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

• • •

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

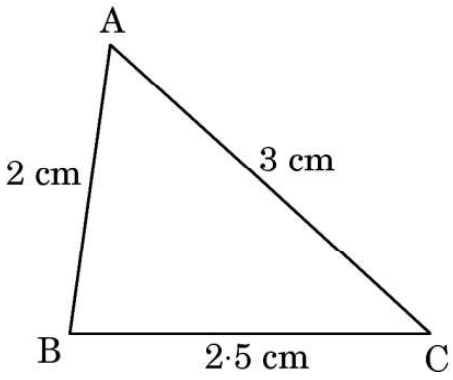
(A) समकोण त्रिभुज

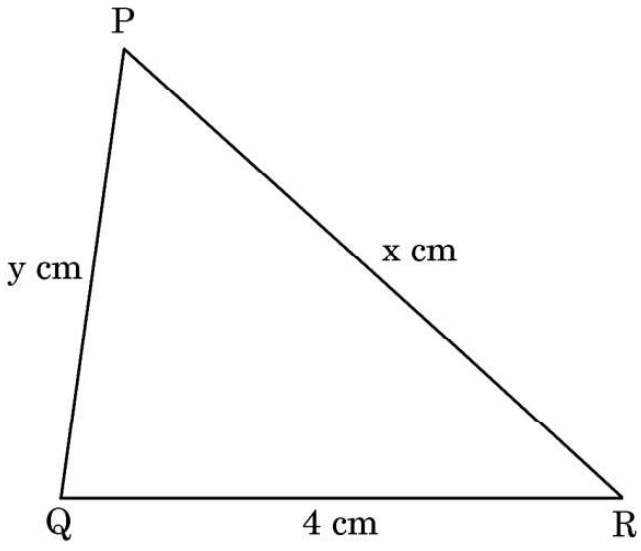
(B) न्यूनकोण त्रिभुज

(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 ?





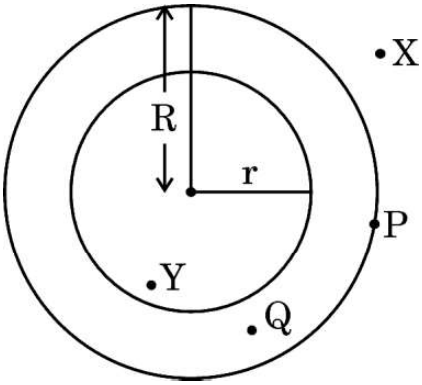
(A) x = 6, y = 5

(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 ?

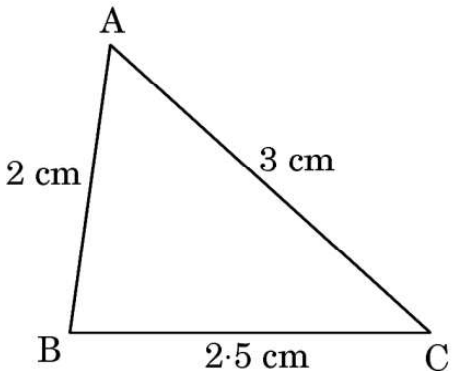
(A) Right-angled triangles

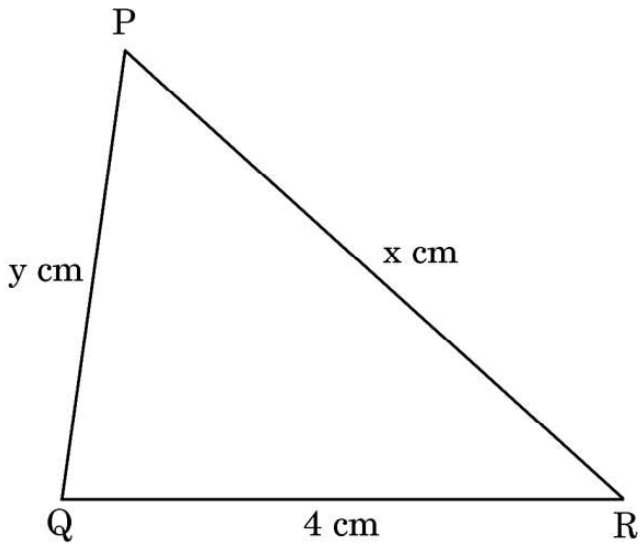
(B) Acute-angled triangles

(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 ?





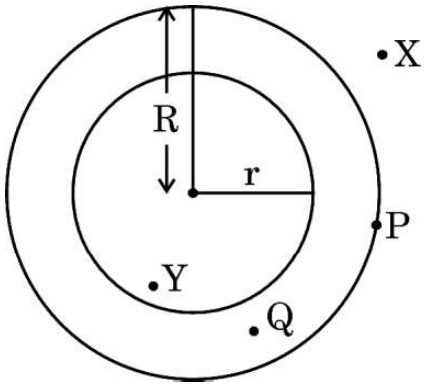
(A) x = 6, y = 5

(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 ?

