Series : 5LMKN

SET ~ 3

रोल नं.

Roll No.

प्रश्न–पत्र कोड
Q.P. Code **430/5/3**

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

नोट/ NOTE :

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

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

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

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

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

Please check that this question paper contains **38** questions.

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

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

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

15 minute time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the 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*

सामान्य निर्देश :

निम्नलिखित निर्देशों को बहुत सावधानी से पढ़िए और उनका सख्ती 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** तथा **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 बनाएँ। जहाँ आवश्यक हो $\pi = \frac{22}{7}$ लीजिए, यदि अन्यथा नहीं दिया गया हो।*

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

General Instructions :

Read the following instructions very carefully and follow them strictly :

(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,** 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 carrying **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 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 $\pi = 22/7$ wherever required, if not stated.*

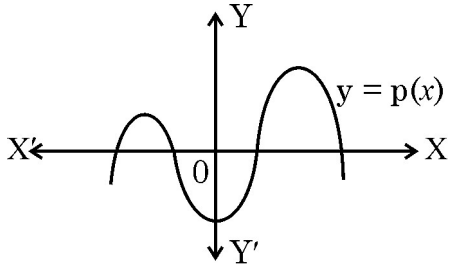
(x) *Use of calculator is **NOT** allowed.*

खण्ड – क

(बहुविकल्पीय प्रश्न) **$20 \times 1 = 20$**

प्रश्न संख्या **1** से **20** तक बहुविकल्पी प्रश्न हैं । प्रत्येक प्रश्न **1** अंक का है ।

1. बहुपद $p(x)$ का ग्राफ यहाँ दर्शाया गया है । बहुपद $p(x)$ के शून्यकों की संख्या है :



(A) 5 (B) 1

(C) 0 (D) 4

2. तीन सिक्कों को एक साथ उछाला जाता है । ठीक दो पट आने की प्रायिकता है :

(A) $\frac{2}{8}$ (B) $\frac{1}{2}$

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

3. एक थैले में कुछ लाल तथा कुछ सफेद गेंदें हैं । थैले में से यादृच्छया एक गेंद निकाली गयी । यदि एक लाल गेंद निकालने की प्रायिकता $\frac{2}{7}$ है, तो एक सफेद गेंद निकालने की प्रायिकता है :

(A) $\frac{1}{14}$ (B) $\frac{5}{7}$

(C) $\frac{1}{7}$ (D) $\frac{2}{7}$

4. एक ठोस शंकु जिसकी त्रिज्या 7 cm तथा तिर्यक ऊँचाई 25 cm है, का संपूर्ण पृष्ठीय क्षेत्रफल है :

(A) 724 cm^2 (B) 704 cm^2

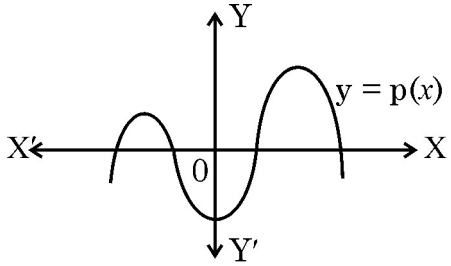
(C) 550 cm^2 (D) 616 cm^2

Section – A

(Multiple Choice Questions) **20 × 1 = 20**

Q. Nos. **1** to **20** are Multiple Choice Questions of **1** mark each.

1. The graph of a polynomial p(x) is shown here. The number of zeroes of the polynomial p(x) is



(A) 5 (B) 1

(C) 0 (D) 4

2. Three coins are tossed together. The probability of getting exactly two tails is

(A) $\frac{2}{8}$ (B) $\frac{1}{2}$

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

3. A bag contains some red and some white balls. A ball is drawn at random from the bag. If the probability of getting a red ball is $\frac{2}{7}$, then the probability of getting a white ball is

(A) $\frac{1}{14}$ (B) $\frac{5}{7}$

(C) $\frac{1}{7}$ (D) $\frac{2}{7}$

4. The total surface area of a solid cone of radius 7 cm and slant height 25 cm, is

(A) 724 cm^2 (B) 704 cm^2

(C) 550 cm^2 (D) 616 cm^2

5. एक पेंडुलम की लम्बाई 70 cm है । घूमने पर यह पेंडुलम 88 cm लम्बाई की चाप बनाता है । चाप द्वारा केन्द्र पर अंतरित कोण की माप है :

