(\frac{1}{\alpha} + \frac{1}{\beta}\right)$ का मान ज्ञात कीजिए ।

अथवा

(b) एक द्विघात बहुपद ज्ञात कीजिए जिसके शून्यक – 9 और 6 हैं ।

25. मान ज्ञात कीजिए :

$$\sin 30° \cos 60° + \cos 30° \sin 60° - \cot 45°$$

खण्ड ग

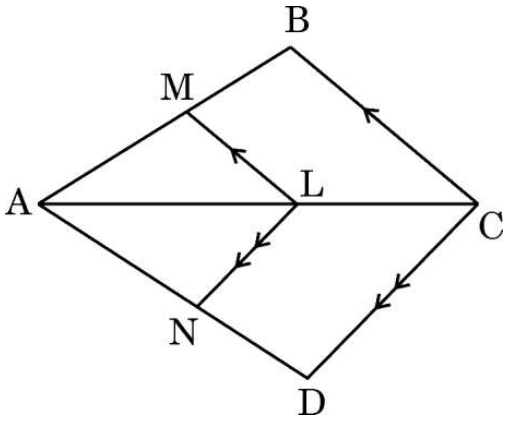
इस खण्ड में लघु-उत्तरीय (SA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक के 3 अंक हैं । *6×3=18*

26. 10 cm त्रिज्या वाले एक वृत्त की कोई जीवा वृत्त के केन्द्र पर एक समकोण अंतरित करती है । संगत (i) लघु त्रिज्यखंड (ii) दीर्घ त्रिज्यखंड के क्षेत्रफल ज्ञात कीजिए । ($\pi = 3{\cdot}14$ का प्रयोग कीजिए)

27. (a) सिद्ध कीजिए कि वृत्त के परिगत बने चतुर्भुज के आमने-सामने की भुजाएँ वृत्त के केन्द्र पर संपूरक कोण अंतरित करती हैं ।

अथवा

(b) In the given figure, LM || CB and LN || CD. Prove that $\frac{AM}{AN} = \frac{AB}{AD}$.



24. (a) If α, β are zeroes of the polynomial $8x^2 + 14x + 3$, then find the value of $\left(\frac{1}{\alpha} + \frac{1}{\beta}\right)$.

OR

(b) Find a quadratic polynomial whose zeroes are -9 and 6.

25. Evaluate :

$\sin 30° \cos 60° + \cos 30° \sin 60° - \cot 45°$

SECTION C

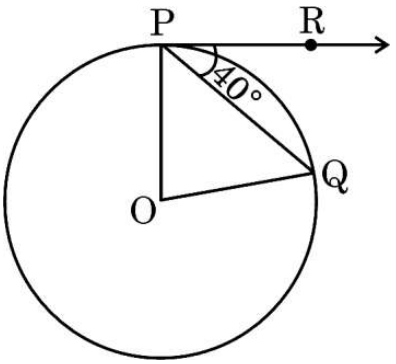
This section comprises Short Answer (SA) type questions of 3 marks each. *6×3=18*

26. A chord of a circle of radius 10 cm subtends a right angle at the centre of the circle. Find the area of the corresponding (i) minor sector (ii) major sector. (Use $\pi = 3{\cdot}14$)

27. (a) Prove that opposite sides of a quadrilateral circumscribing a circle subtends supplementary angles at the centre of the circle.

OR

(b) यदि एक वृत्त का केन्द्र O, जीवा PQ और P पर खींची गई स्पर्श-रेखा PR, जीवा PQ से $40°$ का कोण बनाती हो, तो $\angle POQ$ का माप ज्ञात कीजिए ।



28. (a) द्विघाती सूत्र का प्रयोग करके, समीकरण $2x^2 + 2x + 9 = 0$ के वास्तविक मूल, यदि उनका अस्तित्व है, ज्ञात कीजिए ।

अथवा

(b) 'k' के वे मान ज्ञात कीजिए जिनके लिए द्विघात समीकरण $kx^2 - 2kx + 6 = 0$ के वास्तविक और समान मूल हैं । यह मूल भी ज्ञात कीजिए ।

29. ताश के 52 पत्तों की अच्छी तरह से फेंटी गई एक गड्डी से एक पत्ता यादृच्छया निकाला जाता है । प्रायिकता ज्ञात कीजिए कि निकाला गया पत्ता :

(i) लाल रंग का बादशाह है ।

(ii) काले रंग का पत्ता नहीं है ।

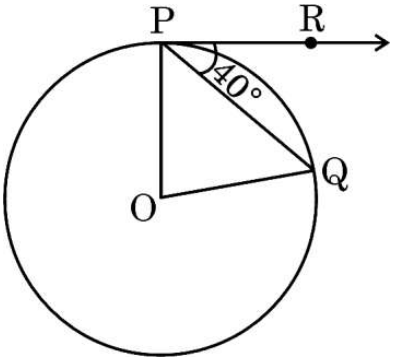
(iii) पान का इक्का है ।

30. सिद्ध कीजिए कि $2 + 5\sqrt{3}$ एक अपरिमेय संख्या है, यदि दिया गया है कि $\sqrt{3}$ एक अपरिमेय संख्या है ।

31. सिद्ध कीजिए कि :

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

(b) If O is the centre of a circle, PQ is a chord and the tangent PR at P makes an angle of 40° with PQ, then find the measure of $\angle$ POQ.



28. (a) Using quadratic formula, find the real roots of the equation $2x^2 + 2x + 9 = 0$, if they exist.

OR

(b) Find the values of 'k' for which the quadratic equation $kx^2 - 2kx + 6 = 0$ has real and equal roots. Also, find the roots.

29. One card is drawn at random from a well-shuffled deck of 52 playing cards. Find the probability that the card drawn is :

(i) a red king.

(ii) not a black card.

(iii) an ace of hearts.