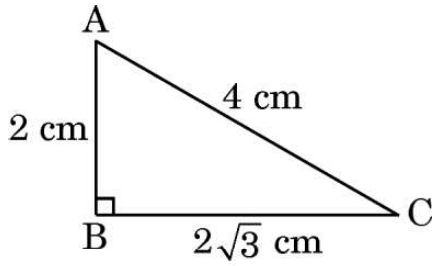


(A) X (B) P

(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

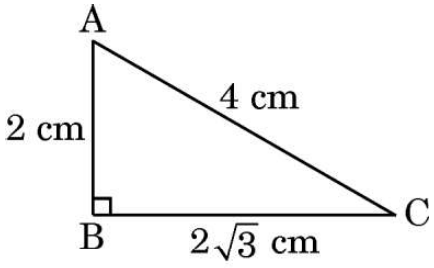
बहुलक वर्ग की निचली सीमा है :

(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 :

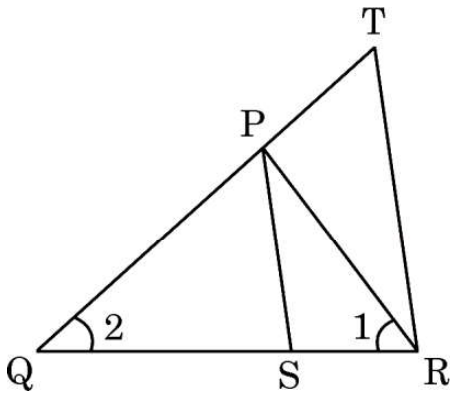
$2x - 3y = -6$ और $x = 3$

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।

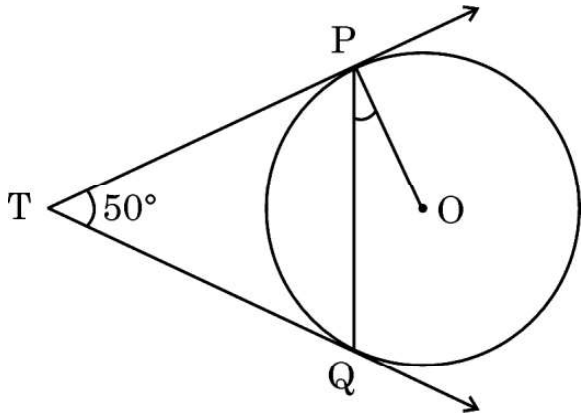
अथवा

(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*

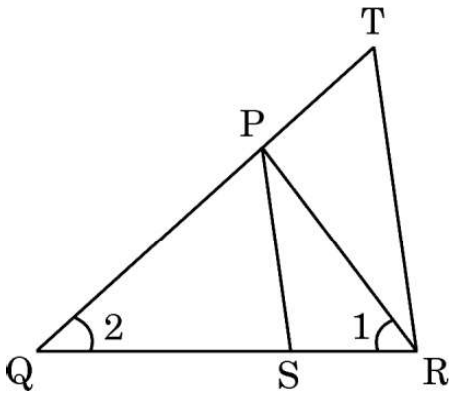
21. Solve the following system of equations graphically :

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

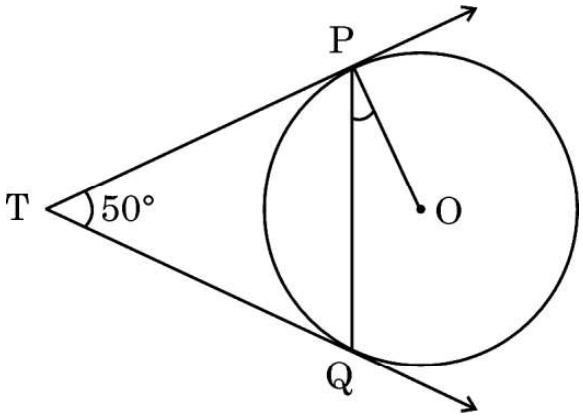
22. (a) A vertical pole of height 10 m casts a shadow of 15 m on the ground and at the same time, a tower casts a shadow of 45 m on the ground. Find the height of the tower.

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 $\angle OPQ$.



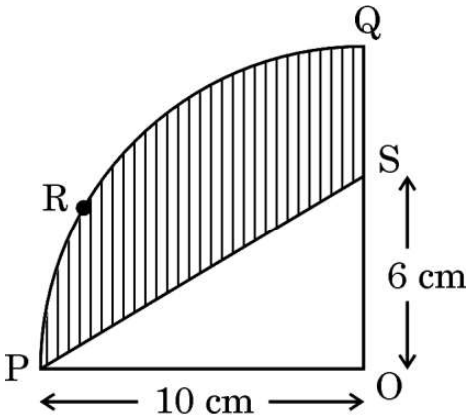
• • •

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।

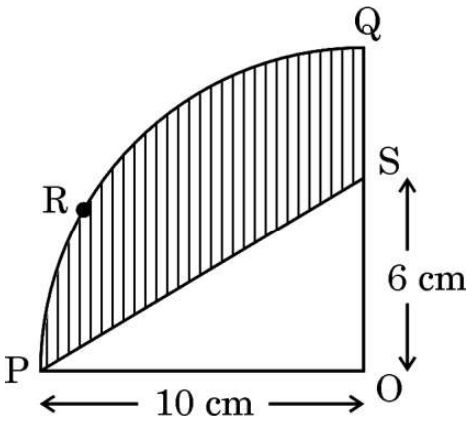
• • •

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 :

