Series : F6EGH

SET ~ 3

प्रश्न-पत्र कोड
Q.P. Code **430/6/3**

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.

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नोट

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

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

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

(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 ।

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NOTE

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

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

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

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

गणित (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 पालन कीजिए :

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

(ii) *प्रश्न–पत्र* ***पाँच*** *खण्डों में विभाजित है –* ***खण्ड–क, ख, ग, घ*** *तथा* ***ङ***।

(iii) *खण्ड –* ***क*** *में प्रश्न संख्या* ***1*** *से* ***18*** *तक बहुविकल्पीय 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*** ***स्रोत/प्रकरण अध्ययन एकीकृत इकाई आधारित*** ***4*** *अंकों के प्रश्न हैं। 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* ***2*** *अंकों वाले* ***3*** *प्रश्नों में आंतरिक विकल्प का प्रावधान दिया गया है।*

(ix) *जहाँ आवश्यक हो स्वच्छ आकृतियाँ बनाएँ। यदि आवश्यक हो तो* $\pi = \frac{22}{7}$ *लें, जहाँ अन्यथा नहीं दिया गया है।*

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

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General Instructions :

Read the following instructions carefully and follow them :

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

(ii) *Question Paper is divided into **FIVE** Sections – **SECTION A, B, C, D** and **E**.*

(iii) *In Section–**A**, question numbers **1** to **18** are Multiple Choice Questions (MCQs) and question numbers **19** & **20** are Assertion-Reason based questions of **1** mark each.*

(iv) *In Section–**B**, question numbers **21** to **25** are Very Short Answer (VSA) type questions of **2** marks each.*

(v) *In Section–**C**, question numbers **26** to **31** are Short Answer (SA) type questions carrying **3** marks each.*

(vi) *In Section–**D**, question numbers **32** to **35** are Long Answer (LA) type questions carrying **5** marks each.*

(vii) *In Section–**E**, question numbers **36** to **38** are **case-based integrated units** of assessment questions carrying **4** marks each. Internal choice is provided in **2** marks question 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 of **2** marks in Section-**E**.*

(ix) *Draw neat figures wherever required. Take $\pi = 22/7$ wherever required if not stated.*

(x) *Use of calculators is **NOT allowed**.*

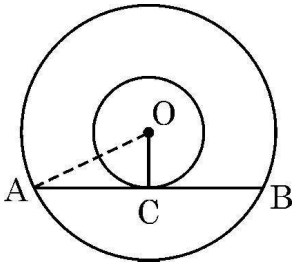
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खण्ड – क $20 \times 1 = 20$

(बहुविकल्पीय प्रश्न)

इस खण्ड में **20** बहुविकल्पीय प्रश्न हैं, जिनमें प्रत्येक का **1** अंक है ।

1. केन्द्र O पर संकेन्द्रित दो वृत्तों में से बड़े वृत्त की जीवा AB छोटे वृत्त को बिन्दु C पर स्पर्श करती है । यदि OA = 3.5 cm, OC = 2.1 cm हो, तो AB का मान है

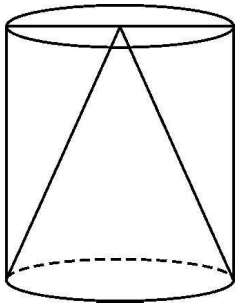


(A) 5.6 cm (B) 2.8 cm
(C) 3.5 cm (D) 4.2 cm

2. तीन सिक्कों को एक साथ उछाला गया । कम से कम एक चित आने की प्रायिकता है

(A) $\frac{3}{8}$ (B) $\frac{7}{8}$
(C) $\frac{1}{8}$ (D) $\frac{3}{4}$

3. एक खोखले लंबवृत्तीय बेलन में हवा का आयतन 450 cm^3 है । समान त्रिज्या तथा ऊँचाई वाला एक शंकु इस बेलन के अन्दर रखा गया है । बेलन में रिक्त स्थान का आयतन है



(A) 225 cm^3 (B) 150 cm^3
(C) 250 cm^3 (D) 300 cm^3

4. किसी समय पर एक मीनार की छाया की लम्बाई उसकी ऊँचाई की $\sqrt{3}$ गुना है । सूर्य का उन्नयन कोण है

(A) 45° (B) 30°
(C) 60° (D) 0°

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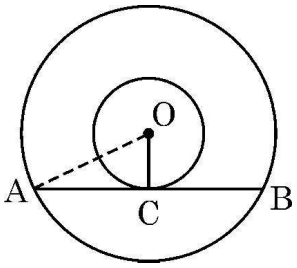
Section – A

20 × 1 = 20

(Multiple Choice Questions)

Section-A consists of **20** Multiple Choice Questions of **1** mark each.

1. In two concentric circles centred at O, a chord AB of the larger circle touches the smaller circle at C. If OA = 3.5 cm, OC = 2.1 cm, then AB is equal to



(A) 5.6 cm (B) 2.8 cm

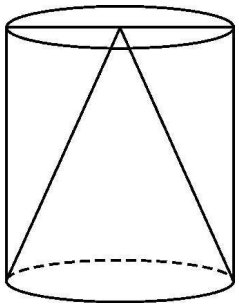
(C) 3.5 cm (D) 4.2 cm

2. Three coins are tossed together. The probability that at least one head comes up, is

(A) $\frac{3}{8}$ (B) $\frac{7}{8}$

(C) $\frac{1}{8}$ (D) $\frac{3}{4}$

3. The volume of air in a hollow cylinder is 450 cm^3. A cone of same height and radius as that of cylinder is kept inside it. The volume of empty space in the cylinder is



(A) 225 cm^3 (B) 150 cm^3

(C) 250 cm^3 (D) 300 cm^3

4. If the length of the shadow of a tower is $\sqrt{3}$ times its height, then the angle of elevation of the sun is

(A) 45° (B) 30°

(C) 60° (D) 0°

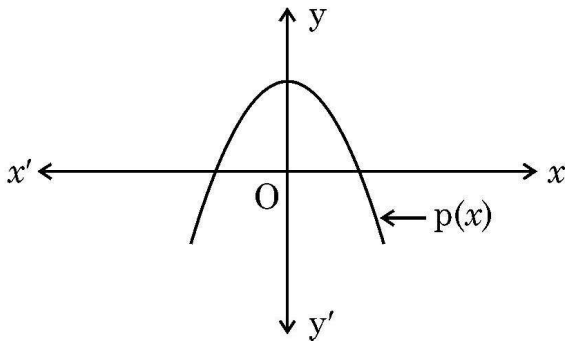
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5. A.P. : $\frac{3}{2}, \frac{1}{2}, \frac{-1}{2}, \frac{-3}{2}$, ... का 22वाँ पद है :

(A) $\frac{45}{2}$ (B) -9

(C) $\frac{-39}{2}$ (D) -21

6. दिये गये ग्राफ में, बहुपद $p(x)$ को दर्शाया गया है । $p(x)$ के शून्यकों की संख्या है



(A) 3 (B) 2

(C) 1 (D) 4

7. यदि किसी घटना के घटित होने की प्रायिकता 57% है, तो उस घटना के घटित ना होने की प्रायिकता है :

(A) 0.43 (B) 0.57

(C) 53% (D) $\frac{1}{57}$

8. 7 cm त्रिज्या तथा केन्द्र O वाले वृत्त का त्रिज्यखंड (sector) OAB है । यदि चाप $\overset{\frown}{AB} = \frac{22}{3}$ cm है, तो $\angle AOB$ बराबर है

(A) $\left(\frac{120}{7}\right)^\circ$ (B) 45°

(C) 60° (D) 30°

9. यदि एक A.P. के प्रथम n पदों का योग $S_n = \frac{n}{2}(3n + 1)$ है, तो A.P. का प्रथम पद है :

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

(C) 4 (D) $\frac{5}{2}$

10. एक वर्गीकृत वितरण का माध्य ज्ञात करने के लिये राहुल ने कल्पित माध्य विधि का उपयोग किया । यदि $d = (x - A)$ है, जहाँ A कल्पित माध्य है, तो $\bar{x}$ का मान है

(A) $A + \bar{d}$ (B) $A + h\bar{d}$

(C) $h(A + \bar{d})$ (D) $A - h\bar{d}$

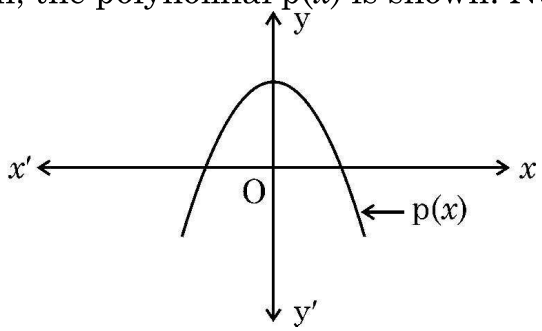
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5. 22^{nd} term of the A.P. : $\frac{3}{2}, \frac{1}{2}, \frac{-1}{2}, \frac{-3}{2}$, ... is