30. Prove that $2 + 5\sqrt{3}$ is an irrational number, if it is given that $\sqrt{3}$ is an irrational number.

31. Prove that :

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

खण्ड घ

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

32. (a) दो घनों, जिनमें से प्रत्येक का आयतन $125\ cm^3$ है, के संलग्न फलकों को मिलाकर रखा जाता है । प्राप्त घनाभ का आयतन और पृष्ठीय क्षेत्रफल ज्ञात कीजिए ।

अथवा

(b) एक ठोस एक अर्धगोले पर अध्यारोपित एक शंकु के आकार का है जिसमें दोनों के व्यास 7 cm के बराबर हैं और शंकु की ऊँचाई उसकी त्रिज्या के बराबर है । ठोस का आयतन ज्ञात कीजिए ।

33. एक ठेकेदार बच्चों को खेलने के लिए एक पार्क में दो फिसलन पट्टी लगाना चाहता है । 6 वर्ष से कम उम्र के बच्चों के लिए, वह एक ऐसी फिसलन पट्टी लगाना चाहता है जिसका शिखर 2·0 m की ऊँचाई पर हो और भूमि के साथ 30° के कोण पर झुकी हुई है, जबकि इससे अधिक उम्र के बच्चों के लिए, वह 4·0 m की ऊँचाई पर अधिक ढाल की फिसलन पट्टी लगाना चाहता है जो भूमि के साथ 60° के कोण पर झुकी हुई हो । प्रत्येक स्थिति में फिसलन पट्टी की लंबाई क्या होगी ?

34. (a) यदि BD और QM क्रमश: त्रिभुज ABC और PQR की माध्यिकाएँ हैं, जहाँ $\Delta ABC \sim \Delta PQR$ है, तो सिद्ध कीजिए कि $\frac{AB}{PQ} = \frac{BD}{QM}$.

अथवा

(b) CD और GH क्रमश: $\angle ACB$ और $\angle EGF$ के ऐसे समद्विभाजक हैं कि बिन्दु D और H क्रमश: ΔABC और ΔFEG की भुजाओं AB तथा FE पर स्थित हैं । यदि $\Delta ABC \sim \Delta FEG$ है, तो दर्शाइए कि :

(i) $\frac{CD}{GH} = \frac{AC}{FG}$

(ii) $\Delta DCB \sim \Delta HGE$

35. टी.वी. सेटों का एक निर्माता चौथे वर्ष में 720 टी.वी. सेट तथा आठवें वर्ष में 880 टी.वी. सेट का उत्पादन करता है । यह मानते हुए कि प्रत्येक वर्ष उत्पादन में एकसमान रूप से एक निश्चित संख्या में वृद्धि होती है, तो दसवें वर्ष का उत्पादन और पहले सात वर्षों का कुल उत्पादन ज्ञात कीजिए ।

SECTION D

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

32. (a) Two cubes each of volume 125 cm^3 are joined end to end. Find the volume and the surface area of the resulting cuboid.

OR

(b) A solid is in the shape of a cone surmounted on a hemisphere with both their diameters being equal to 7 cm and the height of the cone is equal to its radius. Find the volume of the solid.

33. A contractor plans to install two slides for the children to play in a park. For the children below the age of 6 years, he prefers to have a slide whose top is at a height of 2·0 m and is inclined at an angle of 30° to the ground, whereas for older children, he wants to have a steep slide at a height of 4·0 m and inclined at an angle of 60° to the ground. What would be the length of the slide in each case ?

34. (a) If BD and QM are medians of triangles ABC and PQR, respectively, where $\Delta ABC \sim \Delta PQR$, prove that $\frac{AB}{PQ} = \frac{BD}{QM}$.

OR

(b) CD and GH are respectively the bisectors of $\angle ACB$ and $\angle EGF$ such that D and H lie on sides AB and FE of ΔABC and ΔFEG respectively. If $\Delta ABC \sim \Delta FEG$, show that :

(i) $\frac{CD}{GH} = \frac{AC}{FG}$

(ii) $\Delta DCB \sim \Delta HGE$

35. A manufacturer of TV sets produced 720 TV sets in the fourth year and 880 TV sets in the eighth year. Assuming that the production increases uniformly by a fixed number every year, find the production in the tenth year and the total production in the first seven years.

खण्ड ङ

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

प्रकरण अध्ययन – 1

36. म्यूचुअल फंड : म्यूचुअल फंड एक प्रकार का निवेश माध्यम है जो स्टॉक, बॉन्ड या अन्य प्रतिभूतियों में निवेश करने के लिए कई निवेशकों से पैसा एकत्र करता है । म्यूचुअल फंड पेशेवर मनी मैनेजर द्वारा संचालित होते हैं, जो फंड की परिसंपत्ति आबंटित करते हैं और फंड के निवेशकों के लिए पूँजीगत लाभ या आय उत्पन्न करने का प्रयास करते हैं ।



शुद्ध परिसंपत्ति मूल्य (NAV) किसी फंड के प्रति शेयर बाज़ार मूल्य का प्रतिनिधित्व करता है । यह वह कीमत है जिस पर निवेशक किसी फंड कंपनी से फंड शेयर खरीदते हैं और उन्हें किसी फंड कंपनी को बेचते हैं ।

निम्नलिखित तालिका ICICI म्यूचुअल फंडों के म्यूचुअल फंड की प्रति यूनिट शुद्ध परिसंपत्ति मूल्य (NAV) को दर्शाती है :

NAV (₹ में)	0 – 5	5 – 10	10 – 15	15 – 20	20 – 25
म्यूचुअल फंडों की संख्या	13	16	22	18	11

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

(i) आँकड़ों के बहुलक वर्ग की ऊपरी सीमा क्या है ? *1*

(ii) आँकड़ों का माध्यक वर्ग क्या है ? *1*

SECTION E

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

Case Study – 1

36. Mutual Fund : A mutual fund is a type of investment vehicle that pools money from multiple investors to invest in securities like stocks, bonds or other securities. Mutual funds are operated by professional money managers, who allocate the fund's assets and attempt to produce capital gains or income for the fund's investors.



Net Asset Value (NAV) represents a fund's per share market value. It is the price at which the investors buy fund shares from a fund company and sell them to a fund company.

The following table shows the Net Asset Value (NAV) per unit of mutual fund of ICICI mutual funds :

NAV (in ₹)	0 – 5	5 – 10	10 – 15	15 – 20	20 – 25
Number of mutual funds	13	16	22	18	11

Based on the above information, answer the following questions :