(A) 36^o (B) 70^o

(C) 72^o (D) 80^o

6. बिंदुओं (–2, 5) तथा (5, –2) के बीच की दूरी है :

(A) $7\sqrt{2}$ (B) 14

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

7. $17 \times 11 \times 13 + 11$

(A) एक अभाज्य संख्या है । (B) 17 का गुणज है ।

(C) एक भाज्य संख्या है । (D) एक विषम संख्या है ।

8. PQ वृत्त पर स्थित बिंदु P पर खींची गयी एक स्पर्श–रेखा है । PQ के समांतर खींची गयी वृत्त की स्पर्श–रेखाओं की संख्या है :

(A) 2 (B) 1

(C) अनेक (D) शून्य

9. यदि –26, x, 2 समांतर श्रेढ़ी में हैं तो x का मान है :

(A) 14 (B) –13

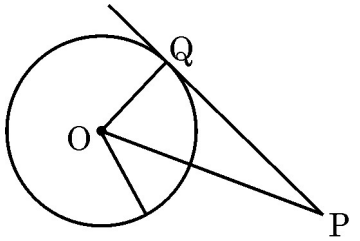
(C) –12 (D) –14

10. द्विघात समीकरण $x^2 + 9 = 0$ के मूल

(A) वास्तविक एवं बराबर हैं । (B) वास्तविक नहीं हैं ।

(C) वास्तविक तथा एक दूसरे के ऋणात्मक हैं । (D) परिमेय संख्याएँ हैं ।

11. PQ केन्द्र O वाले वृत्त पर खींची गयी ऐसी स्पर्श–रेखा है कि OP = 2OQ है । $\angle$OPQ की माप है :



(A) 15^o (B) 60^o

(C) 45^o (D) 30^o

5. The length of a pendulum is 70 cm and it describes an arc of length 88 cm when swings. The angle subtended by the arc at the centre is

(A) 36^o (B) 70^o

(C) 72^o (D) 80^o

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

(A) $7\sqrt{2}$ (B) 14

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

7. $17 \times 11 \times 13 + 11$ is

(A) a prime number. (B) multiple of 17.

(C) a composite number. (D) an odd number.

8. PQ is tangent to a circle at a point P on the circle. The number of tangents which can be drawn to the circle parallel to PQ, is

(A) 2 (B) 1

(C) many (D) zero

9. If –26, x, 2 are in A.P., then the value of x is

(A) 14 (B) –13

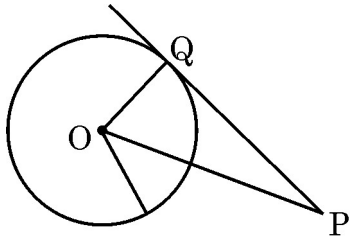
(C) –12 (D) –14

10. The roots of the quadratic equation $x^2 + 9 = 0$ are

(A) real and equal (B) not real

(C) real and negative of each other (D) rational numbers

11. PQ is tangent to the circle with centre O such that OP = 2OQ. m$\angle$OPQ is



(A) 15^o (B) 60^o

(C) 45^o (D) 30^o

12. यदि $\cot\theta$ का मान $\sqrt{5}$ है, तो $\sin\theta$ का मान है :

(A) $\frac{1}{\sqrt{6}}$ (B) $\sqrt{6}$

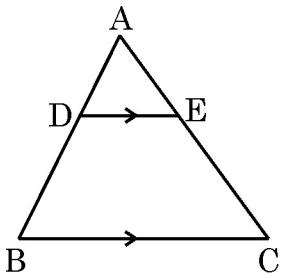
(C) $\frac{\sqrt{5}}{6}$ (D) $\frac{1}{2}$

13. 52 पत्तों की अच्छी प्रकार से फेंटी गयी गड्डी में से एक पत्ता निकाला जाता है । हुकुम (spade) की बेगम निकलने की प्रायिकता है :

(A) $\frac{1}{26}$ (B) $\frac{1}{52}$

(C) 0 (D) $\frac{1}{4}$

14. दी गई आकृति में, त्रिभुज ABC में DE || BC है । यदि AD : AB = 1 : 3 तथा AE = 2.5 cm है, तो AC बराबर है :