(A) $\frac{45}{2}$ (B) -9

(C) $\frac{-39}{2}$ (D) -21

6. In the given graph, the polynomial $p(x)$ is shown. Number of zeroes of $p(x)$ is



(A) 3 (B) 2

(C) 1 (D) 4

7. If probability of happening of an event is 57%, then probability of non-happening of the event is

(A) 0.43 (B) 0.57

(C) 53% (D) $\frac{1}{57}$

8. OAB is sector of a circle with centre O and radius 7 cm. If length of arc $\overset{\frown}{AB} = \frac{22}{3}$ cm, then $\angle AOB$ is equal to

(A) $\left(\frac{120}{7}\right)^\circ$ (B) 45°

(C) 60° (D) 30°

9. If the sum of first n terms of an A.P. is given by $S_n = \frac{n}{2}(3n + 1)$, then the first term of the A.P. is

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

(C) 4 (D) $\frac{5}{2}$

10. To calculate mean of a grouped data, Rahul used assumed mean method. He used $d = (x - A)$, where A is assumed mean. Then $\bar{x}$ is equal to

(A) $A + \bar{d}$ (B) $A + h\bar{d}$

(C) $h(A + \bar{d})$ (D) $A - h\bar{d}$

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11. बिंदु $(3, -5)$, रेखा $mx - y = 11$ पर स्थित है । m का मान है

(A) 3 (B) -2

(C) 8 (D) 2

12. यदि $\sqrt{3} \sin \theta = \cos \theta$ है, तो θ का मान है

(A) $\sqrt{3}$ (B) $60°$

(C) $\frac{1}{\sqrt{3}}$ (D) $30°$

13. बिंदु $(2, -2)$, $(8, 4)$, $(4, 8)$ तथा $(-2, 2)$ इसी क्रम में लेने पर आयत ABCD के शीर्ष बिंदु हैं । इसके विकर्ण की लम्बाई है

(A) $4\sqrt{2}$ (B) $6\sqrt{2}$

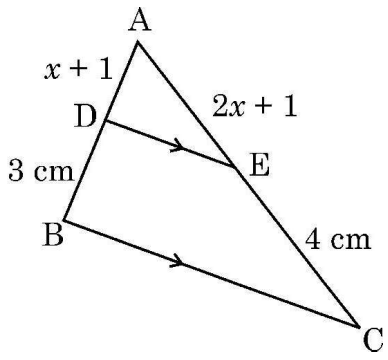
(C) $4\sqrt{26}$ (D) $2\sqrt{26}$

14. दो पासों को एक साथ फेंका जाता है । प्राप्त संख्याओं का योग 9 से अधिक होने की प्रायिकता है

(A) $\frac{5}{6}$ (B) $\frac{5}{18}$

(C) $\frac{1}{6}$ (D) $\frac{1}{2}$

15. ΔABC में, $DE || BC$ है । यदि $AE = (2x + 1)$ cm, $EC = 4$ cm, $AD = (x + 1)$ cm तथा $DB = 3$ cm है, तो x का मान है



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

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

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11. The point (3, – 5) lies on the line mx – y = 11. The value of m is

(A) 3 (B) – 2

(C) 8 (D) 2

12. If $\sqrt{3}\sin\theta = \cos\theta$, then value of θ is

(A) $\sqrt{3}$ (B) 60°

(C) $\frac{1}{\sqrt{3}}$ (D) 30°

13. ABCD is a rectangle with its vertices at (2, –2), (8, 4), (4, 8) and (– 2, 2) taken in order. Length of its diagonal is

(A) $4\sqrt{2}$ (B) $6\sqrt{2}$

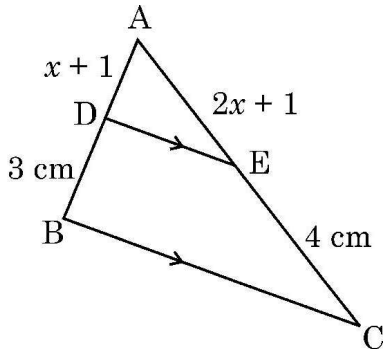
(C) $4\sqrt{26}$ (D) $2\sqrt{26}$

14. Two dice are rolled together. The probability of getting a sum more than 9 is

(A) $\frac{5}{6}$ (B) $\frac{5}{18}$

(C) $\frac{1}{6}$ (D) $\frac{1}{2}$

15. In ΔABC, DE||BC. If AE = (2x + 1) cm, EC = 4 cm, AD = (x + 1) cm and DB = 3 cm, then value of x is



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

(C) – 1 (D) $\frac{1}{3}$

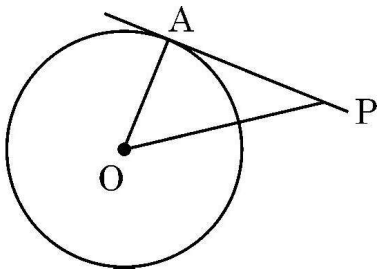
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16. k का वह मान जिसके लिये समीकरण युग्म $3x - 7y = 1$ तथा $kx + 14y = 6$ असंगत है, है :

(A) -6 (B) $\frac{2}{3}$

(C) 6 (D) $\frac{-3}{2}$

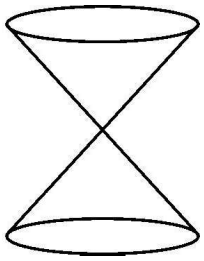
17. दी गयी आकृति में, केन्द्र O वाले वृत्त पर स्पर्शरेखा PA खींची गयी है । यदि $\angle APO = 30°$ तथा $OA = 2.5$ cm हो, तो OP बराबर है



(A) 2.5 cm (B) 5 cm

(C) $\frac{5}{\sqrt{3}}$ cm (D) 2 cm

18. दो समान आकार के शंकुओं को दिखाये गये चित्र के अनुसार जोड़ा गया है । यदि शंकु की आधार त्रिज्या 4 cm तथा तिर्यक ऊँचाई 6 cm हो, तो ठोस की ऊँचाई है



(A) 8 cm (B) $4\sqrt{5}$ cm

(C) $2\sqrt{5}$ cm (D) 12 cm

(अभिकथन – तर्क आधारित प्रश्न)

निर्देश : प्रश्न संख्या **19** तथा **20** में एक अभिकथन (A) के बाद तर्क (R), कथन दिया गया है । सही विकल्प चुनिये:

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

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

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

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

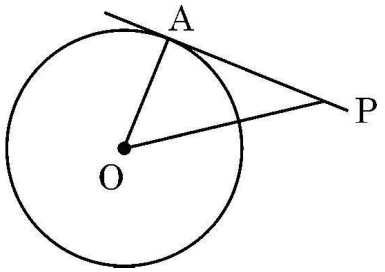
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16. The value of k for which the system of equations $3x - 7y = 1$ and $kx + 14y = 6$ is inconsistent, is

(A) -6 (B) $\frac{2}{3}$

(C) 6 (D) $\frac{-3}{2}$

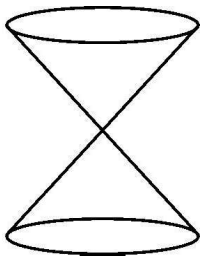
17. In the given figure, PA is tangent to a circle with centre O. If $\angle APO = 30°$ and OA = 2.5 cm, then OP is equal to



(A) 2.5 cm (B) 5 cm

(C) $\frac{5}{\sqrt{3}}$ cm (D) 2 cm

18. Two identical cones are joined as shown in the figure. If radius of base is 4 cm and slant height of the cone is 6 cm, then height of the solid is



(A) 8 cm (B) $4\sqrt{5}$ cm

(C) $2\sqrt{5}$ cm (D) 12 cm

(Assertion – Reason based questions)

Directions : In question numbers **19** and **20**, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option :

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

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

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

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

• • •

19. **अभिकथन (A) :** $(a + \sqrt{b}) \cdot (a - \sqrt{b})$ एक परिमेय संख्या है, जहाँ a तथा b धनात्मक पूर्णांक हैं ।

तर्क (R) : दो अपरिमेय संख्याओं का गुणनफल हमेशा परिमेय होता है ।

20. **अभिकथन (A) :** $\Delta ABC \sim \Delta PQR$ ताकि $\angle A = 65°$, $\angle C = 60°$ हैं, अतः $\angle Q = 55°$ है ।

तर्क (R) : एक त्रिभुज के सभी कोणों का योग $180°$ होता है ।

खण्ड – ख

(अति लघु–उत्तरीय प्रश्न) $5 \times 2 = 10$

प्रश्न संख्या **21** से **25** तक अति लघु–उत्तरीय प्रकार के प्रश्न हैं तथा प्रत्येक प्रश्न के **2** अंक हैं ।

21. एक बक्से में 120 डिस्क हैं जिनमें 1 से लेकर 120 तक की संख्या अंकित हैं । बक्से में से एक डिस्क यादृच्छया निकाली जाती है । इसकी क्या प्रायिकता है कि

(i) प्राप्त संख्या दो अंकों की संख्या है ।

(ii) प्राप्त संख्या एक पूर्ण वर्ग है ।

22. (a) मान ज्ञात कीजिये : $\dfrac{\cos 45°}{\tan 30° + \sin 60°}$

अथवा

(b) सत्यापित कीजिये कि $A = 30°$ के लिये $\sin 2A = \dfrac{2 \tan A}{1 + \tan^2 A}$ है ।

23. (a) द्विघाती सूत्र का उपयोग करते हुये निम्न द्विघाती समीकरण को हल कीजिये :

$$\sqrt{3}x^2 + 10x + 7\sqrt{3} = 0$$

अथवा

(b) निम्न समीकरण के मूलों की प्रकृति ज्ञात कीजिये :

$$4x^2 - 4a^2x + a^4 - b^4 = 0, \quad b \neq 0$$

24. अभाज्य गुणनखंडन की सहायता से 180, 140 तथा 210 का HCF ज्ञात कीजिये ।

25. दो समरूप त्रिभुजों के परिमाप क्रमशः 22 cm तथा 33 cm हैं । यदि पहले त्रिभुज की एक भुजा 9 cm लम्बी हो, तो दूसरे त्रिभुज की संगत भुजा की लम्बाई ज्ञात कीजिये ।

• • •

19. **Assertion (A) :** $(a + \sqrt{b}) \cdot (a - \sqrt{b})$ is a rational number, where a and b are positive integers.
Reason (R) : Product of two irrationals is always rational.