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

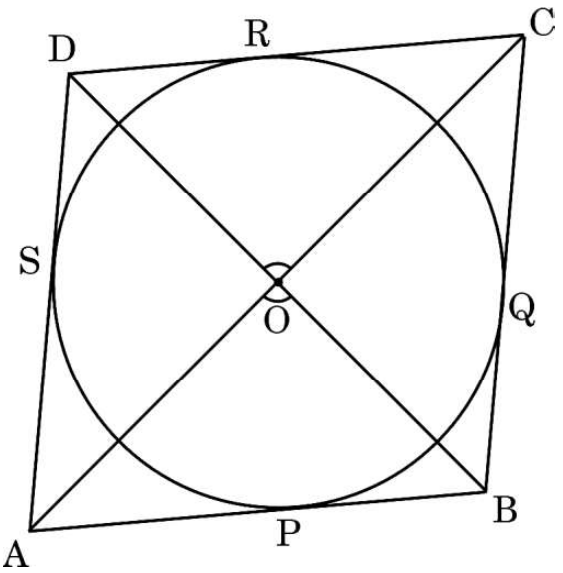
30. एक डिब्बे में 6 नीले, 4 सफेद और 8 लाल कंचे हैं। एक कंचा इस डिब्बे से यादृच्छया निकाला जाता है। प्रायिकता ज्ञात कीजिए कि निकाला गया कंचा :

(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 $\angle AOB + \angle COD = 180°$.



• • •

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 :

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

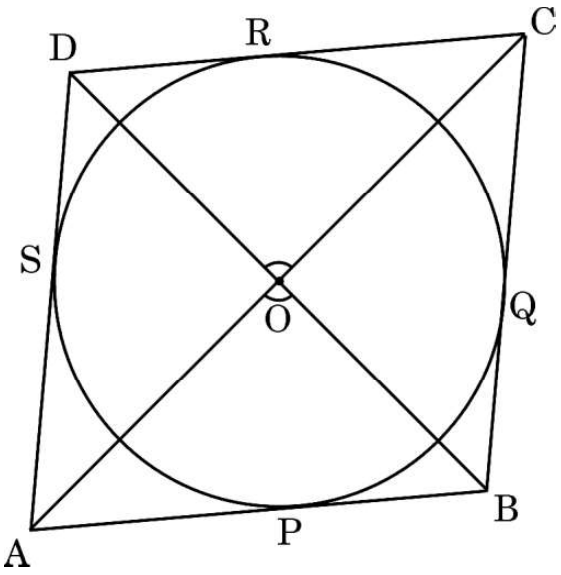
30. A box contains 6 blue, 4 white and 8 red marbles. A marble is drawn at random from this box. Find the probability that the marble so drawn is :

(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।

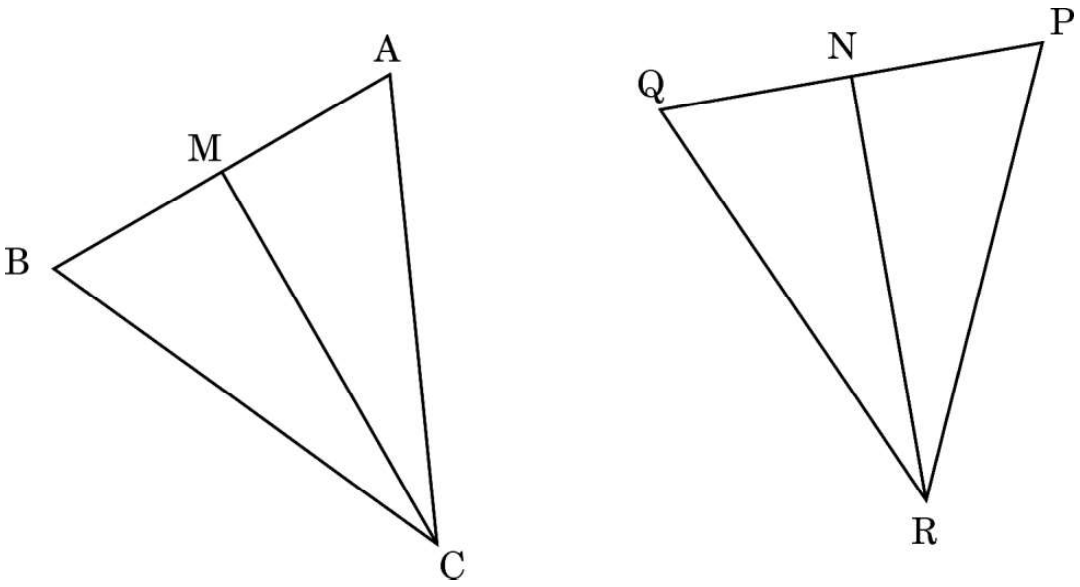
अथवा

(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.