(i) What is the upper limit of modal class of the data ? *1*

(ii) What is the median class of the data ? *1*

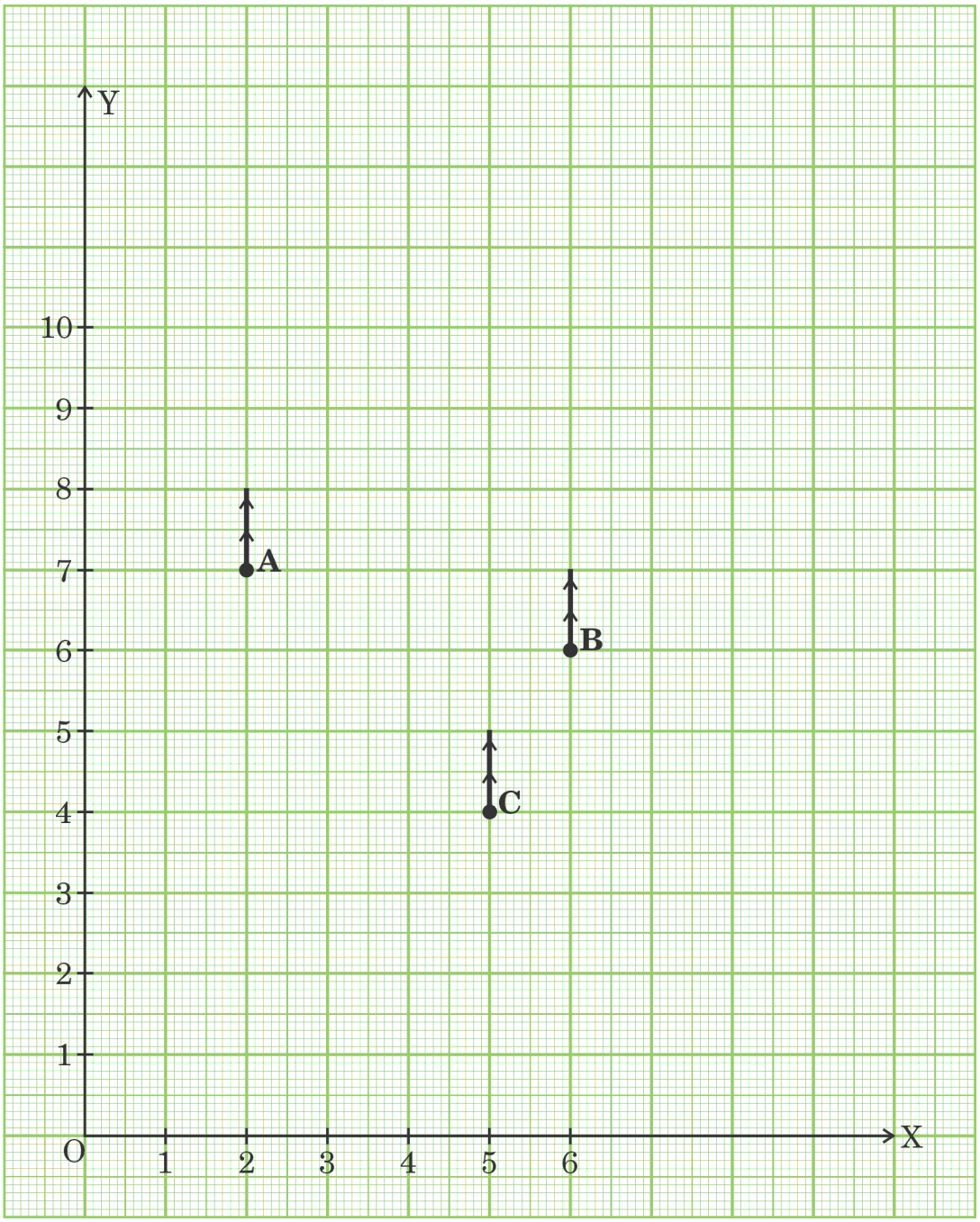
(iii) (a) म्यूचुअल फंडों का बहुलक NAV क्या है ? *2*

अथवा

(b) म्यूचुअल फंडों का माध्यक NAV क्या है ? *2*

प्रकरण अध्ययन – 2

37. दिल्ली में गुलमोहर सोसाइटी के आवासीय कल्याण संघ (RWA) ने सोसाइटी के कॉमन पार्क में तीन बिजली के खंभे A, B और C लगाए हैं । इन तीन खंभों के बावजूद, पार्क के कुछ हिस्से अब भी अँधेरे में हैं । इसलिए, RWA ने पार्क में एक और बिजली का खंभा D लगाने का फैसला किया । पार्क को नीचे दी गई निर्देशांक प्रणाली के रूप में तैयार किया जा सकता है ।



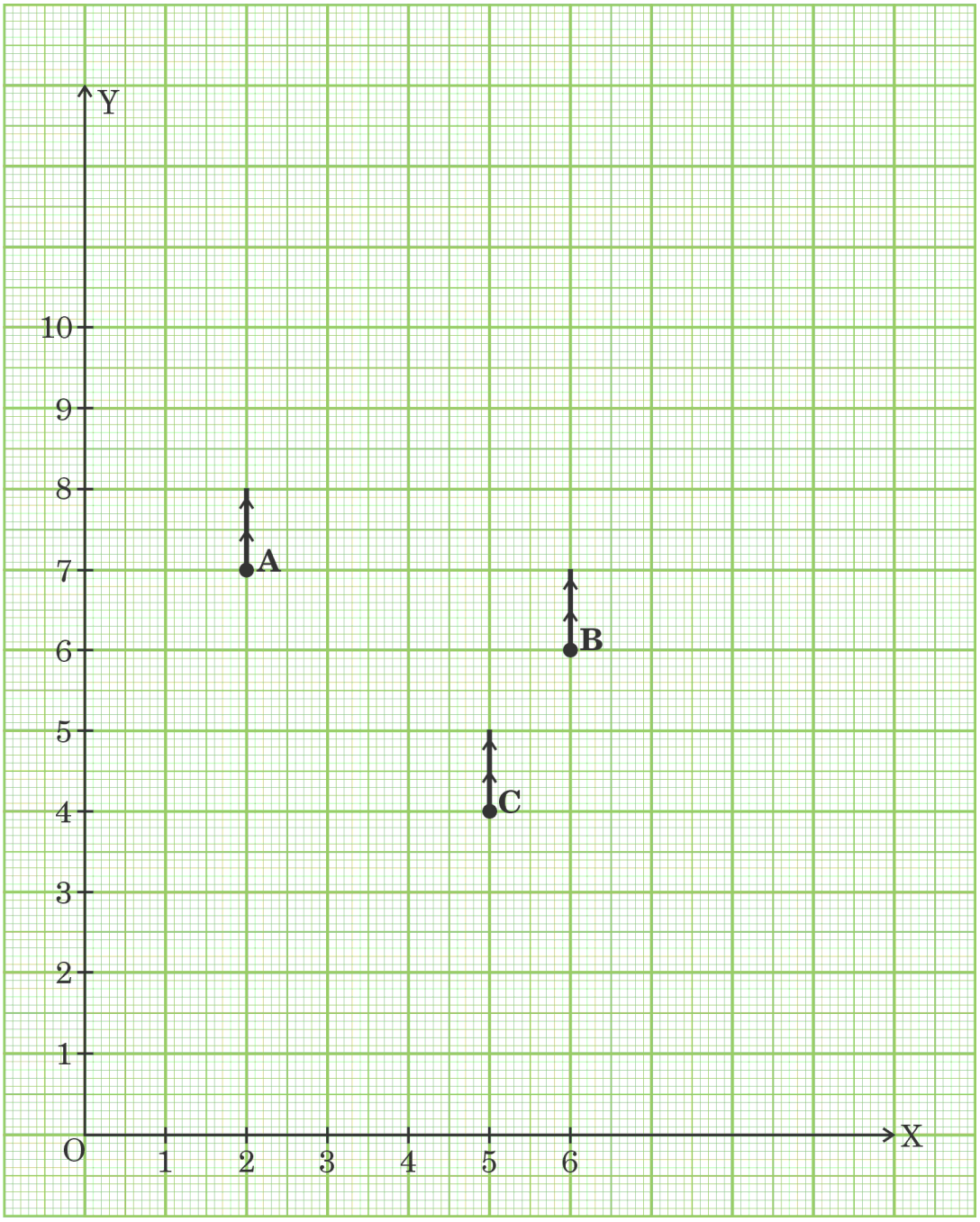
(iii) (a) What is the mode NAV of mutual funds ? *2*