20. **Assertion (A) :** $\Delta ABC \sim \Delta PQR$ such that $\angle A = 65°$, $\angle C = 60°$. Hence $\angle Q = 55°$.
Reason (R) : Sum of all angles of a triangle is 180°.

Section – B

(Very Short Answer Type Questions) **5 × 2 = 10**

Q. Nos. **21** to **25** are Very Short Answer type questions of **2** marks each.

21. A box contains 120 discs, which are numbered from 1 to 120. If one disc is drawn at random from the box, find the probability that
(i) it bears a 2– digit number
(ii) the number is a perfect square.

22. (a) Evaluate : $\dfrac{\cos 45°}{\tan 30° + \sin 60°}$

OR

(b) Verify that $\sin 2A = \dfrac{2 \tan A}{1 + \tan^2 A}$, for $A = 30°$.

23. (a) Solve the quadratic equation $\sqrt{3}x^2 + 10x + 7\sqrt{3} = 0$ using quadratic formula.

OR

(b) Find the nature of roots of the equation $4x^2 - 4a^2x + a^4 - b^4 = 0$, $b \neq 0$

24. Using prime factorisation, find the HCF of 180, 140 and 210.

25. The perimeters of two similar triangles are 22 cm and 33 cm respectively. If one side of first triangle is 9 cm, then find the length of corresponding side of the second triangle.

• • •

खण्ड – ग

(लघु–उत्तरीय प्रश्न) **$6 \times 3 = 18$**

प्रश्न संख्या **26** से **31** तक लघु–उत्तरीय प्रकार के प्रश्न हैं तथा प्रत्येक प्रश्न के **3** अंक हैं ।

26. दिया है कि $\sqrt{5}$ एक अपरिमेय संख्या है, सिद्ध कीजिये कि $2 + 3\sqrt{5}$ एक अपरिमेय संख्या है ।

27. (a) उस A.P. को ज्ञात कीजिये जिसका तीसरा पद 16 तथा सातवाँ पद पाँचवें पद से 12 ज्यादा है । A.P. के प्रथम 29 पदों का योग भी ज्ञात कीजिये ।

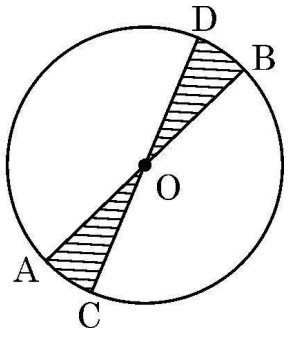
अथवा

(b) एक A.P. का nवाँ पद $a_n = 5 + 2n$ है । इस A.P. के प्रथम 20 पदों का योग ज्ञात कीजिये । क्या 52 इस A.P. का कोई पद हो सकता है ?

28. सिद्ध कीजिये : $\frac{\sin \theta}{1 + \cos \theta} + \frac{1 + \cos \theta}{\sin \theta} = 2 \operatorname{cosec} \theta.$

29. उस आयताकार पार्क की लम्बाई व चौड़ाई ज्ञात कीजिये जिसका परिमाप 100 m तथा क्षेत्रफल 600 m^2 हो ।

30. 7 cm त्रिज्या तथा केन्द्र O वाले वृत्त के दो व्यास AB तथा CD हैं । यदि $\angle BOD = 30°$ है, तो छायांकित भाग का क्षेत्रफल तथा परिमाप ज्ञात कीजिये ।



31. (a) बहुपद $3x^2 - 8x + k$ के मूल α तथा β हैं । k का वह मान ज्ञात कीजिये जिसके लिये $\alpha^2 + \beta^2 = \frac{40}{9}$ हो ।

अथवा

(b) बहुपद $2x^2 + 7x + 5$ के शून्यक ज्ञात कीजिये तथा इसके गुणांकों एवं शून्यक के बीच संबंध को सत्यापित कीजिये ।

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Section – C

(Short Answer Type Questions) **6 × 3 = 18**

Q. Nos. **26** to **31** are Short Answer type questions of **3** marks each.

26. Given that $\sqrt{5}$ is an irrational number, prove that $2 + 3\sqrt{5}$ is an irrational number.

27. (a) Find the A.P. whose third term is 16 and seventh term exceeds the fifth term by 12. Also, find the sum of first 29 terms of the A.P.

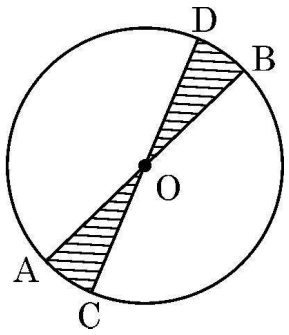
OR

(b) Find the sum of first 20 terms of an A.P. whose n^{th} term is given by $a_n = 5 + 2n$. Can 52 be a term of this A.P. ?

28. Prove that $\frac{\sin\theta}{1+\cos\theta} + \frac{1+\cos\theta}{\sin\theta} = 2\,\text{cosec}\,\theta$.

29. Find length and breadth of a rectangular park whose perimeter is 100 m and area is 600 m^2.

30. AB and CD are diameters of a circle with centre O and radius 7 cm. If $\angle BOD = 30°$, then find the area and perimeter of the shaded region.



31. (a) α, β are zeroes of the polynomial $3x^2 - 8x + k$. Find the value of k, if $\alpha^2 + \beta^2 = \frac{40}{9}$.

OR

(b) Find the zeroes of the polynomial $2x^2 + 7x + 5$ and verify the relationship between its zeroes and co-efficients.

• • •

खण्ड – घ

(दीर्घ–उत्तरीय प्रश्न) **$4 \times 5 = 20$**

प्रश्न संख्या **32** से **35** तक दीर्घ–उत्तरीय प्रश्न हैं जिनमें प्रत्येक के **5** अंक हैं ।

32. निम्न आँकड़ों का 'माध्य' तथा 'बहुलक' ज्ञात कीजिये :

अंक	0 – 5	5 – 10	10 – 15	15 – 20	20 – 25	25 – 30
विद्यार्थियों की संख्या	2	3	8	15	14	8

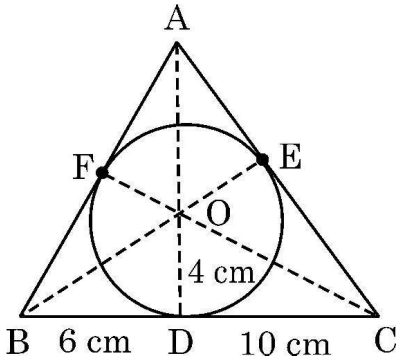
33. (a) निम्नलिखित रैखिक समीकरण युग्म को ग्राफीय विधि द्वारा हल कीजिये :

$2x + y = 9$ तथा $x - 2y = 2$

अथवा

(b) निधि ने ₹ x को 6% p.a. पर तथा ₹ y को 5% p.a. पर एक साल के लिये साधारण ब्याज पर निवेश किया तथा उसे ₹ 1,200 की राशि मिली । यदि उसने ₹ x को 3% p.a. तथा ₹ y को 8% p.a. पर साधारण ब्याज पर निवेश किया होता तो उसे ₹ 1,260 की राशि मिलती । x तथा y का मान ज्ञात कीजिये ।

34. (a) दी गयी आकृति, 4 cm त्रिज्या तथा केन्द्र O वाले वृत्त को दर्शाती है जो ΔABC के अन्तर्गत खींचा गया है । भुजा BC, वृत्त को बिंदु D पर स्पर्श करती है ताकि BD = 6 cm तथा DC = 10 cm हो । AE की लम्बाई ज्ञात कीजिये ।



अथवा

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Section – D

(Long Answer Type Questions) **4 × 5 = 20**

Q. Nos. **32** to **35** are Long Answer type questions of **5** marks each.

32. Find 'mean' and 'mode' marks of the following data :

Marks	0 – 5	5 – 10	10 – 15	15 – 20	20 – 25	25 – 30
Number of students	2	3	8	15	14	8

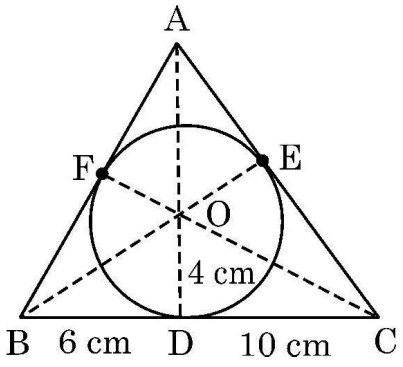
33. (a) Solve the following pair of linear equations by graphical method :

$2x + y = 9$ and $x - 2y = 2$

OR

(b) Nidhi received simple interest of ₹ 1,200 when invested ₹ x at 6% p.a. and ₹ y at 5% p.a. for 1 year. Had she invested ₹ x at 3% p.a. and ₹ y at 8% p.a. for that year, she would have received simple interest of ₹ 1,260. Find the values of x and y.