(A) 7.5 cm (B) 5 cm

(C) 10 cm (D) 2.5 cm

15. एक A.P. का 14वाँ पद 4 तथा 15वाँ पद शून्य है । इसका प्रथम पद है :

(A) –48 (B) –56

(C) 56 (D) 48

12. If value of cot θ is $\sqrt{5}$, then sin θ equals

(A) $\frac{1}{\sqrt{6}}$ (B) $\sqrt{6}$

(C) $\frac{\sqrt{5}}{6}$ (D) $\frac{1}{2}$

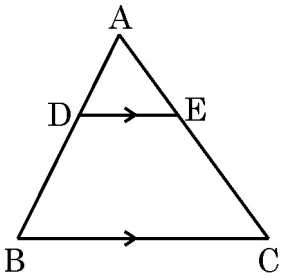
13. A card is drawn from a well-shuffled deck of 52 playing cards. The probability of getting a queen of spade is

(A) $\frac{1}{26}$ (B) $\frac{1}{52}$

(C) 0 (D) $\frac{1}{4}$

14. In the given figure, DE || BC.

If AD : AB = 1 : 3 and AE = 2.5 cm, then AC equals



(A) 7.5 cm (B) 5 cm

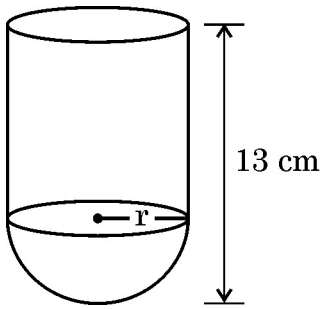
(C) 10 cm (D) 2.5 cm

15. If 14^{th} term of an A.P. is 4 and its 15^{th} term is zero, then its first term is

(A) –48 (B) –56

(C) 56 (D) 48

16. त्रिज्या r वाला एक बेलन समान त्रिज्या वाले अर्धगोले पर अध्यारोपित है । यदि वस्तु की कुल ऊँचाई 13 cm है तो इसका आंतरिक पृष्ठीय क्षेत्रफल है :



(A) $2\pi r(r + 13)$ (B) $13\pi r$

(C) $2\pi(13 + r)^2$ (D) $26\pi r$

17. यदि बहुपद $p(x) = 3x^2 - kx + 6$ के शून्यकों का योग 2 है, तो k का मान है :

(A) 2 (B) –6

(C) –2 (D) 6

18. निम्न में से कौन सा कथन हमेशा सत्य नहीं है ?

(A) दो वृत्त समरूप होते हैं ।

(B) दो समद्विबाहु समकोण त्रिभुज समरूप होते हैं ।

(C) दो आयत समरूप होते हैं ।

(D) दो समबाहु त्रिभुज समरूप होते हैं ।

(अभिकथन – तर्क आधारित प्रश्न)

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

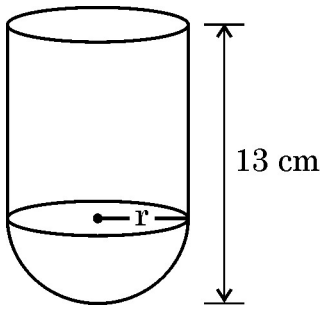
(A) दोनों, अभिकथन (A) तथा तर्क (R) सही हैं । तर्क (R), अभिकथन (A) की सही व्याख्या करता है ।

(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 ।

16. A cylinder of radius r is surmounted on a hemisphere of same radius. If total height of the object is 13 cm, then its inner surface area is



(A) $2\pi r(r + 13)$ (B) $13\pi r$

(C) $2\pi(13 + r)^2$ (D) $26\pi r$

17. The value of k for which sum of the zeroes of the polynomial $p(x) = 3x^2 - kx + 6$ is 2, is

(A) 2 (B) –6

(C) –2 (D) 6

18. Which of the following statements is not always true ?

(A) Two circles are similar.

(B) Two isosceles right triangles are similar.

(C) Two rectangles are similar.

(D) Two equilateral triangles are similar.