OR

(b) What is the median NAV of mutual funds ? *2*

Case Study – 2

37. Resident Welfare Association (RWA) of Gulmohar Society in Delhi, have installed three electric poles A, B and C in the society's common park. Despite these three poles, some parts of the park are still in the dark. So, RWA decides to have one more electric pole D in the park. The park can be modelled as a coordinate system given below.



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

(i) खंभे C का स्थान क्या है ? *1*

(ii) पार्क के कोने O से खंभे B की दूरी कितनी है ? *1*

(iii) (a) चौथे खंभे D का स्थान ज्ञात कीजिए जिससे चार बिन्दु A, B, C और D एक समांतर चतुर्भुज ABCD बनाएँ । *2*

अथवा

(b) खंभे A और C के बीच की दूरी ज्ञात कीजिए । *2*

प्रकरण अध्ययन – 3

38. दिपांकर ने स्कूल की पुस्तक की दुकान से 3 नोटबुक और 2 पेन ₹ 80 में खरीदे और उसके मित्र सूर्यांश ने 4 नोटबुक और 3 पेन ₹ 110 में खरीदे ।



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

(i) यदि एक नोटबुक का मूल्य ₹ x और एक पेन का मूल्य ₹ y है, तो दी गई स्थिति को बीजगणितीय रूप में लिखिए । *1*

(ii) (a) एक नोटबुक का मूल्य क्या है ? *2*

अथवा

(b) एक पेन का मूल्य क्या है ? *2*

(iii) सूर्यांश यदि 6 नोटबुक और 3 पेन खरीदता है, तो उसे कुल कितनी राशि खर्च करनी पड़ेगी ? *1*

On the basis of the above information, answer the following questions :

(i) What is the position of the pole C ? *1*

(ii) What is the distance of the pole B from the corner O of the park ? *1*

(iii) (a) Find the position of the fourth pole D so that the four points A, B, C and D form a parallelogram ABCD. *2*

OR

(b) Find the distance between poles A and C. *2*

Case Study – 3

38. Deepankar bought 3 notebooks and 2 pens for ₹ 80 and his friend Suryansh bought 4 notebooks and 3 pens for ₹ 110 from the school bookshop.



Based on the above information, answer the following questions.

(i) If the price of one notebook be ₹ x and the price of one pen be ₹ y, write the given situation algebraically. *1*

(ii) (a) What is the price of one notebook ? *2*

OR

(b) What is the price of one pen ? *2*

(iii) What is the total amount to be paid by Suryansh, if he purchases 6 notebooks and 3 pens ? *1*

Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2024
SUBJECT NAME MATHEMATICS (BASIC) (Q.P. CODE 430/4/1)

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.

SECTION A

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

1. The distance between the points (2, – 1) and (– 1, – 5) is :

(A) 15 units (B) 5 units

(C) 25 units (D) 41 units

Answer (B) 5 units 1

---

2. If C(1, –1) is the mid-point of the line segment AB joining points A(4, x) and B(– 2, 4), then value of x is :

(A) 5 (B) – 5

(C) 6 (D) – 6

Answer (D) – 6 1

---

3. Which of the following relationship is correct ?

(A) $P(E) = 1 + P(\overline{E})$ (B) $P(\overline{E}) - P(E) = 1$

(C) $P(E) + P(\overline{E}) = 1$ (D) $P(E) = 2P(\overline{E})$

Answer (C) $P(E) + P(\overline{E}) = 1$ 1

---

4. The following distribution gives the daily income of 50 workers of a factory :

Income (in ₹)	400 – 424	425 – 449	450 – 474	475 – 499	500 – 524
Number of workers	12	14	8	6	10

The lower limit of the modal class is :

(A) 425 (B) 449

(C) 424·5 (D) 425·5

Answer (C) 424·5 1

---

5. A lamp post 9 m high casts a shadow $3\sqrt{3}$ m long on the ground. The Sun's elevation at this moment is :

(A) 60° (B) 90°

(C) 45° (D) 30°

Answer (A) 60° 1

---

6. If one zero of a quadratic polynomial $kx^2 + 4x + k$ is 1, then the value of k is :

(A) 2 (B) – 2

(C) 4 (D) – 4

Answer (B) – 2 1

---

7. The number of quadratic polynomials having zeroes –1 and 3 is :

(A) 1 (B) 2

(C) 3 (D) more than 3

Answer (D) more than 3 1

---

8. The roots of the quadratic equation $x^2 - 4 = 0$ is/are :

(A) 2 only (B) – 2, 2

(C) 4 only (D) – 4, 4

Answer (B) – 2, 2 1

---

9. Which of the following is ***not*** a quadratic equation ?

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

(B) $(2x - 1)(x - 3) = (x + 5)(x - 1)$

(C) $x(x + 1) + 8 = (x + 2)(x - 2)$

(D) $2x + \frac{3}{x} = 5$

Answer (C) x(x + 1) + 8 = (x + 2) (x – 2) 1

---

10. The common difference of an A.P., if $a_{23} - a_{19} = 32$, is :

(A) 8 (B) – 8

(C) – 4 (D) 4

Answer (A) 8 1

---

11. $\left(\frac{1}{\tan^2 \theta} - \frac{1}{\sin^2 \theta}\right)$ is equal to :