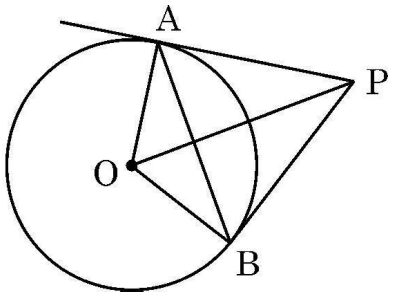
34. (a) The given figure shows a circle with centre O and radius 4 cm circumscribed by ΔABC. BC touches the circle at D such that BD = 6 cm, DC = 10 cm. Find the length of AE.



OR

• • •

(b) PA तथा PB बाह्य बिंदु P से, O केन्द्र वाले वृत्त पर खींची गयी स्पर्श-रेखायें हैं । यदि $\angle AOB = 120°$ तथा $OA = 10$ cm है, तो



(i) $\angle OPA$ का मान ज्ञात कीजिये । **1**

(ii) ΔOAP का परिमाप ज्ञात कीजिये । **3**

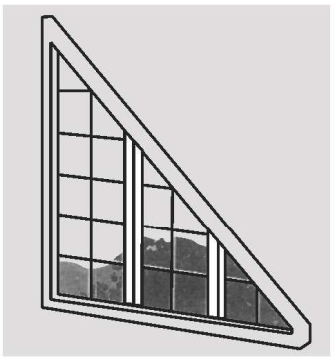
(iii) जीवा AB की लम्बाई ज्ञात कीजिये । **1**

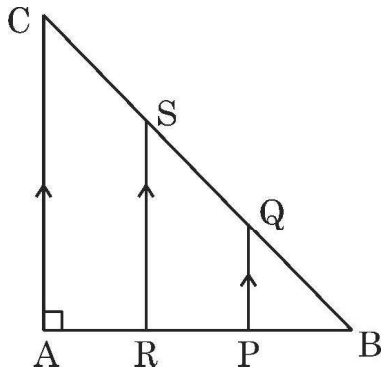
35. एक ड्रोन h मीटर की ऊँचाई पर उड़ रहा है । किसी समय पर ड्रोन से औद्योगिक टर्बाइन के शिखर का उन्नयन कोण $60°$ तथा इसके तल का अवनमन कोण $30°$ है । यदि टर्बाइन की ऊँचाई 200 मीटर है, तो h का मान ज्ञात कीजिये । ड्रोन से टर्बाइन की दूरी भी ज्ञात कीजिये । ($\sqrt{3} = 1.73$ लीजिये)

खण्ड – ङ

(प्रकरण अध्ययन आधारित प्रश्न) $3 \times 4 = 12$

प्रश्न संख्या **36** से **38** तक प्रकरण अध्ययन आधारित प्रश्न हैं । प्रत्येक प्रश्न के **4** अंक हैं ।

36. 



उपरोक्त चित्र में, एक भवन की त्रिभुजीय आकार की खिड़की दिखायी गयी है । इस चित्र में ΔABC दिखाया गया है जहाँ $\angle A = 90°$ तथा $AB = AC$ है । बिन्दु P तथा R भुजा AB को समत्रिभाजित करते हैं तथा $PQ \parallel RS \parallel AC$ है ।

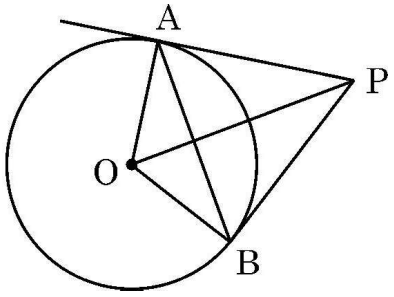
उपरोक्त के आधार पर निम्न प्रश्नों के उत्तर दीजिए :

(i) दर्शाइये कि $\Delta BPQ \sim \Delta BAC$ है । **1**

• • •

(b) PA and PB are tangents drawn to a circle with centre O.

If $\angle AOB = 120°$ and OA = 10 cm, then



(i) Find $\angle OPA$. **1**

(ii) Find the perimeter of ΔOAP. **3**

(iii) Find the length of chord AB. **1**

35. A drone is flying at a height of h metres. At an instant it observes the angle of elevation of top of an industrial turbine as 60° and angle of depression of foot of the turbine as 30°. If height of turbine is 200 metres, find the value of h and the distance of drone from the turbine.

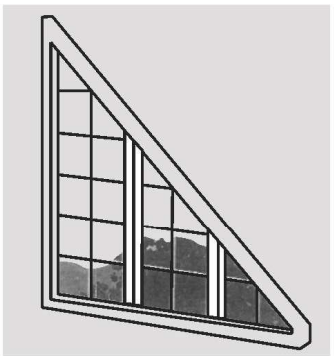
(Use $\sqrt{3} = 1.73$)

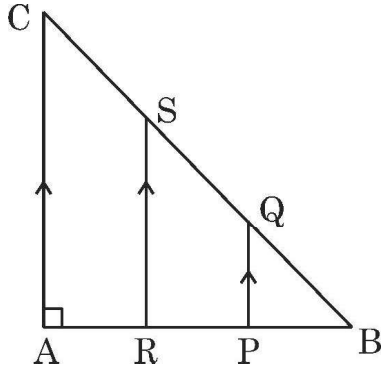
Section – E

(Case-study based Questions) $3 \times 4 = 12$

Q. Nos. **36** to **38** are Case-study based Questions of **4** marks each.

36.





A triangular window of a building is shown above. Its diagram represents a ΔABC with $\angle A = 90°$ and AB = AC. Points P and R trisect AB and PQ || RS || AC.

Based on the above, answer the following questions :

(i) Show that $\Delta BPQ \sim \Delta BAC$. **1**

• • •

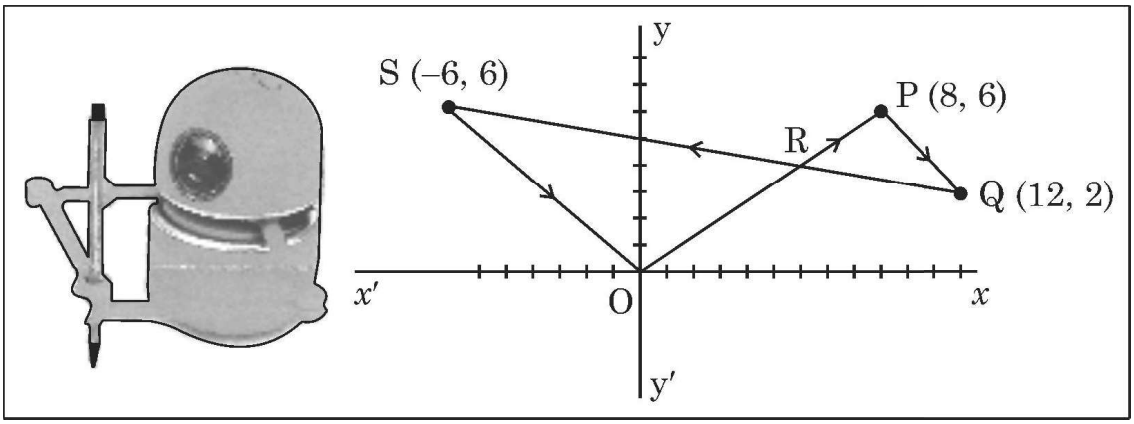
(ii) सिद्ध कीजिये कि $PQ = \frac{1}{3} AC$. **1**

(iii) (a) यदि AB = 3 m है, तो BQ तथा BS की लम्बाई ज्ञात कीजिये । सत्यापित कीजिये कि $BQ = \frac{1}{2} BS$ है । **2**

अथवा

(iii) (b) सिद्ध कीजिये कि $BR^2 + RS^2 = \frac{4}{9} BC^2$.