(Assertion – Reason based questions)

Directions : In Q. No. **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 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. **अभिकथन (A) :** न्यून कोण θ के लिये $\cos\theta$ का मान हमेशा 1 से कम होता है ।

तर्क (R) : एक समकोण त्रिभुज में कर्ण सबसे लम्बी भुजा होती है तथा $\cos\theta = \frac{\text{आधार}}{\text{कर्ण}}$ ।

20. **अभिकथन (A) :** दिये गये आँकड़ों में माध्यक $\frac{N}{2}$ का मान होता है, जहाँ N सभी आवृत्तियों का योग है ।

तर्क (R) : माध्यक का मान समस्त वितरण को दो बराबर भागों में बाँटता है ।

खण्ड – ख

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

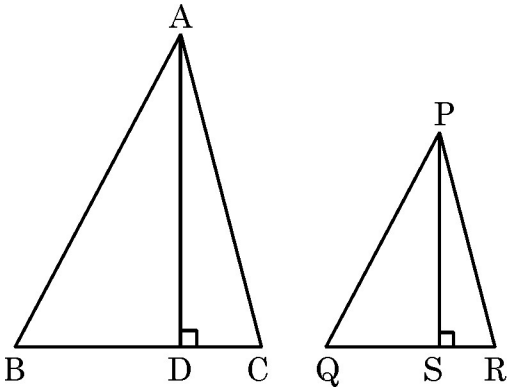
प्रश्न संख्या **21** से **25** तक अति लघु–उत्तरीय प्रकार के प्रश्न हैं । प्रत्येक प्रश्न के **2** अंक हैं ।

21. (a) दी गयी संख्यायों 30, 31, 32, 33, ..., 60 में से यादृच्छया एक संख्या चुनी जाती है । इसकी क्या प्रायिकता है कि चुनी गयी संख्या (i) एक अभाज्य संख्या है (ii) 6 का गुणज है ?

अथवा

(b) शब्द 'BACKGROUND' के अक्षरों वाली पर्चियों को एक कटोरे में डालकर अच्छी प्रकार मिला दिया जाता है । एक पर्ची यादृच्छया उठाई जाती है । इसकी क्या प्रायिकता है कि उठाई गई पर्ची का अक्षर (i) एक स्वर है (ii) शब्द 'BALL' में भी उपस्थित है ?

22. दी गयी आकृति में दो त्रिभुज ΔABC तथा ΔPQR दर्शाये गये हैं ताकि $\angle A = \angle P$ तथा $\angle C = \angle R$ है । यदि $AD \perp BC$ तथा $PS \perp QR$ है तो सिद्ध कीजिए कि (i) $\Delta ADB \sim \Delta PSQ$ (ii) $AD \times QS = BD \times PS$



23. 408 तथा 312 का H.C.F. तथा L.C.M. ज्ञात कीजिए ।

19. **Assertion (A) :** For an acute angle θ, cos θ is always less than 1.

Reason (R) : In a right-angled triangle, hypotenuse is the longest side and $\cos\theta = \frac{\text{Base}}{\text{Hypotenuse}}$.

20. **Assertion (A) :** Median of a data is the value of $\frac{N}{2}$, where N represents sum of all frequencies.

Reason (R) : Median divides the whole distribution in two equal parts.

Section – B

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

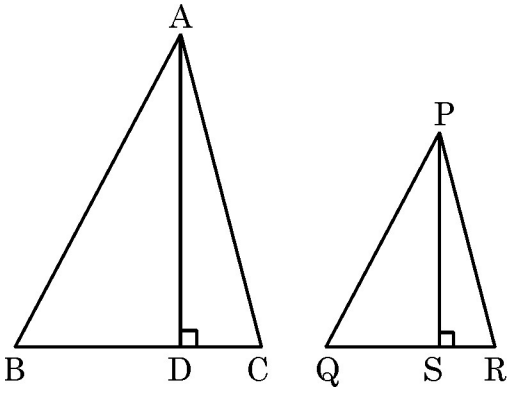
Q. Nos. **21** to **25** are Very Short Answer type questions of **2** marks each.

21. (a) Find the probability that a number selected at random from the numbers 30, 31, 32, 33, ..., 60 is (i) a prime number (ii) a multiple of 6.

OR

(b) Slips of letters of the word 'BACKGROUND' are put in a bowl and thoroughly mixed. One slip is picked up at random. Find the probability that picked up slip's letter is (i) a vowel (ii) present in the word 'BALL'.