(A) 1 (B) – 1

(C) $\sec^2 \theta$ (D) $\sin^2 \theta$

Answer (B) – 1 1

---

12. The region between a chord and either of the two arcs of a circle is called :

(A) an arc (B) a sector

(C) a segment (D) a semicircle

Answer (C) a segment 1

---

13. If $1080 = 2^x \times 3^y \times 5$, then $(x - y)$ is equal to :

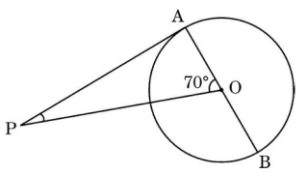
(A) 6 (B) -1

(C) 1 (D) 0

Answer (D)0 1

---

14. In the given figure, PA is a tangent from an external point P to a circle with centre O. If $\angle AOP = 70°$, then the measure of $\angle APO$ is :



(A) 70° (B) 90°

(C) 110° (D) 20°

Answer (D) 20° 1

---

15. The median group in the following frequency distribution is :

Class	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
Frequency	5	8	20	15	7	5

(A) 10 – 20 (B) 20 – 30

(C) 30 – 40 (D) 40 – 50

Answer (B) 20 – 30 1

---

16. In a circle of radius 21 cm, if an arc subtends an angle of 60° at the centre of the circle, then the length of the arc is :

(A) 11 cm (B) 44 cm

(C) $\frac{22}{7}$ cm (D) 22 cm

Answer (D) 22 cm 1

---

17. A tangent to a circle is a line that touches the circle at :

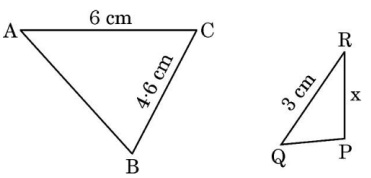
(A) one point only (B) two points

(C) three points (D) infinite number of points

Answer (A) one point only 1

---

18. In the given figure, if $\Delta ABC \sim \Delta QPR$, then the value of x is :



(A) 5·3 cm (B) 4·6 cm

(C) 2·3 cm (D) 4 cm

Answer (C) 2·3 cm 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 pair of linear equations $5x + 2y + 6 = 0$ and $7x + 6y + 18 = 0$ have infinitely many solutions.

Reason (R) : The pair of linear equations $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ have 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

---

20. *Assertion (A) :* The probability of getting number 8 on rolling a die is zero (0).

Reason (R) : The probability of an impossible event is zero (0).

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

SECTION B

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

21. Given that HCF (306, 1314) = 18, find LCM of (306, 1314).

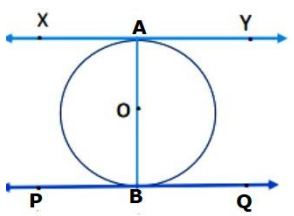
Solution: $LCM \times 18 = 306 \times 1314$ 1

$LCM = \frac{306 \times 1314}{18} = 22{,}338$ 1

---

22. XY and PQ are two tangents drawn at the end points of the diameter AB of a circle. Prove that XY || PQ.

Solution:



$\frac{1}{2}$ For figure

Given: XY & PQ are tangents, AB is the diameter

To prove: XY || PQ

Proof: XY ⊥ OA (Tangent is perpendicular to radius)

$\therefore \angle OAY = 90^0$ $\frac{1}{2}$

PQ ⊥ OB (Tangent is perpendicular to radius)

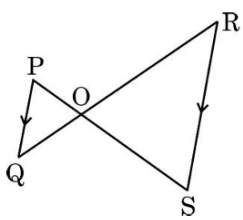
$\therefore \angle OBP = 90°$ $\frac{1}{2}$

But ∠OAY and ∠OBP are alternate interior angles

$\therefore$ XY || PQ $\frac{1}{2}$

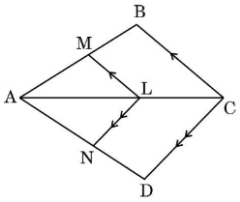
---

23. (a) In the given figure, PQ || RS. Prove that OP × OR = OQ × OS.



OR

(b) In the given figure, LM || CB and LN || CD. Prove that $\frac{AM}{AN} = \frac{AB}{AD}$.



Solution: (a) In Δ POQ and Δ SOR

$\angle POQ = \angle SOR$ (vertically opposite angles) $\frac{1}{2}$

$\angle OPQ = \angle OSR$ (alternate interior angles as PQ || SR) $\frac{1}{2}$

$\therefore \Delta POQ \sim \Delta SOR$ (AA criteria) $\frac{1}{2}$

$\Rightarrow \frac{OP}{OS} = \frac{OQ}{OR}$ or $OP \times OR = OQ \times OS$ $\frac{1}{2}$

OR

(b) In Δ ABC, LM || CB

$\therefore \frac{AM}{AB} = \frac{AL}{AC}$ _____ (i)

In Δ ADC, LN || CD $1\frac{1}{2}$

$\therefore \frac{AN}{AD} = \frac{AL}{AC}$ _____ (ii)

from (i) and (ii) $\frac{AM}{AB} = \frac{AN}{AD}$ or $\frac{AM}{AN} = \frac{AB}{AD}$ $\frac{1}{2}$

---

24. (a) If α, β are zeroes of the polynomial $8x^2 + 14x + 3$, then find the value of $\left(\frac{1}{\alpha} + \frac{1}{\beta}\right)$.

OR

(b) Find a quadratic polynomial whose zeroes are -9 and 6.