37. गुरवीर और आरुषि ने एक रोबोट बनाया जो कि ग्राफ पेपर पर चलते हुये अपने द्वारा तय किये गये रास्ते को पेन्ट (paint) करता जाता है । इसमें कुछ बिंदुओं के निर्देशांक अंकित कर दिये जाते हैं । रोबोट मूल बिन्दु (0, 0) से शुरू होता है । निर्धारित बिंदुओं पर सीधी रेखाओं में चलते हुये मूल बिंदु पर आकर रुक जाता है ।



आरुषि ने बिंदु P(8, 6), Q(12, 2) तथा S(– 6, 6) इसी क्रम में अंकित किये । रोबोट के द्वारा तय रास्ता आकृति में दिखाया गया है ।

उपरोक्त के आधार पर, निम्न प्रश्नों के उत्तर दीजिए :

(i) OP की दूरी ज्ञात कीजिये । **1**

(ii) रेखाखंड QS का समीकरण $2x + 9y = 42$ है । QS तथा y-अक्ष के प्रतिच्छेद बिंदु के निर्देशांक ज्ञात कीजिये । **1**

(iii) (a) बिंदु R(4.8, y) OP को एक निश्चित अनुपात में विभाजित करता है । वह अनुपात तथा y का मान ज्ञात कीजिये । **2**

अथवा

(iii) (b) दूरी सूत्र का उपयोग करते हुये दर्शाइये कि $\frac{PQ}{OS} = \frac{2}{3}$

• • •

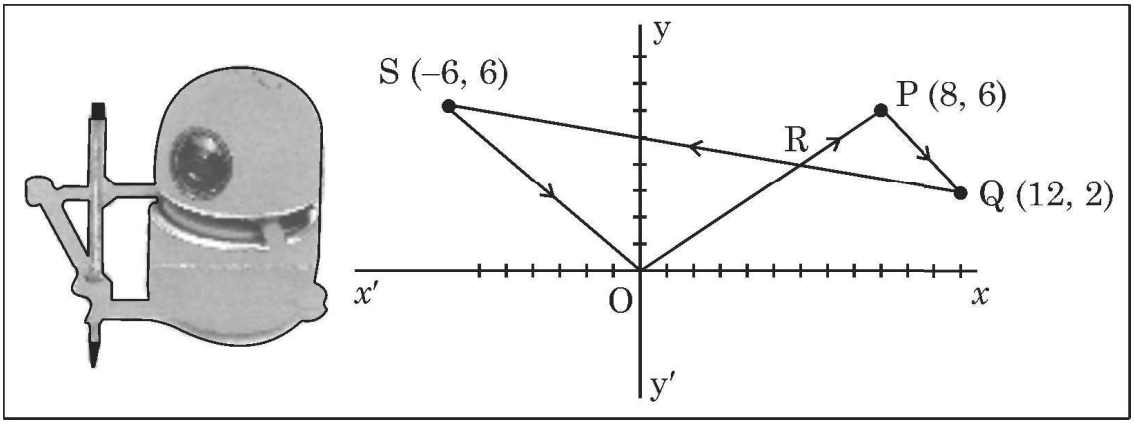
(ii) Prove that $PQ = \frac{1}{3} AC$. **1**

(iii) (a) If AB = 3 m, find length BQ and BS. Verify that $BQ = \frac{1}{2} BS$. **2**

OR

(iii) (b) Prove that $BR^2 + RS^2 = \frac{4}{9} BC^2$.

37. Gurveer and Arushi built a robot that can paint a path as it moves on a graph paper. Some co-ordinate of points are marked on it. It starts from (0, 0), moves to the points listed in order (in straight lines) and ends at (0, 0).



Arushi entered the points P(8, 6), Q(12, 2) and S(– 6, 6) in order. The path drawn by robot is shown in the figure.

Based on the above, answer the following questions :

(i) Determine the distance OP. **1**

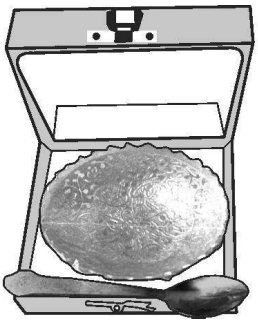
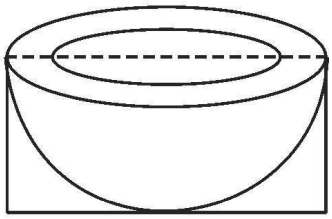
(ii) QS is represented by equation $2x + 9y = 42$. Find the co-ordinates of the point where it intersects y – axis. **1**

(iii) (a) Point R(4.8, y) divides the line segment OP in a certain ratio, find the ratio. Hence, find the value of y. **2**

OR

(iii) (b) Using distance formula, show that $\frac{PQ}{OS} = \frac{2}{3}$.

• • •

38.  

एक अर्धगोलाकार कटोरा, घनाभ आकार के एक डिब्बे में रखा है । यह कटोरा डिब्बे में फिट (fit) बैठता है । कटोरे की आंतरिक त्रिज्या 10 cm है तथा कटोरे की बाहरी त्रिज्या 10.5 cm है ।

उपरोक्त के आधार पर निम्न प्रश्नों के उत्तर दीजिए :

(i) घनाभ आकार के डिब्बे की विमायें बताइये । **1**

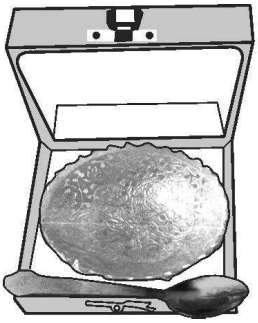
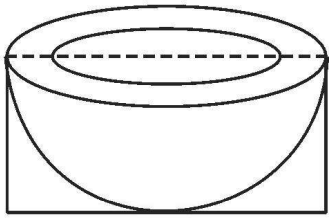
(ii) डिब्बे के बाहरी पृष्ठ का कुल क्षेत्रफल ज्ञात कीजिये । **1**

(iii) (a) कटोरे की क्षमता तथा डिब्बे के आयतन के बीच अंतर ज्ञात कीजिये । ($\pi = 3.14$ लीजिये) **2**

अथवा

(iii) (b) कटोरे के आंतरिक पृष्ठीय क्षेत्रफल तथा कटोरे की मोटाई (ऊपरी सतह पर) के क्षेत्रफल को रंगीन करना है । रंग किये जाने वाले क्षेत्र का क्षेत्रफल ज्ञात कीजिये ।

• • •

38.  

A hemispherical bowl is packed in a cuboidal box. The bowl just fits in the box. Inner radius of the bowl is 10 cm. Outer radius of the bowl is 10.5 cm.

Based on the above, answer the following questions :

(i) Find the dimensions of the cuboidal box. **1**

(ii) Find the total outer surface area of the box. **1**

(iii) (a) Find the difference between the capacity of the bowl and the volume of the box. (use $\pi = 3.14$) **2**

OR

(iii) (b) The inner surface of the bowl and the thickness is to be painted. Find the area to be painted.

• • •

Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2025
SUBJECT NAME MATHEMATICS (BASIC) (Q.P. CODE 430/6/3)

General Instructions: -

1	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully.
2	**"Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, evaluation done and several other aspects. It's leakage to public in any manner could lead to derailment of the examination system and affect the life and future of millions of candidates. Sharing this policy/document to anyone, publishing in any magazine and printing in News Paper/Website etc. may invite action under various rules of the Board and 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.

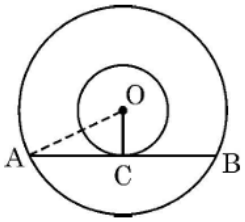
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MARKING SCHEME
MATHEMATICS (BASIC)

SECTION A

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

1. In two concentric circles centred at O, a chord AB of the larger circle touches the smaller circle at C. If OA = 3.5 cm, OC = 2.1 cm, then AB is equal to



(A) 5.6 cm (B) 2.8 cm
(C) 3.5 cm (D) 4.2 cm

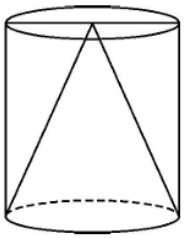
Ans: (A) 5.6 cm	1

2. Three coins are tossed together. The probability that at least one head comes up, is

(A) $\frac{3}{8}$ (B) $\frac{7}{8}$
(C) $\frac{1}{8}$ (D) $\frac{3}{4}$

Ans: (B) $\frac{7}{8}$	1

3. The volume of air in a hollow cylinder is 450 cm^3. A cone of same height and radius as that of cylinder is kept inside it. The volume of empty space in the cylinder is



(A) 225 cm^3 (B) 150 cm^3
(C) 250 cm^3 (D) 300 cm^3

Ans: (D) 300 cm^3	1

4. If the length of the shadow of a tower is $\sqrt{3}$ times its height, then the angle of elevation of the sun is

(A) 45° (B) 30°

(C) 60° (D) 0°

Ans: (B) 30^0 1

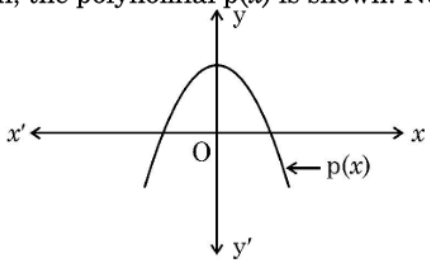
5. 22^{nd} term of the A.P. : $\frac{3}{2}, \frac{1}{2}, \frac{-1}{2}, \frac{-3}{2}$, ... is