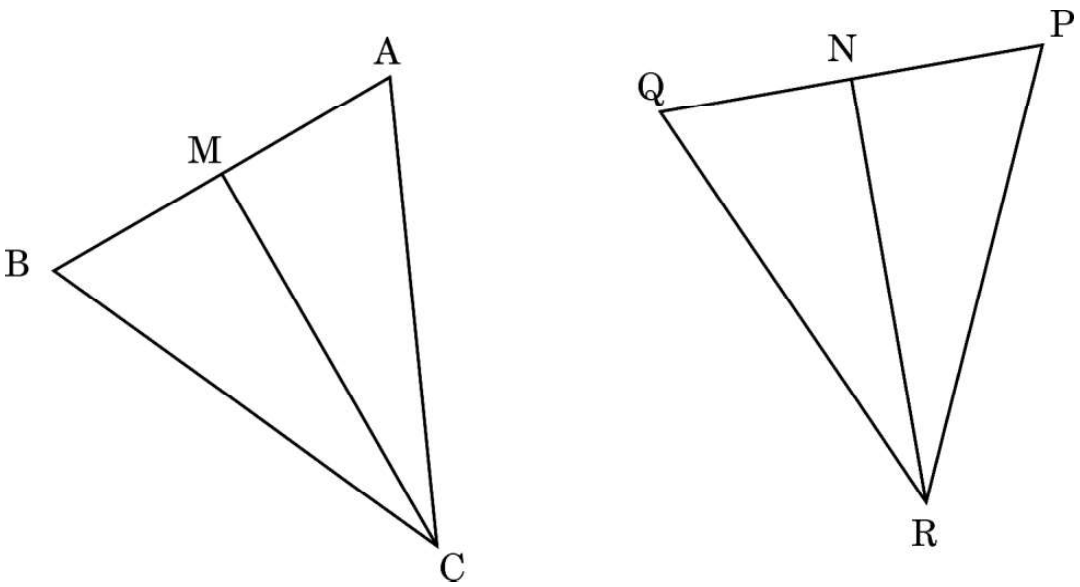
OR

(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 :



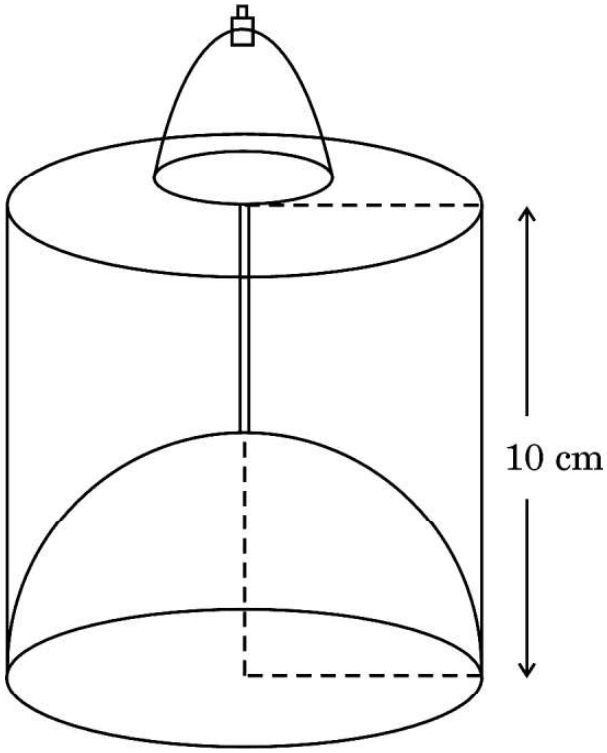
(i) Δ AMC ~ Δ PNR

(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)



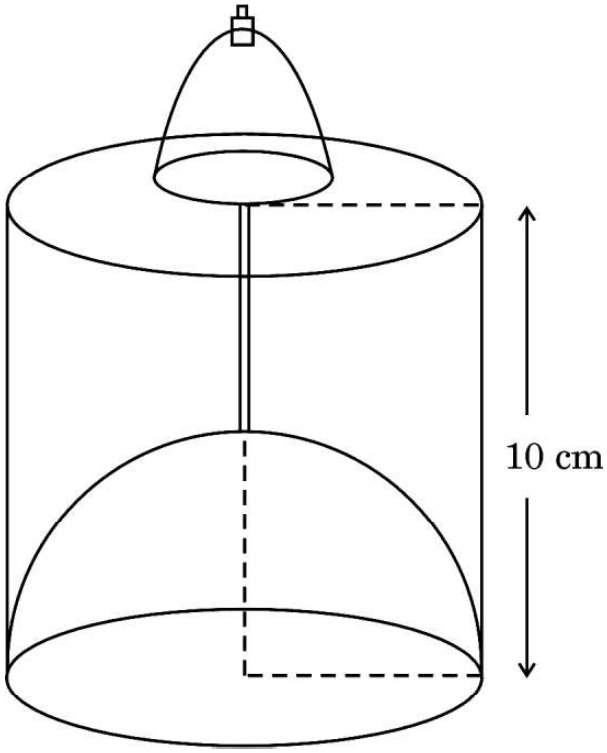
35. निम्नलिखित बंटन सारणी में एक कक्षा के 30 विद्यार्थियों का वज़न दिया गया है :