Solution: (a)As α, β are zeroes of the polynomial

$\therefore \alpha + \beta = \frac{-14}{8}$ $\frac{1}{2}$

$\alpha\beta = \frac{3}{8}$ $\frac{1}{2}$

$\frac{1}{\alpha} + \frac{1}{\beta} = \frac{\beta + \alpha}{\alpha\beta} = \frac{-14}{3}$ $\frac{1}{2}+\frac{1}{2}$

OR

(b) Sum of zeroes $= -3$ $\frac{1}{2}$

Product of zeroes $= -54$ $\frac{1}{2}$

Quadratic polynomial is : $k(x^2 + 3x - 54)$ or $x^2 + 3x - 54$ 1

---

25. Evaluate :

$$\sin 30° \cos 60° + \cos 30° \sin 60° - \cot 45°$$

Solution $\sin 30° \cos 60° + \cos 30° \sin 60° - \cot 45^0$

$= \frac{1}{2} \times \frac{1}{2} + \frac{\sqrt{3}}{2} \times \frac{\sqrt{3}}{2} - 1$ $1\frac{1}{2}$

$= 0$ $\frac{1}{2}$

SECTION C

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

26. A chord of a circle of radius 10 cm subtends a right angle at the centre of the circle. Find the area of the corresponding (i) minor sector (ii) major sector. (Use $\pi = 3{\cdot}14$)

Solution

(i) Area of minor sector $= \frac{\pi r^2 \theta}{360^\circ} = \frac{3.14 \times 10 \times 10 \times 90}{360}$ 1

$= \frac{314}{4}$ cm^2 or $\frac{157}{2}$ cm^2 or 78·5 cm^2 $\frac{1}{2}$

(ii) Area of circle $= \pi r^2 = 3{\cdot}14 \times 10 \times 10 = 314$ cm^2 1

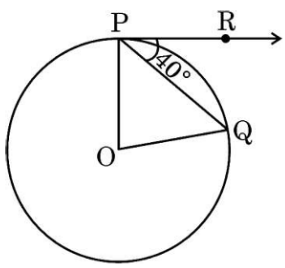
$\therefore$ Area of major sector $= 314 - 78{\cdot}5 = 235{\cdot}5$ cm^2 $\frac{1}{2}$

---

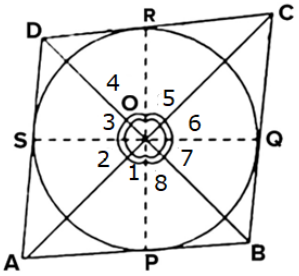
27. (a) Prove that opposite sides of a quadrilateral circumscribing a circle subtends supplementary angles at the centre of the circle.

OR

(b) If O is the centre of a circle, PQ is a chord and the tangent PR at P makes an angle of 40° with PQ, then find the measure of $\angle$ POQ.



Solution: (a) Given: A quadrilateral ABCD circumscribes a circle with centre O



$\frac{1}{2}$ for fig.

To Prove: $\angle$ AOB + $\angle$ COD = 180° *and* $\angle$ BOC + $\angle$ AOD = 180°

Proof: In Δ AOP and Δ AOS

OA = OA (common)

OP = OS (radii)

AP = AS (tangents from an external point)

$\therefore \Delta AOP \cong \Delta AOS$ (SSS criteria) 1

$\therefore \angle 1 = \angle 2$

||ly, $\angle 3 = \angle 4$, $\angle 5 = \angle 6$ and $\angle 7 = \angle 8$ $\frac{1}{2}$

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

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

$\Rightarrow (\angle 1 + \angle 8) + (\angle 4 + \angle 5) = 180°$ $\frac{1}{2}$

$\Rightarrow \angle AOB + \angle COD = 180°$

||ly, $\angle BOC + \angle AOD = 180°$ $\frac{1}{2}$

OR

(b) $\angle RPQ = 40°$ (given)

$\angle OPR = 90°$ (radius $\perp$ tangent)

$\therefore \angle OPQ = 90° - 40° = 50°$ 1

In Δ POQ, OP = OQ (radii of same circle)

$\therefore \angle OPQ = \angle OQP = 50°$ (angles opposite to equal sides) 1

Now , $\angle OPQ + \angle OQP + \angle POQ = 180°$

$50° + 50° + \angle POQ = 180°$

$\angle POQ = 80°$ 1

---

28. (a) Using quadratic formula, find the real roots of the equation $2x^2 + 2x + 9 = 0$, if they exist.

OR

(b) Find the values of 'k' for which the quadratic equation $kx^2 - 2kx + 6 = 0$ has real and equal roots. Also, find the roots.

Solution (a) D=-68 2

since D<0, the equation does not have real roots. 1

OR

(b) $kx^2 - 2kx + 6 = 0$

Quadratic Equation has equal roots (given)

$\therefore D = 0 \Rightarrow 4k^2 - 24k = 0$ 1

$4k(k - 6) = 0$

$\Rightarrow k = 6 \ (k \neq 0)$ 1

Putting k = 6 we get

$6x^2 - 12x + 6 = 0$ or $x^2 - 2x + 1 = 0$

$\Rightarrow (x - 1)^2 = 0 \Rightarrow x = 1$ 1

---

29. One card is drawn at random from a well-shuffled deck of 52 playing cards. Find the probability that the card drawn is :

(i) a red king.

(ii) not a black card.

(iii) an ace of hearts.

Solution: (i) P (Red king) = $\frac{2}{52}$ or $\frac{1}{26}$ 1

(ii) P(not a black card) = $\frac{26}{52}$ or $\frac{1}{2}$ 1

(iii) P(ace of hearts) = $\frac{1}{52}$ 1

---

30. Prove that $2 + 5\sqrt{3}$ is an irrational number, if it is given that $\sqrt{3}$ is an irrational number.

Solution: Let us assume that $x = 2 + 5\sqrt{3}$ is a rational number 1

$\Rightarrow \sqrt{3} = \frac{x-2}{5}$ 1

Now RHS is rational number but LHS is an irrational number

$\therefore$ our assumption is wrong 1

Hence $2 + 5\sqrt{3}$ is an irrational number

---

31. Prove that :

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

Solution: LHS = $\tan^2 A + \sec^2 A + 2\sec A \tan A + \tan^2 A + \sec^2 A - 2\sec A \tan A$ 1

$= 2\left[\frac{\sin^2 A + 1}{\cos^2 A}\right]$ $1\frac{1}{2}$

$= 2\left[\frac{1 + \sin^2 A}{1 - \sin^2 A}\right]$ = RHS $\frac{1}{2}$

SECTION D

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

32. (a) Two cubes each of volume 125 cm^3 are joined end to end. Find the volume and the surface area of the resulting cuboid.

OR

(b) A solid is in the shape of a cone surmounted on a hemisphere with both their diameters being equal to 7 cm and the height of the cone is equal to its radius. Find the volume of the solid.