(A) $\frac{45}{2}$ (B) -9

(C) $\frac{-39}{2}$ (D) -21

Ans: (C) $\frac{-39}{2}$ 1

6. In the given graph, the polynomial $p(x)$ is shown. Number of zeroes of $p(x)$ is



(A) 3 (B) 2

(C) 1 (D) 4

Ans: (B) 2 1

7. If probability of happening of an event is 57%, then probability of non-happening of the event is

(A) 0.43 (B) 0.57

(C) 53% (D) $\frac{1}{57}$

Ans: (A) 0.43 1

8. OAB is sector of a circle with centre O and radius 7 cm. If length of arc $\overset{\frown}{AB} = \frac{22}{3}$ cm, then $\angle AOB$ is equal to

(A) $\left(\frac{120}{7}\right)^\circ$ (B) 45°

(C) 60° (D) 30°

Ans: (C) 60° 1

9. If the sum of first n terms of an A.P. is given by $S_n = \frac{n}{2}(3n + 1)$, then the first term of the A.P. is

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

(C) 4 (D) $\frac{5}{2}$

Ans: (A) 2 — 1

10. To calculate mean of a grouped data, Rahul used assumed mean method. He used $d = (x - A)$, where A is assumed mean. Then $\bar{x}$ is equal to

(A) $A + \bar{d}$ (B) $A + h\bar{d}$

(C) $h(A + \bar{d})$ (D) $A - h\bar{d}$

Ans: (A) $A + \bar{d}$ — 1

11. The point $(3, -5)$ lies on the line $mx - y = 11$. The value of m is

(A) 3 (B) -2

(C) 8 (D) 2

Ans: (D) 2 — 1

12. If $\sqrt{3}\sin\theta = \cos\theta$, then value of θ is

(A) $\sqrt{3}$ (B) 60°

(C) $\frac{1}{\sqrt{3}}$ (D) 30°

Ans: (D) 30° — 1

13. ABCD is a rectangle with its vertices at (2, –2), (8, 4), (4, 8) and (– 2, 2) taken in order. Length of its diagonal is

(A) $4\sqrt{2}$ (B) $6\sqrt{2}$

(C) $4\sqrt{26}$ (D) $2\sqrt{26}$

Ans: (D) $2\sqrt{26}$ — 1

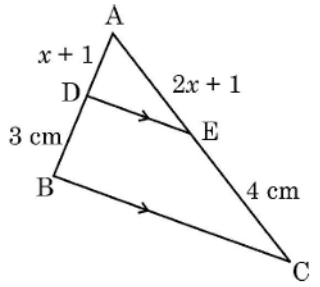
14. Two dice are rolled together. The probability of getting a sum more than 9 is

(A) $\frac{5}{6}$ (B) $\frac{5}{18}$

(C) $\frac{1}{6}$ (D) $\frac{1}{2}$

Ans: (C) $\frac{1}{6}$ — 1

15. In ΔABC, $DE||BC$. If $AE = (2x + 1)$ cm, $EC = 4$ cm, $AD = (x + 1)$ cm and $DB = 3$ cm, then value of x is



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

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

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

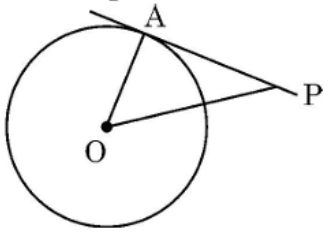
16. The value of k for which the system of equations $3x - 7y = 1$ and $kx + 14y = 6$ is inconsistent, is

(A) -6 (B) $\frac{2}{3}$

(C) 6 (D) $\frac{-3}{2}$

Ans: (A) -6 1

17. In the given figure, PA is tangent to a circle with centre O. If $\angle APO = 30°$ and $OA = 2.5$ cm, then OP is equal to

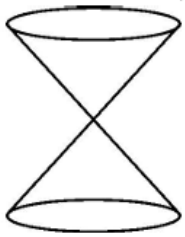


(A) 2.5 cm (B) 5 cm

(C) $\frac{5}{\sqrt{3}}$ cm (D) 2 cm

Ans: (B) 5 cm 1

18. Two identical cones are joined as shown in the figure. If radius of base is 4 cm and slant height of the cone is 6 cm, then height of the solid is



(A) 8 cm
(B) $4\sqrt{5}$ cm
(C) $2\sqrt{5}$ cm
(D) 12 cm

Ans: (B) $4\sqrt{5}$ cm	1

(Assertion – Reason based questions)

Directions : In question numbers **19** and **20**, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option :

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is correct explanation of Assertion (A).
(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not correct explanation for 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) :** $(a + \sqrt{b}) \cdot (a - \sqrt{b})$ is a rational number, where a and b are positive integers.
Reason (R) : Product of two irrationals is always rational.

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

20. **Assertion (A) :** $\Delta ABC \sim \Delta PQR$ such that $\angle A = 65°$, $\angle C = 60°$. Hence $\angle Q = 55°$.
Reason (R) : Sum of all angles of a triangle is 180°.

Ans: (B) Both Assertion (A) and Reason (R) are true and Reason (R) is not the correct explanation of Assertion (A).	1

SECTION B

*This section has **5** Very Short Answer (VSA) type questions of **2** marks each.* $5 \times 2 = 10$

21. A box contains 120 discs, which are numbered from 1 to 120. If one disc is drawn at random from the box, find the probability that

(i) it bears a 2– digit number

(ii) the number is a perfect square.

Solution:

(i) P(2 - digit number) $=\frac{90}{120}$ or $\frac{3}{4}$ — 1

(ii) P(the number is a perfect square) $=\frac{10}{120}$ or $\frac{1}{12}$ — 1

22. (a) Evaluate : $\frac{\cos 45°}{\tan 30° + \sin 60°}$

OR

(b) Verify that $\sin 2A = \frac{2 \tan A}{1 + \tan^2 A}$, for $A = 30°$.

Solution:

(a) $\frac{\frac{1}{\sqrt{2}}}{\frac{1}{\sqrt{3}}+\frac{\sqrt{3}}{2}}$ — 1½

$= \frac{2\sqrt{3}}{5\sqrt{2}}$ or $\frac{\sqrt{6}}{5}$ — ½

OR

(b) LHS $= \sin 60° = \frac{\sqrt{3}}{2}$ — ½

RHS $= \frac{2 \tan 30°}{1 + \tan^2 30°} = \frac{\frac{2}{\sqrt{3}}}{1 + \frac{1}{3}}$ — 1

$= \frac{\sqrt{3}}{2}$ = LHS — ½

23. (a) Solve the quadratic equation $\sqrt{3}x^2 + 10x + 7\sqrt{3} = 0$ using quadratic formula.

OR

(b) Find the nature of roots of the equation $4x^2 - 4a^2x + a^4 - b^4 = 0$, $b \neq 0$

Solution: (a) Discriminant = 16	1
$x = \frac{-10 \pm \sqrt{16}}{2\sqrt{3}}$	
$x = -\frac{3}{\sqrt{3}}, -\frac{7}{\sqrt{3}}$ or $x = -\sqrt{3}, -\frac{7}{3}\sqrt{3}$	1
OR	
(b) Discriminant = $(-4a^2)^2 - 4 \times 4 \times (a^4 - b^4) = 16b^4$	1
Since, Discriminant > 0	
Therefore, the given equation has real and distinct roots	1

24. Using prime factorisation, find the HCF of 180, 140 and 210.

Solution:	
$180 = 2^2 \times 3^2 \times 5$, $140 = 2^2 \times 5 \times 7$, $210 = 2 \times 3 \times 5 \times 7$	1½
HCF (180, 140, 210) $= 2 \times 5 = 10$	½

25. The perimeters of two similar triangles are 22 cm and 33 cm respectively. If one side of first triangle is 9 cm, then find the length of corresponding side of the second triangle.

Solution: Let the length of corresponding side of the second triangle be x cm	
$\frac{9}{x} = \frac{22}{33}$	1
$\Rightarrow x = 13{\cdot}5$	1
$\therefore$ The length of corresponding side of the second triangle = 13·5 cm	

Section – C

(Short Answer Type Questions) **6 × 3 = 18**

Q. Nos. **26** to **31** are Short Answer type questions of **3** marks each.

26. Given that $\sqrt{5}$ is an irrational number, prove that $2 + 3\sqrt{5}$ is an irrational number.

Solution: Let $2 + 3\sqrt{5} = a$, where 'a' is a rational number	½
$\Rightarrow \sqrt{5} = \frac{a-2}{3}$	1
Here L.H.S. is an irrational number but R.H.S. is a rational number	1
So, our assumption is wrong	
Hence, $2 + 3\sqrt{5}$ is an irrational number	½

27. (a) Find the A.P. whose third term is 16 and seventh term exceeds the fifth term by 12. Also, find the sum of first 29 terms of the A.P.

OR

(b) Find the sum of first 20 terms of an A.P. whose n^{th} term is given by $a_n = 5 + 2n$. Can 52 be a term of this A.P. ?