22. In the given figure, two triangles ABC and PQR are shown such that ∠A = ∠P and ∠C = ∠R. If AD ⊥ BC and PS ⊥ QR, then prove that (i) ΔADB ~ ΔPSQ (ii) AD × QS = BD × PS.



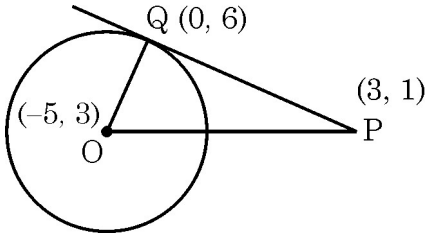
23. Find the H.C.F. and L.C.M. of 408 and 312.

24. (a) यदि $\sec A = \sqrt{2}$ तथा $\tan B = \sqrt{3}$ है तो $2 \sin A \cos B$ का मान ज्ञात कीजिए ।

अथवा

(b) मान ज्ञात कीजिए : $\frac{4\cos^3 60^\circ + \text{cosec } 30^\circ}{\tan^2 30^\circ}$

25. दी गयी आकृति में, केन्द्र O(–5, 3) वाले वृत्त पर स्पर्श–रेखा PQ खींची गयी है । यदि P तथा Q के निर्देशांक क्रमशः (3, 1) तथा (0, 6) हैं तो दूरी सूत्र का प्रयोग करते हुये दर्शाइये कि $PQ \perp OQ$ है ।



खण्ड – ग

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

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

26. (a) यदि α तथा β दिये गये बहुपद $p(x) = 5x^2 - 7x - 3$ के शून्यक हैं, तो एक ऐसा द्विघात बहुपद बनाइये जिसके शून्यक $\frac{2}{\alpha}$ तथा $\frac{2}{\beta}$ हैं ।

अथवा

(b) बहुपद $p(x) = 3x^2 + 7x - 20$ के शून्यक ज्ञात कीजिए तथा शून्यकों एवं गुणांकों के बीच के संबंध की सत्यता की जाँच कीजिए ।

27. (a) एक A.P. का चौथा तथा दसवाँ पद क्रमशः 13 और 25 है । इसका 24वाँ पद ज्ञात कीजिए ।

अथवा

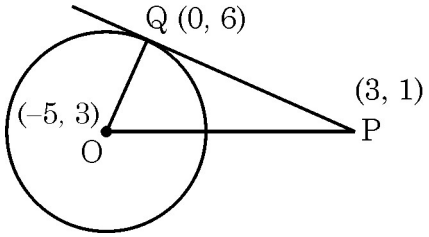
(b) 232 से लेकर 540 तक की संख्याओं में 3 के गुणजों की संख्या ज्ञात कीजिए ।

24. (a) If sec A = $\sqrt{2}$ and tan B = $\sqrt{3}$, then find the value of 2 sin A cos B.

OR

(b) Evaluate : $\dfrac{4\cos^3 60^\circ + \text{cosec } 30^\circ}{\tan^2 30^\circ}$

25. In the given figure, PQ is a tangent to a circle with centre O(–5, 3). If coordinates of P and Q are (3, 1) and (0, 6) respectively, then using distance formula, show that PQ ⊥ OQ.



Section – C

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

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

26. (a) If α, β are zeroes of the polynomial $p(x) = 5x^2 - 7x - 3$, then form a quadratic polynomial whose zeroes are $\dfrac{2}{\alpha}$ and $\dfrac{2}{\beta}$.

OR

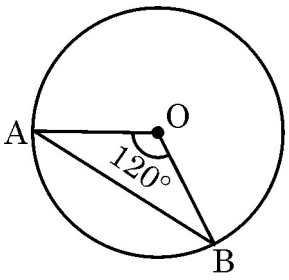
(b) Find the zeroes of the polynomial $p(x) = 3x^2 + 7x - 20$ and verify the relationship between its zeroes and the coefficients.

27. (a) The 4^{th} and 10^{th} term of an A.P. are 13 and 25 respectively. Find its 24^{th} term.

OR

(b) From 232 to 540, find the number of multiples of 3.