Solution: (a)Volume of one cube = 125 cm^3

$\therefore$ side of the cube = 5 cm 1

Volume of the resulting cuboid = volume of 2 cubes = 250 cm^3 1

$\therefore$ Length of new cuboid 5 + 5 = 10 cm

Breadth of new cuboid = 5 cm

Height of new cuboid = 5 cm $1\frac{1}{2}$

Surface area of the resulting cuboid = 2 (*l*b + bh + h*l*)

= 2 (10 × 5 + 5 × 5 + 5 × 10) 1

=250 cm^2 $\frac{1}{2}$

OR

(b)Radius of hemisphere = radius of cone = $\frac{7}{2}$ cm 1

Height of cone = $\frac{7}{2}$ cm $\frac{1}{2}$

Volume of the solid = Volume of hemisphere + Volume of cone

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

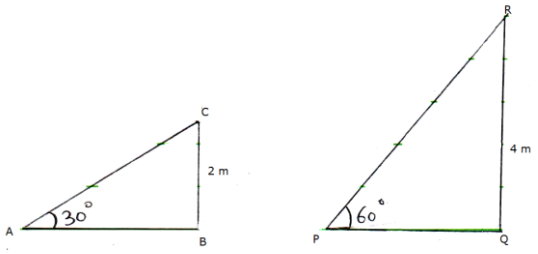
$= \frac{1}{3} \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2}\left(2 \times \frac{7}{2} + \frac{7}{2}\right)$ 3

$= \frac{539}{4}$ cm^3 or 134·75 cm^3 $\frac{1}{2}$

---

33. A contractor plans to install two slides for the children to play in a park. For the children below the age of 6 years, he prefers to have a slide whose top is at a height of 2·0 m and is inclined at an angle of 30° to the ground, whereas for older children, he wants to have a steep slide at a height of 4·0 m and inclined at an angle of 60° to the ground. What would be the length of the slide in each case ?

Solution:



1 for figure

In Δ ABC, $\frac{BC}{AC}$ = sin 30° 1

$\frac{2}{AC} = \frac{1}{2}$ $\frac{1}{2}$

$\Rightarrow$ AC = 4 m $\frac{1}{2}$

$\therefore$ length of slide meant for children below 6 years = 4 m

In Δ PQR, $\frac{QR}{PR}$ = sin 60° 1

$\frac{4}{PR} = \frac{\sqrt{3}}{2}$ $\frac{1}{2}$

$\Rightarrow$ PR = $\frac{8\sqrt{3}}{3}$ m or $\frac{13{\cdot}856}{3}$ m or 4·62 m approx. $\frac{1}{2}$

$\therefore$ length of slide meant for older children = 4·62 m

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34. (a) If BD and QM are medians of triangles ABC and PQR, respectively, where Δ ABC ~ Δ PQR, prove that $\frac{AB}{PQ} = \frac{BD}{QM}$.

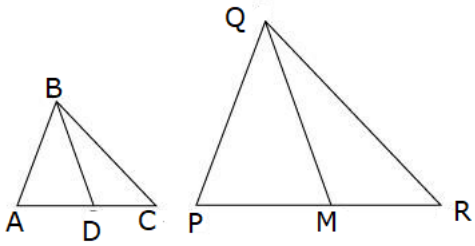
OR

(b) CD and GH are respectively the bisectors of $\angle$ ACB and $\angle$ EGF such that D and H lie on sides AB and FE of Δ ABC and Δ FEG respectively. If Δ ABC ~ Δ FEG, show that :

(i) $\frac{CD}{GH} = \frac{AC}{FG}$

(ii) Δ DCB ~ Δ HGE

Solution (a) 1 for figure



Given : Δ ABC ~ Δ PQR and BD, QM are medians

To prove : $\frac{AB}{PQ} = \frac{BD}{QM}$

Proof : Δ ABC ~ Δ PQR (given)

$\therefore \frac{AB}{PQ} = \frac{AC}{PR}$ 1

$\Rightarrow \frac{AB}{PQ} = \frac{2AD}{2PM}$ (BD and QM are medians)

$\Rightarrow \frac{AB}{PQ} = \frac{AD}{PM}$ 1

In Δ ABD and Δ PQM

$\frac{AB}{PQ} = \frac{AD}{PM}$ (proved above)

$\angle A = \angle P$ (Δ ABC ~ Δ PQR)

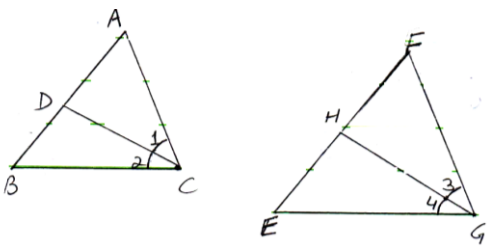
$\therefore \Delta$ ABD ~ Δ PQM (SAS criteria) $1\frac{1}{2}$

$\therefore \frac{AB}{PQ} = \frac{BD}{QM}$ (C.P.S.T.) $\frac{1}{2}$

OR

(b) Given: Δ ABC ~ Δ FEG and CD, GH are bisectors of $\angle$ ACB and $\angle$ EGF respectively.

To Prove (i) $\frac{CD}{GH} = \frac{AC}{FG}$ (ii) Δ DCB ~ Δ HGE



1 for figure

Proof: (i) $\angle ACB = \angle FGE$ ($\Delta ABC \sim \Delta FEG$) $\frac{1}{2}$

$\Rightarrow \frac{1}{2}\angle ACB = \frac{1}{2}\angle FGE$ (CD and GH are bisectors of $\angle ACB$ and $\angle EGF$)

$\Rightarrow \angle 1 = \angle 3$ and $\angle 2 = \angle 4$ $\frac{1}{2}+\frac{1}{2}$

In ΔACD and ΔFGH

$\angle A = \angle F$ ($\Delta ABC \sim \Delta FEG$)

$\angle 1 = \angle 3$ (proved above)

$\Rightarrow \Delta ACD \sim \Delta FGH$ (AA criteria) 1

$\Rightarrow \frac{CD}{GH} = \frac{AC}{FG}$ $\frac{1}{2}$

(ii) In ΔDCB and ΔHGE

$\angle B = \angle E$ ($\Delta ABC \sim \Delta FEG$)

$\angle 2 = \angle 4$ (proved above)

$\therefore \Delta DCB \sim \Delta HGE$ (AA criteria) 1

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35. A manufacturer of TV sets produced 720 TV sets in the fourth year and 880 TV sets in the eighth year. Assuming that the production increases uniformly by a fixed number every year, find the production in the tenth year and the total production in the first seven years.