Solution:

(a) $a + 2d = 16$ … (i) ½

$a + 6d = 12 + a + 4d$ …(ii) ½

Solving (i) and (ii) to get $d = 6$, $a = 4$ ½

∴ A.P. is 4, 10, 16, ... ½

$S_{29} = \frac{29}{2}\,[8 + 28 \times 6]$ ½

$= 2552$ ½

OR

(b) $a_n = 5 + 2n$

getting $a = 7$ and $d = 2$ 1

$S_{20} = \frac{20}{2}\,[14 + 19 \times 2]$

$= 520$ 1

$52 = 7 + (n - 1) \times 2$ ½

$\Rightarrow n = \frac{47}{2}$, which is not a natural number

Therefore, 52 cannot be a term of this A.P. ½

28. Prove that $\frac{\sin\theta}{1 + \cos\theta} + \frac{1 + \cos\theta}{\sin\theta} = 2 \operatorname{cosec}\theta$.

Solution:

$$\text{LHS} = \frac{\sin^2\theta + (1 + \cos\theta)^2}{(1 + \cos\theta)\sin\theta}$$ 1

$$= \frac{sin^2\theta + 1 + cos^2\theta + 2\cos\theta}{(1+\cos\theta)\sin\theta}$$ ½

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

$$= \frac{2}{sin\theta} = 2 \operatorname{cosec}\theta = \text{RHS}$$ ½

29. Find length and breadth of a rectangular park whose perimeter is 100 m and area is 600 m^2.

Solution:

Let length and breadth of the park be a metres and b metres respectively. ½

A.T.Q. $2(a + b) = 100$ …(i) ½

and $ab = 600$ …(ii)

using (i) & (ii) we get $a^2 - 50a + 600 = 0$ 1

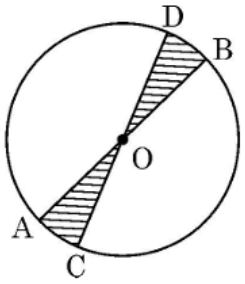
$\Rightarrow a = 30$ or 20 ½

and $b = 20$ or 30 ½

$\therefore$ length = 30 m, breadth = 20 m

or length = 20 m, breadth = 30 m

30. AB and CD are diameters of a circle with centre O and radius 7 cm. If $\angle BOD = 30°$, then find the area and perimeter of the shaded region.



Solution:

Area of the shaded region $= 2\left(\frac{30}{360} \times \frac{22}{7} \times 7 \times 7\right)$ 1

$= \frac{77}{3}$ sq. cm or 25.67 sq. cm ½

Perimeter of the shaded region $= 2\left(14 + \frac{30}{360} \times 2 \times \frac{22}{7} \times 7\right)$ 1

$= \frac{106}{3}$ cm or 35.33 cm ½

31. (a) α, β are zeroes of the polynomial $3x^2 - 8x + k$. Find the value of k, if $\alpha^2 + \beta^2 = \frac{40}{9}$.

OR

(b) Find the zeroes of the polynomial $2x^2 + 7x + 5$ and verify the relationship between its zeroes and co-efficients.

Solution:

(a) $p(x) = 3x^2 - 8x + k$

$\alpha + \beta = \frac{8}{3}, \quad \alpha\beta = \frac{k}{3}$ — 1

$\alpha^2 + \beta^2 = \frac{40}{9} \Rightarrow \left(\frac{8}{3}\right)^2 - \frac{2k}{3} = \frac{40}{9}$ — 1

$\Rightarrow k = 4$ — 1

OR

(b) $p(x) = 2x^2 + 7x + 5$

$= (x + 1)(2x + 5)$

Zeroes of p(x) are -1 and $\frac{-5}{2}$ — 1

Sum of zeroes $= -1 - \frac{5}{2} = \frac{-7}{2} = -\frac{\text{coefficient of x}}{\text{coefficient of } x^2}$ — 1

Product of zeroes $= (-1)\left(\frac{-5}{2}\right) = \frac{5}{2} = \frac{\text{constant term}}{\text{coefficient of } x^2}$ — 1

Section – D

(Long Answer Type Questions) **4 × 5 = 20**

Q. Nos. **32** to **35** are Long Answer type questions of **5** marks each.

32. Find 'mean' and 'mode' marks of the following data :

Marks	0 – 5	5 – 10	10 – 15	15 – 20	20 – 25	25 – 30
Number of students	2	3	8	15	14	8

Solution:

Class	x_i	f_i	$u_i = \frac{x_i - 17.5}{5}$	$f_i u_i$
0 – 5	2.5	2	– 3	- 6
5 – 10	7.5	3	– 2	- 6
10 – 15	12.5	8	– 1	- 8
15 – 20	17.5	15	0	0
20 – 25	22.5	14	1	14
25 - 30	27.5	8	2	16
		$\sum f_i = 50$		$\sum f_i u_i = 10$

Correct table 1½

Mean = $17{\cdot}5 + 5 \times \frac{10}{50} = 18.5$ Modal class is 15 – 20 Mode = $15 + 5 \times \frac{15-8}{30-8-14}$ $= 19.38$	1½ 1½ ½

33. (a) Solve the following pair of linear equations by graphical method :

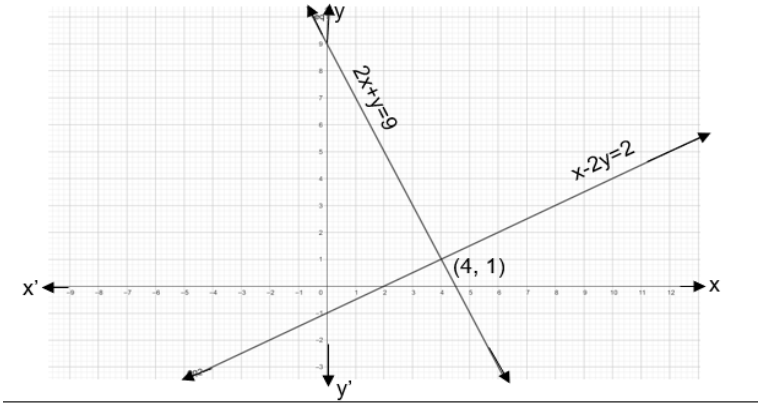
$2x + y = 9$ and $x - 2y = 2$

OR

(b) Nidhi received simple interest of ₹ 1,200 when invested ₹ x at 6% p.a. and ₹ y at 5% p.a. for 1 year. Had she invested ₹ x at 3% p.a. and ₹ y at 8% p.a. for that year, she would have received simple interest of ₹ 1,260. Find the values of x and y.

Solution:

(a) Correct graph of each equation — 2 + 2



Solution x = 4, y = 1 or (4, 1) — 1

OR

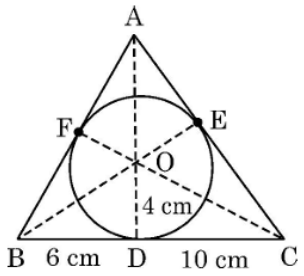
(b) A.T.Q.

$\frac{6}{100}x + \frac{5}{100}y = 1200 \Rightarrow 6x + 5y = 120000$ …(i) — 1½

$\frac{3}{100}x + \frac{8}{100}y = 1260 \Rightarrow 3x + 8y = 126000$ …(ii) — 1½

Solving (i) and (ii) we get, x = 10000 and y = 12000 — 1 + 1

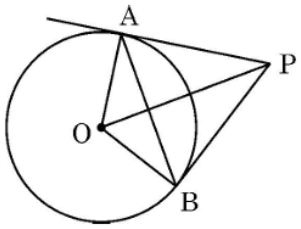
34. (a) The given figure shows a circle with centre O and radius 4 cm circumscribed by ΔABC. BC touches the circle at D such that BD = 6 cm, DC = 10 cm. Find the length of AE.



OR

(b) PA and PB are tangents drawn to a circle with centre O.

If $\angle AOB = 120°$ and OA = 10 cm, then



(i) Find $\angle OPA$. **1**

(ii) Find the perimeter of ΔOAP. **3**

(iii) Find the length of chord AB. **1**

Solution:

(a) Let AE = x $\Rightarrow$ AF = x and CE = 10 cm, BF = 6 cm — 1

(Lengths of tangents drawn from an external point to a circle are equal)

$s = \frac{16 + 10 + x + 6 + x}{2} = 16 + x$ — ½

$\therefore$ Area of $\Delta ABC = \sqrt{(16 + x)(x)(6)(10)}$ …(i) — 1

Also, area of $\Delta ABC = \frac{1}{2}[16 \times 4 + (10 + x)4 + (6 + x)4]$ …(ii) — 1

Equating (i) & (ii), we get $x = \frac{64}{11}$ or 5·8 — 1½

x = – 16 (Rejected)

Length of AE = $\frac{64}{11}$ cm or 5.8 cm

OR

(b) (i) $\angle OPA = 30°$ — 1

(ii) In ΔOAP, $\sin 30° = \frac{10}{OP} \Rightarrow OP = 20$ cm — 1

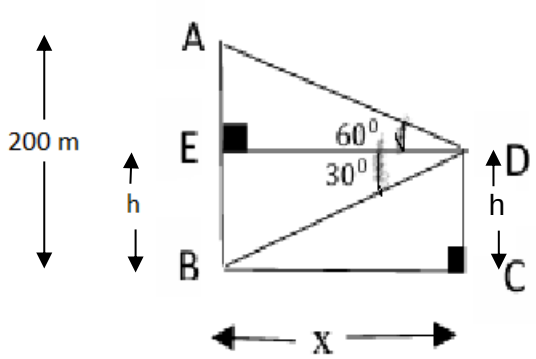
$\tan 30° = \frac{10}{PA} \Rightarrow PA = 10\sqrt{3}$ cm — 1