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*

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SECTION E

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

Case Study – 1

36. 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 31^{st} 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*

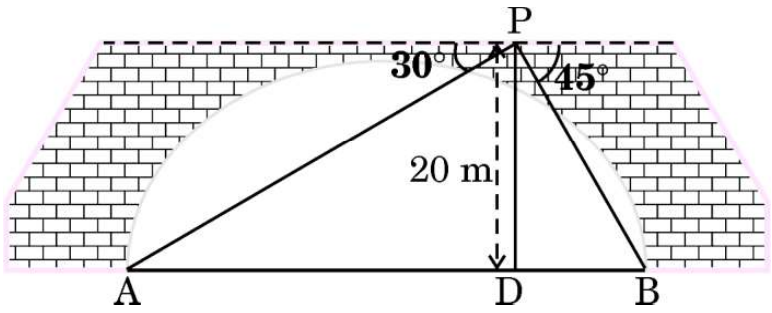
OR

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

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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*

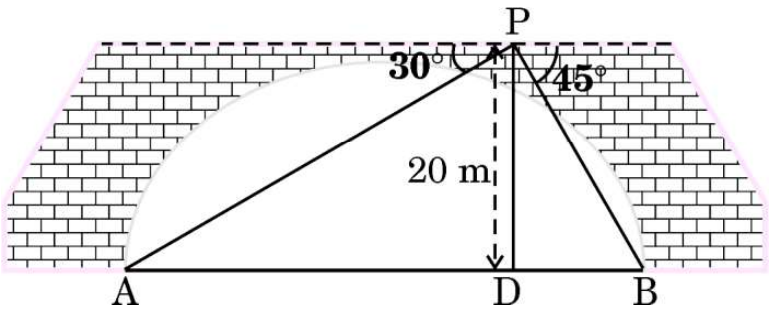
अथवा

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

• • •

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*

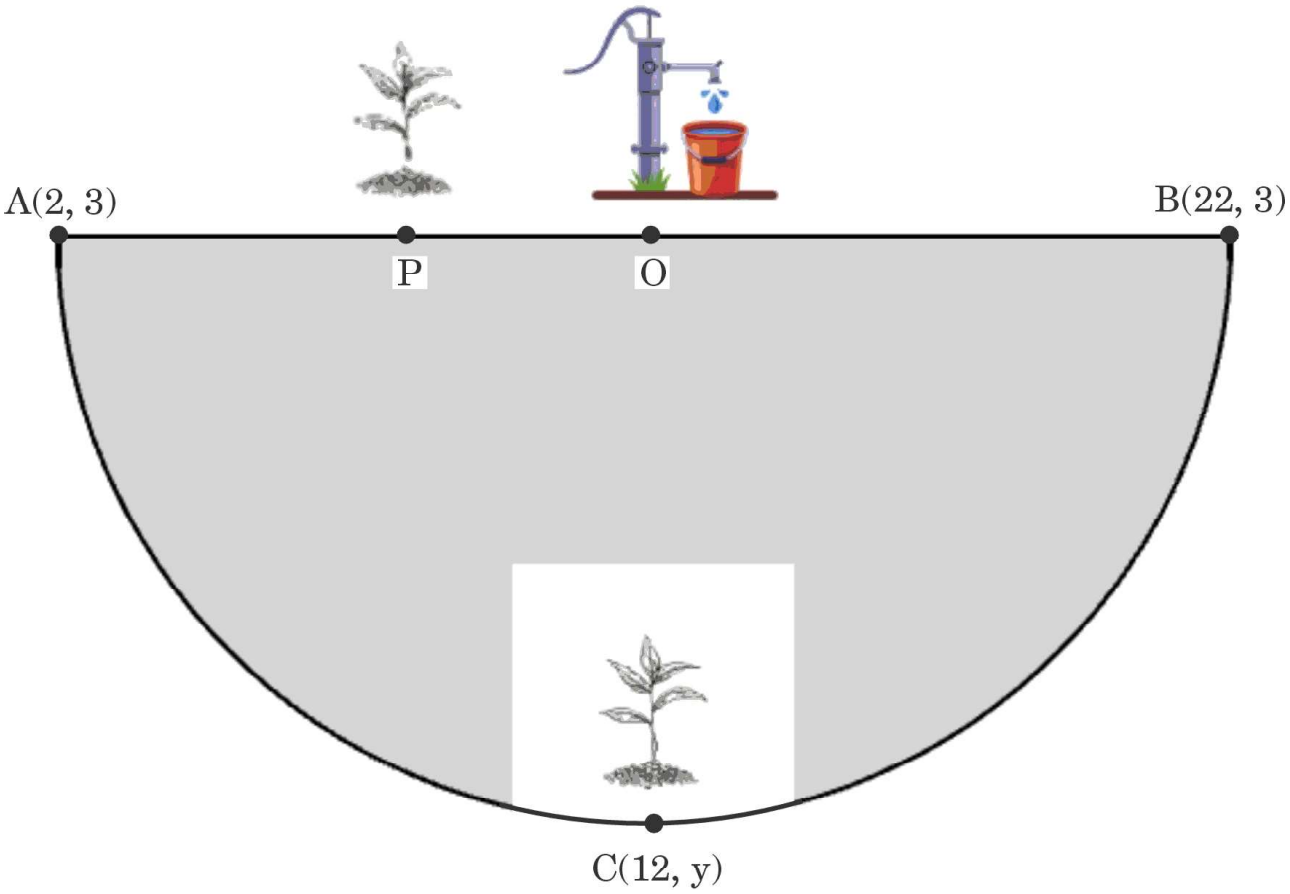
OR

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

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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*