Solution: Let first term= a and common difference = d

Production in 4th year = 720

$a_4 = 720 \Rightarrow a + 3d = 720$ _____ (i) 1

Production in 8th year = 880

$a_8 = 880 \Rightarrow a + 7d = 880$ _____ (ii) 1

Solving (i) and (ii)

$d = 40$ and $a = 600$ $\frac{1}{2}+\frac{1}{2}$

$\therefore$ Production in 10th year $= a_{10} = 600 + 9 \times 40$ $\frac{1}{2}$

$= 960$ $\frac{1}{2}$

Total Production in the first seven years $= S_7 = \frac{7}{2}[2(600) + 6(40)]$ $\frac{1}{2}$

$= 5040$ $\frac{1}{2}$

SECTION E

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

Case Study – 1

36. Mutual Fund : A mutual fund is a type of investment vehicle that pools money from multiple investors to invest in securities like stocks, bonds or other securities. Mutual funds are operated by professional money managers, who allocate the fund's assets and attempt to produce capital gains or income for the fund's investors.



Net Asset Value (NAV) represents a fund's per share market value. It is the price at which the investors buy fund shares from a fund company and sell them to a fund company.

The following table shows the Net Asset Value (NAV) per unit of mutual fund of ICICI mutual funds :

NAV (in ₹)	0 – 5	5 – 10	10 – 15	15 – 20	20 – 25
Number of mutual funds	13	16	22	18	11

Based on the above information, answer the following questions :

(i) What is the upper limit of modal class of the data ? *1*

(ii) What is the median class of the data ? *1*

(iii) (a) What is the mode NAV of mutual funds ? *2*

OR

(b) What is the median NAV of mutual funds ? *2*

Solution: (i) Upper limit of modal class = 15 1

(ii) Median class = 10 – 15 1

(iii)(a) $l = 10, f_0 = 16, f_1 = 22, f_2 = 18, h = 5$

$$\text{Mode} = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h = 10 + \left(\frac{22 - 16}{44 - 16 - 18}\right) \times 5 \quad 1\frac{1}{2}$$

$= 13$ $\frac{1}{2}$

OR

(iii) (b)

NAV (in ₹)	f	cf
0 – 5	13	13
5 – 10	16	29
10 – 15	22	51
15 – 20	18	69
20 – 25	11	80

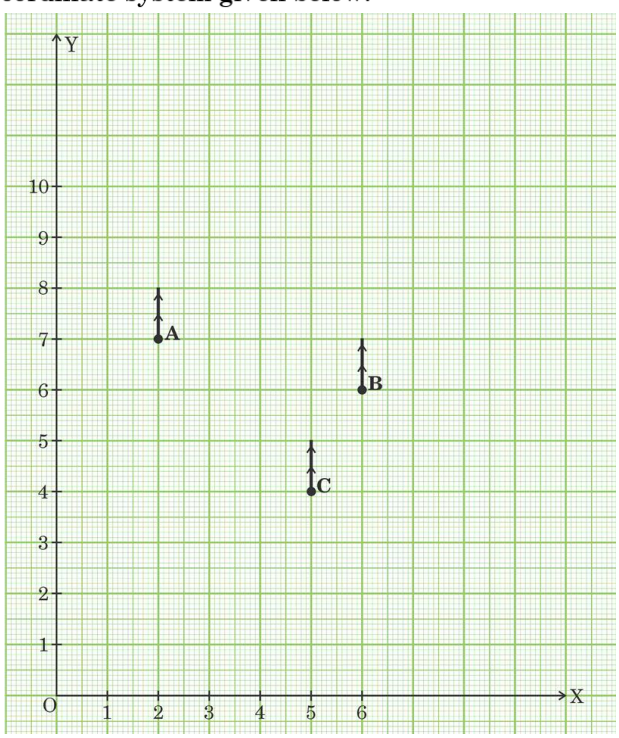
$\frac{1}{2}$ for table

Median $= l + \left(\frac{\frac{N}{2} - cf}{f}\right) \times h = 10 + \left(\frac{40 - 29}{22}\right) \times 5$ 1

$= 12{\cdot}5$ $\frac{1}{2}$

Case Study – 2

37. Resident Welfare Association (RWA) of Gulmohar Society in Delhi, have installed three electric poles A, B and C in the society's common park. Despite these three poles, some parts of the park are still in the dark. So, RWA decides to have one more electric pole D in the park. The park can be modelled as a coordinate system given below.



On the basis of the above information, answer the following questions :

(i) What is the position of the pole C ? *1*

(ii) What is the distance of the pole B from the corner O of the park ? *1*

(iii) (a) Find the position of the fourth pole D so that the four points A, B, C and D form a parallelogram ABCD. *2*

OR

(b) Find the distance between poles A and C. *2*

Solution: (i) Position of the pole C(5, 4) 1

(ii) B(6, 6) $\frac{1}{2}$

$\therefore$ BO = $\sqrt{(6-0)^2 + (6-0)^2} = \sqrt{36+36} = \sqrt{72}$ or $6\sqrt{2}$ $\frac{1}{2}$

(iii)(a) A(2, 7), B(6, 6), C(5, 4)

Let D(x, y)

· ABCD forms a parallelogram

$\therefore$ Mid-point of AC = Mid-point of BD

$\left(\frac{2+5}{2}, \frac{7+4}{2}\right) = \left(\frac{6+x}{2}, \frac{6+y}{2}\right)$ 1

$\frac{7}{2} = \frac{6+x}{2} \Rightarrow x = 1$ $\frac{1}{2}$

$\frac{11}{2} = \frac{6+y}{2} \Rightarrow y = 5$ $\frac{1}{2}$

Position of the fourth pole D is (1, 5)

OR

(iii)(b) AC = $\sqrt{(5-2)^2 + (4-7)^2} = \sqrt{9+9}$ $1\frac{1}{2}$

$= \sqrt{18}$ or $3\sqrt{2}$ $\frac{1}{2}$

Case Study – 3

38. Deepankar bought 3 notebooks and 2 pens for ₹ 80 and his friend Suryansh bought 4 notebooks and 3 pens for ₹ 110 from the school bookshop.



Based on the above information, answer the following questions.

(i) If the price of one notebook be ₹ x and the price of one pen be ₹ y, write the given situation algebraically. *1*

(ii) (a) What is the price of one notebook ? *2*

OR

(b) What is the price of one pen ? *2*

(iii) What is the total amount to be paid by Suryansh, if he purchases 6 notebooks and 3 pens ? *1*

Solution:(i) $3x + 2y = 80$ ----------(1) $\frac{1}{2}$

$4x + 3y = 110$ ----------(2) $\frac{1}{2}$

(ii) (a) Solving (1) and (2) to get x=20 2

OR

(b) Solving (1) and (2) to get y=10 2

(iii) Total amount paid = $6 \times 20 + 3 \times 10 = ₹ 150$ 1