$\therefore$ Perimeter of $\Delta OPA = (30 + 10\sqrt{3})$ cm — 1

(iii) PA = PB and ∠ APB = 60° Δ APB is an equilateral triangle ∴ PA = AB = $10\sqrt{3}$ cm	½ ½

35. A drone is flying at a height of h metres. At an instant it observes the angle of elevation of top of an industrial turbine as 60° and angle of depression of foot of the turbine as 30°. If height of turbine is 200 metres, find the value of h and the distance of drone from the turbine.
(Use $\sqrt{3}$ = 1.73)

Solution:



Correct figure 1

Let the drone be flying at the height CD = h metres,
distance of drone from the turbine be x metres and
height of industrial turbine is AB = 200 metres

In Δ DEB, $\tan 30° = \frac{h}{x} \Rightarrow x = h\sqrt{3}$ (i) — 1½

In Δ DEA, $\tan 60° = \frac{200-h}{x} \Rightarrow x\sqrt{3} = 200 - h$ (ii) — 1½

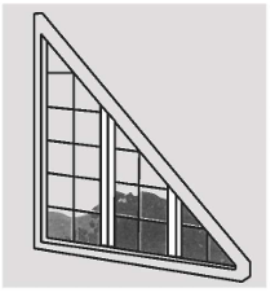
Solving (i) & (ii) we get $x = 50\sqrt{3} = 86.5$, h = 50 — ½ + ½
∴ h = 50 m and the distance of drone from the turbine is 86.5 m

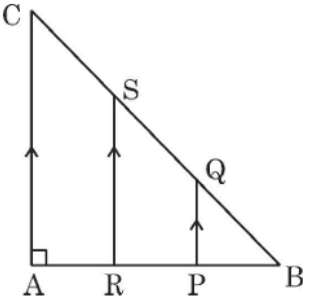
Section – E

(Case-study based Questions) **3 × 4 = 12**

Q. Nos. **36** to **38** are Case-study based Questions of **4** marks each.

36.





A triangular window of a building is shown above. Its diagram represents a ΔABC with ∠A = 90° and AB = AC. Points P and R trisect AB and PQ ‖ RS ‖ AC.

Based on the above, answer the following questions :

(i) Show that $\Delta BPQ \sim \Delta BAC$. **1**

(ii) Prove that $PQ = \frac{1}{3} AC$. **1**

(iii) (a) If AB = 3 m, find length BQ and BS. Verify that $BQ = \frac{1}{2} BS$. **2**

OR

(iii) (b) Prove that $BR^2 + RS^2 = \frac{4}{9} BC^2$.

Solution:

(i) In Δ BAC and Δ BPQ, PQ ∥ AC

∴ ∠ BQP = ∠ BCA and ∠ B is common

∴ Δ BPQ ~ Δ BAC (By AA similarity criterion) 1

(ii) Since, Δ BPQ ~ Δ BAC $\Rightarrow \frac{PQ}{AC} = \frac{BP}{BA} = \frac{1}{3}$ ½

$\Rightarrow \frac{PQ}{AC} = \frac{1}{3} \Rightarrow PQ = \frac{1}{3} AC$ ½

(iii) (a) $\frac{BP}{BA} = \frac{PQ}{AC}$ (corresponding sides of similar triangles)

$\Rightarrow$ BP = PQ (as BA = AC)

∴ $PQ = \frac{1}{3} \times 3 = 1$ m

Hence, BQ = $\sqrt{2}$ m 1

getting BS = $2\sqrt{2}$ m ½

$\Rightarrow \frac{1}{2}$BS = BQ (Hence verified) ½

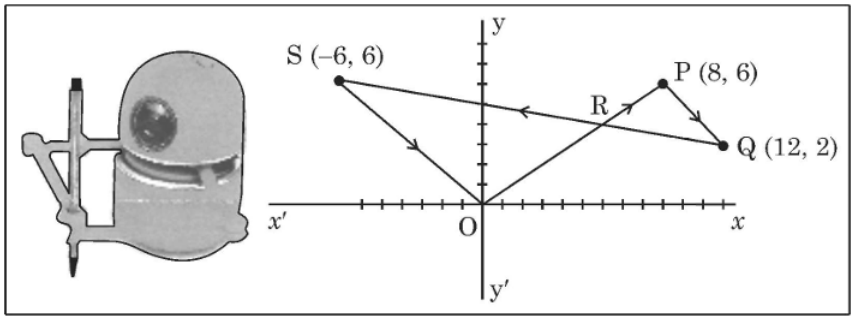
OR

(b) $BR^2 + RS^2 = \left(\frac{2}{3}AB\right)^2 + \left(\frac{2}{3}AC\right)^2$ ½ + ½

$= \frac{4}{9}(AB^2 + AC^2)$ ½

$= \frac{4}{9} BC^2$ ½

37. Gurveer and Arushi built a robot that can paint a path as it moves on a graph paper. Some co-ordinate of points are marked on it. It starts from (0, 0), moves to the points listed in order (in straight lines) and ends at (0, 0).



Arushi entered the points P(8, 6), Q(12, 2) and S(– 6, 6) in order. The path drawn by robot is shown in the figure.

Based on the above, answer the following questions :

(i) Determine the distance OP. **1**

(ii) QS is represented by equation $2x + 9y = 42$. Find the co-ordinates of the point where it intersects y – axis. **1**

(iii) (a) Point R(4.8, y) divides the line segment OP in a certain ratio, find the ratio. Hence, find the value of y. **2**

OR

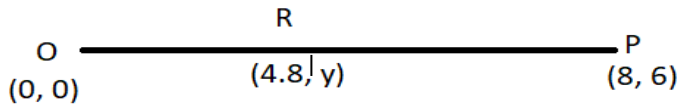
(iii) (b) Using distance formula, show that $\frac{PQ}{OS} = \frac{2}{3}$.

Solution:

(i) The distance OP = $\sqrt{64 + 36} = 10$ — 1

(ii) $2x + 9y = 42$ intersects y-axis at $\left(0, \frac{14}{3}\right)$ — 1

(iii) (a)



Let OR : RP = k : 1, therefore $4{\cdot}8 = \frac{8k}{k+1} \Rightarrow k = \frac{3}{2}$ — 1½

$\Rightarrow$ OR : RP = 3 : 2

$y = \frac{18}{5}$ — ½

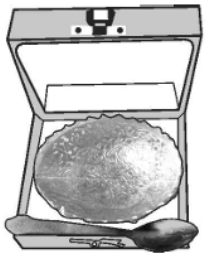
OR

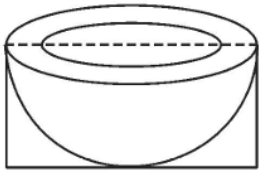
(b) $PQ = \sqrt{4^2 + (-4)^2} = \sqrt{32}$ or $4\sqrt{2}$ — ½

$OS = \sqrt{(-6)^2 + 6^2} = \sqrt{72}$ or $6\sqrt{2}$ — ½

$\therefore \frac{PQ}{OS} = \sqrt{\frac{32}{72}} = \sqrt{\frac{4}{9}} = \frac{2}{3}$	1

38.





A hemispherical bowl is packed in a cuboidal box. The bowl just fits in the box. Inner radius of the bowl is 10 cm. Outer radius of the bowl is 10.5 cm.

Based on the above, answer the following questions :

(i) Find the dimensions of the cuboidal box. **1**

(ii) Find the total outer surface area of the box. **1**

(iii) (a) Find the difference between the capacity of the bowl and the volume of the box. (use $\pi = 3.14$) **2**

OR

(iii) (b) The inner surface of the bowl and the thickness is to be painted. Find the area to be painted.

Solution:

(i) Diameter of bowl = 21 cm

Dimensions of the box are 21 cm × 21 cm × 10·5 cm — 1

(ii) Total surface area of the box $= 2\left(441 + \frac{441}{2} + \frac{441}{2}\right) = 1764$ sq. cm — ½ + ½

(iii) (a) Capacity of bowl $= \frac{2}{3} \times 3{\cdot}14 \times 10^3$ — ½

$= \frac{6280}{3}$ cu. cm or 2093·33 cu. cm — ½

Volume of box $= 21 \times 21 \times \frac{21}{2} = \frac{9261}{2}$ cu. cm. or 4630·5 cu. cm — ½

Required difference $= \frac{15223}{6}$ cu. cm or 2537·17 cu. cm — ½

(NOTE: Here capacity is considered as volume to compute the difference.)

OR

(b) Required area $= 2 \times \frac{22}{7} \times 10^2 + \frac{22}{7} \times (10{\cdot}5^2 - 10^2)$ — 1

$= \frac{4400}{7} + \frac{451}{14}$

$= \frac{9251}{14}$ sq. cm or 660·79 sq. cm — 1