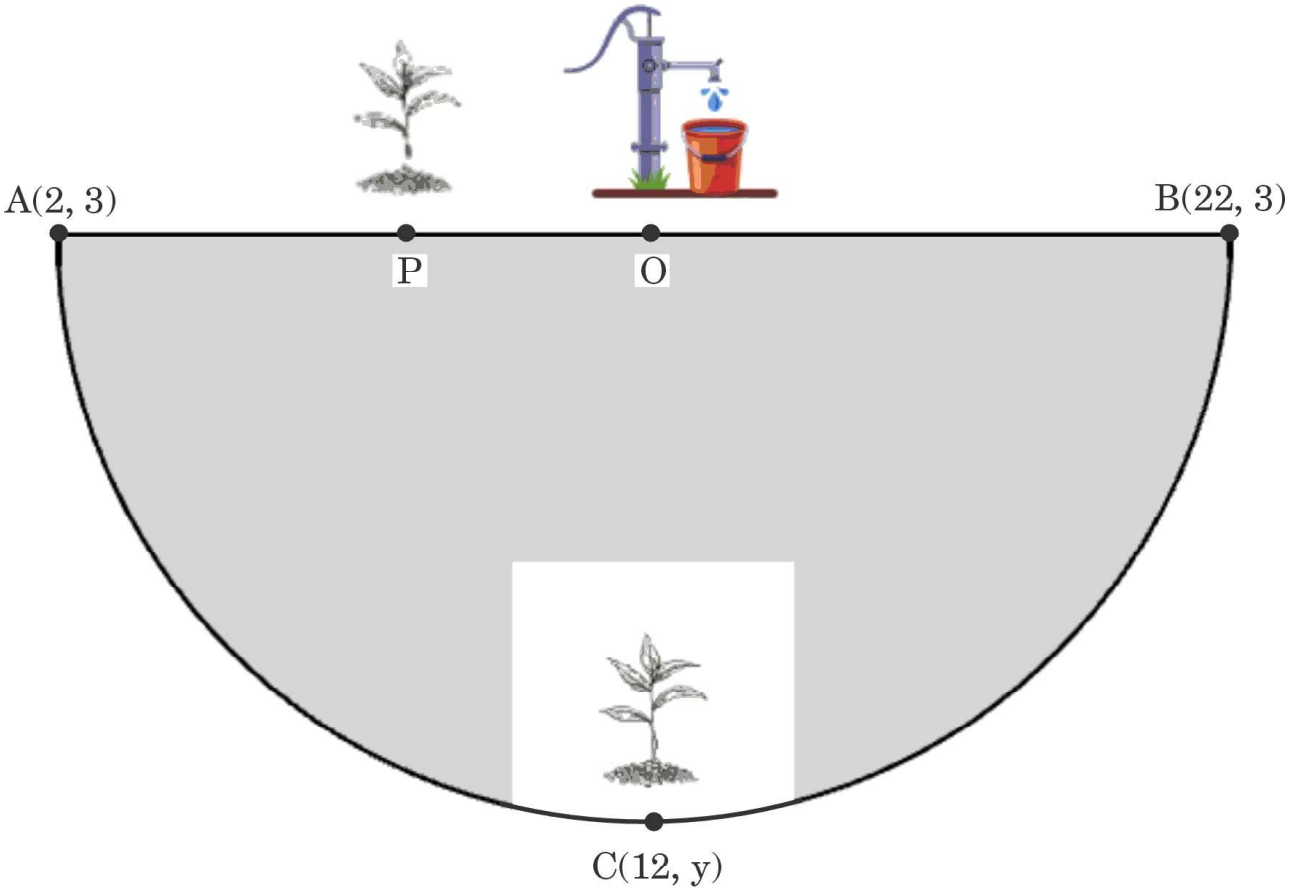
अथवा

(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 : -

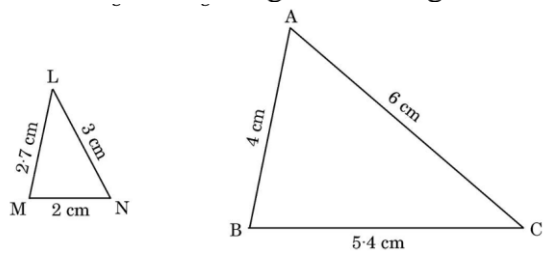
1	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested 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