28. वृत्त की जीवा AB, केन्द्र O पर 120° का कोण अंतरित करती है । यदि वृत्त की त्रिज्या 21 cm है तो चाप AB की लम्बाई ज्ञात कीजिए ।



29. वह अनुपात ज्ञात कीजिए जिसमें बिंदुओं (1, 3) तथा (2, 5) को मिलाने वाला रेखाखंड, रेखा $2x + y = 6$ से विभाजित होता है ।

30. सिद्ध कीजिए कि $\sqrt{2}$ एक अपरिमेय संख्या है ।

31. सिद्ध कीजिए : $\sqrt{\frac{1-\cos A}{1+\cos A}} = \frac{\tan A}{\sec A + 1}$

खण्ड – घ

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

प्रश्न संख्या **32** से **35** तक दीर्घ–उत्तरीय प्रकार के प्रश्न हैं । प्रत्येक प्रश्न **5** अंकों का है ।

32. निम्नलिखित आँकड़ों का माध्य 19 तथा बारम्बारताओं का योग 40 है । लुप्त बारम्बारता p तथा q के मान ज्ञात कीजिए :

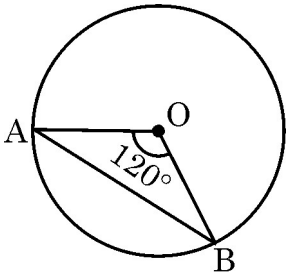
वर्ग	0-5	5-10	10-15	15-20	20-25	25-30	30-35
बारम्बारता	2	5	6	p	10	q	4

33. (a) ABCD एक आयत है जिसकी विमायें 80 cm × 60 cm हैं । PQRS एक अन्य आयत है जो आयत ABCD के अंदर भुजाओं से x cm की समान दूरी बनाते हुये खींचा गया है । यदि PQRS का क्षेत्रफल आयत ABCD के क्षेत्रफल का आधा है, तो x का मान ज्ञात कीजिए ।

अथवा

(b) एक रेलगाड़ी एकसमान चाल से 90 km की दूरी तय करती है । यदि यह चाल 15 km/h अधिक होती तो वह उसी यात्रा में 30 मिनट कम समय लेती । रेलगाड़ी की मूल चाल ज्ञात कीजिए ।

28. Chord AB of a circle subtends an angle of 120° at the centre O of the circle. Find the length of arc AB, if radius of the circle is 21 cm.



29. Determine the ratio in which the line $2x + y = 6$ divides the line segment joining the points (1, 3) and (2, 5).

30. Prove that $\sqrt{2}$ is an irrational number.

31. Prove that : $\sqrt{\frac{1-\cos A}{1+\cos A}} = \frac{\tan A}{\sec A + 1}$.

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 the missing frequencies p and q in the following frequency distribution, when sum of frequencies is 40 and mean is 19 :

Class	0-5	5-10	10-15	15-20	20-25	25-30	30-35
Frequency	2	5	6	p	10	q	4

33. (a) ABCD is a rectangle of dimensions 80 cm × 60 cm. Another rectangle PQRS is drawn inside ABCD leaving space of equal width x cm along the edges of ABCD. If area PQRS is half of the area ABCD, then find the value of x.

OR

(b) A train covers a distance of 90 km at a uniform speed. Had the speed been 15 km/h more, it would have taken 30 minutes less for the same journey. Find the original speed of the train.

34. एक 80 m चौड़ी सड़क के दोनों ओर आमने-सामने समान लम्बाई वाले दो खंभे लगे हुये हैं । इन दोनों खंभों के बीच सड़क के एक बिंदु से खंभों के शिखर के उन्नयन कोण क्रमशः 60^o तथा 30^o हैं । खंभों की ऊँचाई और खंभों से बिंदु की दूरी ज्ञात कीजिए ।

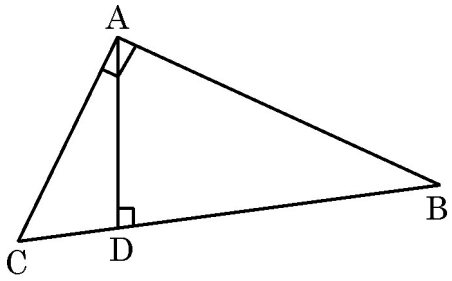
35. (a) दी गयी आकृति में, ΔABC एक समकोण त्रिभुज है जहाँ $\angle A = 90^o$ है । AD कर्ण BC पर खींचा गया लम्ब है ।

सिद्ध कीजिए कि :

(i) $\Delta DBA \sim \Delta DAC$

(ii) $DA^2 = DB \times DC$

(iii) यदि DB = 9 cm तथा DC = 16 cm है, तो ΔABC का क्षेत्रफल ज्ञात कीजिए ।



अथवा

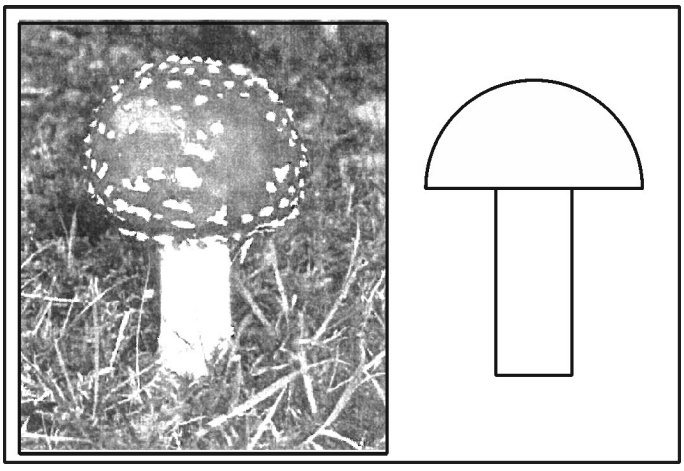
(b) यदि किसी त्रिभुज की एक भुजा के समांतर अन्य दो भुजाओं को भिन्न-भिन्न बिंदुओं पर प्रतिच्छेद करने के लिये एक रेखा खींची जाये तो सिद्ध कीजिए कि अन्य दो भुजायें एक ही अनुपात में विभाजित हो जाती हैं ।

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.



34. Two poles of equal heights are standing opposite each other on either side of the road, which is 80 m wide. From a point between them on the road, the angles of elevation of the top of the poles are 60^o and 30^o respectively. Find the height of the poles and the distance of the point from the poles.

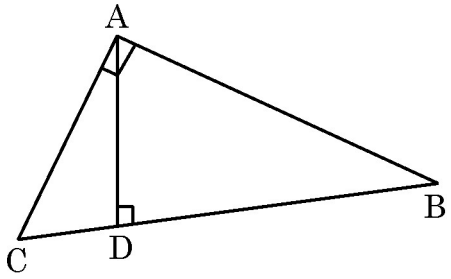
35. (a) In the given figure, ΔABC is right angled triangle with $\angle A = 90^o$. AD is perpendicular to BC.

Prove that :

(i) $\Delta DBA \sim \Delta DAC$

(ii) $DA^2 = DB \times DC$

(iii) Find the area of ΔABC when DB = 9 cm and DC = 16 cm.



OR

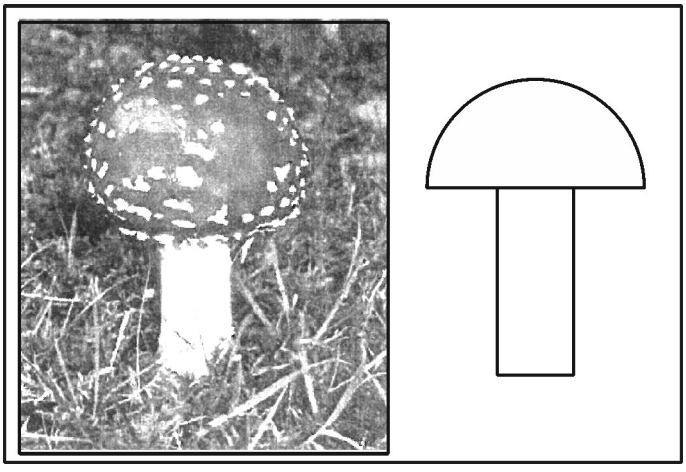
(b) If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, then prove that the other two sides are divided in the same ratio.

Section – E

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

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

36.