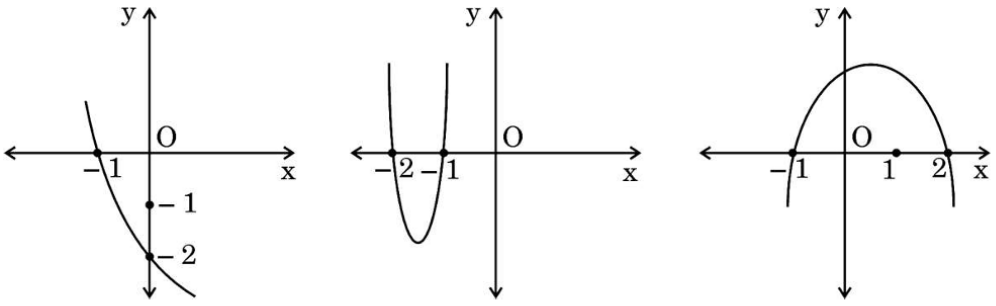
9. The number of solutions of the system of equations given by $x = -2$ and $y = 2$ is :

(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

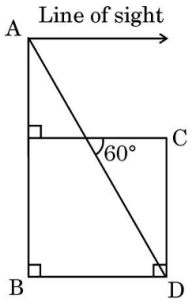
13. Which of the following is ***not*** defined for x = 90° ?

(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.

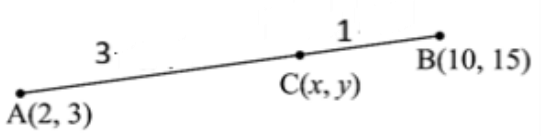
Ans.	(D) Assertion (A) is false but Reason (R) is true.	1

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

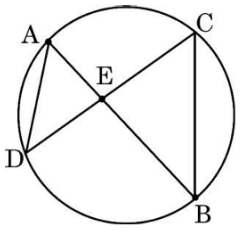
$y = \frac{3(15)+1(3)}{3+1} = 12$ ½

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

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

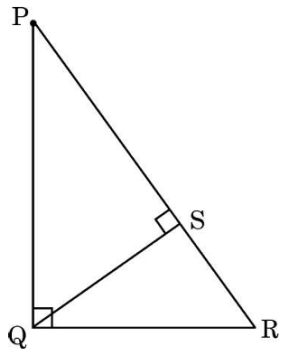
Solution		
	Zeroes are $0, \frac{5}{3}$	½+½
	Sum of zeroes $= 0 + \frac{5}{3} = \frac{5}{3} = \frac{-\text{ coefficient of } x}{\text{coefficient of } x^2}$	½
	Product of zeroes $= 0 \times \left(\frac{5}{3}\right) = \frac{0}{3} = \frac{\text{constant term}}{\text{coefficient of } x^2}$	½

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.



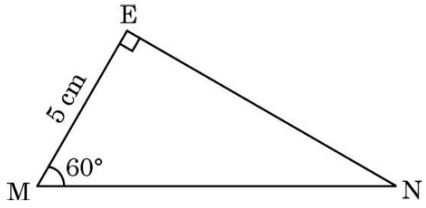
OR

(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.* $6\times3=18$

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

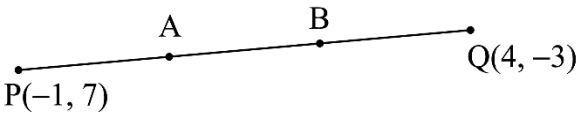
Roots of $3x^2 - 2x - 1 = 0$ are $\frac{-1}{3}, 1$ — 1+1

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 :

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

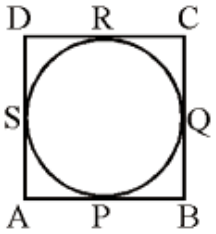
OR

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

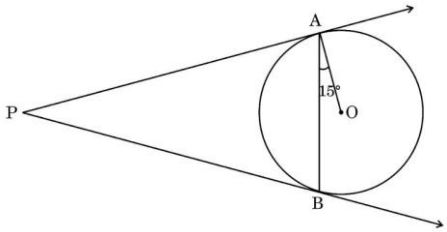
Hence, find the value of $\tan (B - A)$.

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*

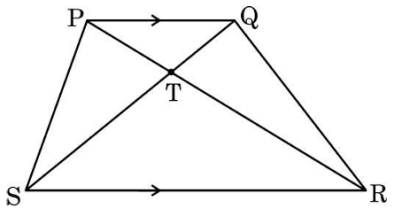
32. A fraction becomes $\frac{5}{6}$ when 3 is added to both the numerator and the denominator. If 2 is added to both the numerator and the denominator, the fraction becomes $\frac{9}{11}$. Express the given information algebraically as a system of linear equations in two variables. Hence, find the original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

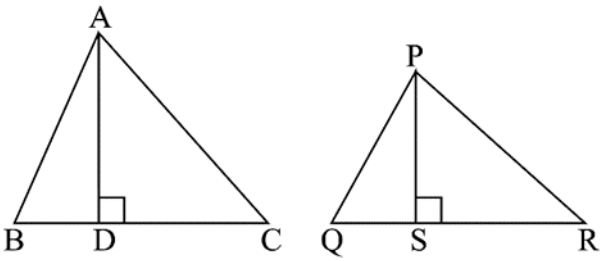
33. (a) Sides AB, AC and altitude AD of Δ ABC are proportional to sides PQ, PR and altitude PS of another triangle PQR. Prove that Δ ABC ~ Δ PQR.

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

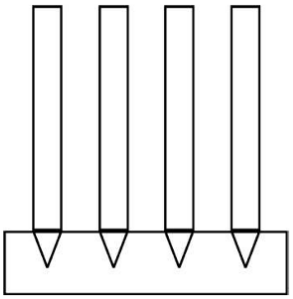
Now In ΔPTS and ΔQTR

$\frac{PT}{QT} = \frac{ST}{RT}$ 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 :



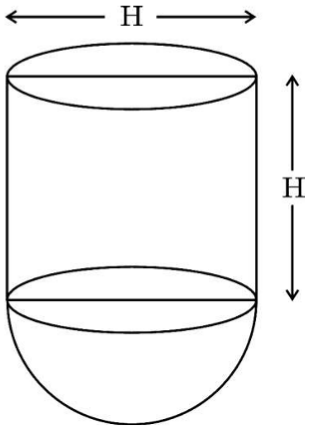
The dimensions of the cuboidal block of wood are 15 cm × 10 cm × 3·5 cm. The radius of each conical depression is 0·5 cm and depth is 1·4 cm. The radius and height of each cylindrical metal extension are 0·5 cm and 4·9 cm respectively.

(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

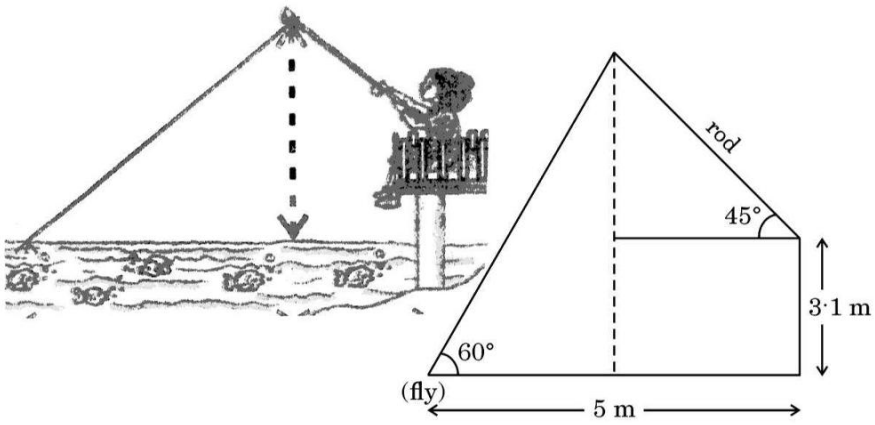
(iii) (b) At which level is the number of members 5 times the number of members at level ten ? *2*

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 5^{th} 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*

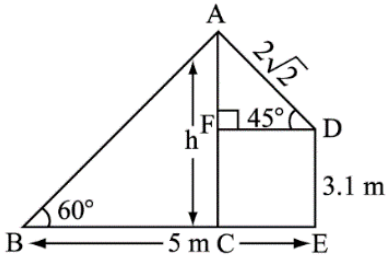
(ii) How far is the fly from the point on the surface of water directly below the top of the fishing rod ? *1*

(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,

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

(ii) In ΔACB,

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

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

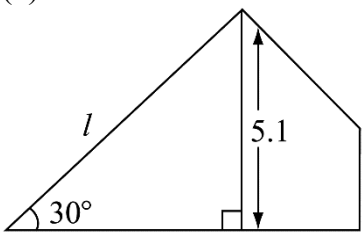
In ΔACB, $\sin 60° = \dfrac{h}{AB}$

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

$\Rightarrow$ AB $= 6$ m 1

OR

(iii) (b)



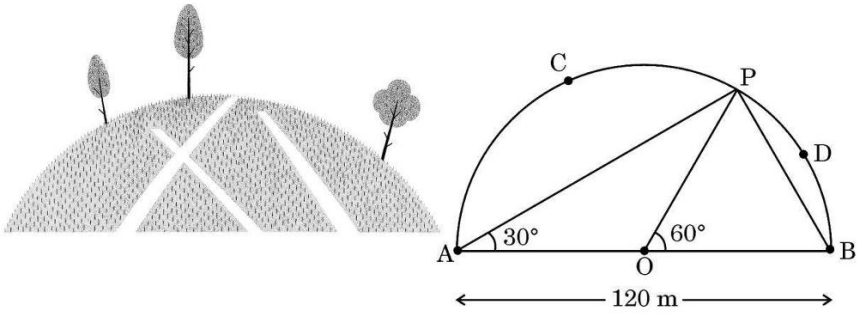
$\sin 30° = \dfrac{5.1}{l}$

$\dfrac{1}{2} = \dfrac{5.1}{l}$ 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	
	= Area of $\Delta APB = \frac{1}{2} \times 60 \times 60\sqrt{3} = 1800\sqrt{3}\ m^2$	1