दुनियाभर में अलग-अलग प्रकार की मशरूम पायी जाती हैं । 'Amanita muscaria' एक ऐसी मशरूम है जिसका ऊपरी हिस्सा लाल रंग की अर्धगोलाकार टोपी की तरह है तथा निचला हिस्सा सफेद तने (बेलनाकार) के जैसा है ।

यदि अर्धगोलाकार टोपी की त्रिज्या = 3 cm तथा बेलनाकार तने का व्यास 1.4 cm और ऊँचाई 2 cm है, तो मशरूम को एक ठोस वस्तु मानते हुये निम्न प्रश्नों के उत्तर दीजिए :

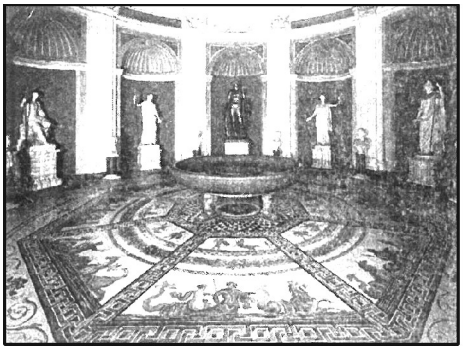
(i) मशरूम की कुल ऊँचाई कितनी है ?

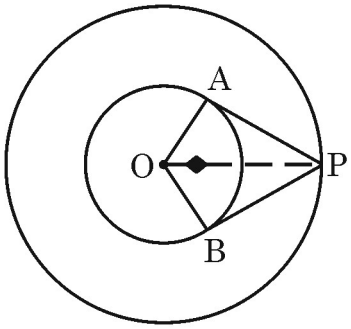
(ii) तने का आयतन ज्ञात कीजिए ।

(iii) (a) ऐसे 7 मशरूमों का आयतन ज्ञात कीजिए ।

अथवा

(b) ऐसे 7 मशरूमों का सम्पूर्ण पृष्ठीय क्षेत्रफल ज्ञात कीजिए ।

37. 



एक संग्रहालय के 14 m त्रिज्या वाले एक गोलाकार कमरे में कुछ मूर्तियाँ रखी गयी हैं । मूर्तियों को 7 m त्रिज्या वाले एक संकेन्द्रीय वृत्त के अंदर के क्षेत्र में रखा है । ऐसी ही एक मूर्ति त्रिज्यखंड OAB के अन्दर स्थित है । इस मूर्ति को रेखाखंड OA, AP, PB, BO के द्वारा बाड़ बनाकर सुरक्षित किया गया है, यहाँ बिन्दु P बाहरी वृत्त पर स्थित है ।

उपरोक्त सूचना के आधार पर निम्न प्रश्नों के उत्तर दीजिए :

(i) $\angle AOP$ का मान बताइए । **1**

(ii) सिद्ध कीजिए कि $\Delta OAP \cong \Delta OBP$ है । **1**

(iii) (a) मूर्ति की सुरक्षा हेतु लगायी गयी बाड़ की लम्बाई बताइए । ($\sqrt{3} = 1.73$ लीजिये) **2**

अथवा

(b) चतुर्भुज OAPB का क्षेत्रफल ज्ञात कीजिए । ($\sqrt{3} = 1.73$ लीजिये)

There are many varieties of mushrooms available in the world. One such mushroom 'Amanita muscaria' has a upper part which is like red cap (hemispherical) and lower part is like white stem (cylinderical).

The hemispherical cap's radius = 3 cm and cylindrical stem is 2 cm high with diameter 1.4 cm. Considering mushroom a solid object, answer the following questions :

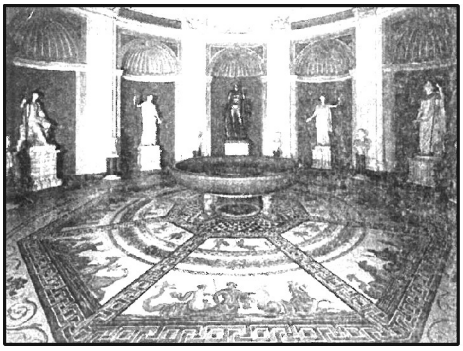
(i) What is the total height of a mushroom ?

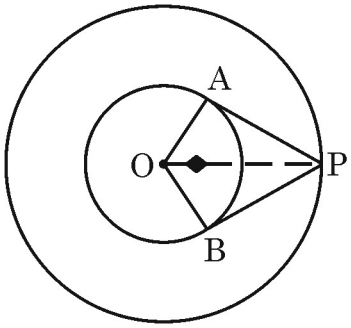
(ii) Find the volume of the stem.

(iii) (a) Determine the volume of 7 such mushrooms.

OR

(b) Find the total surface area of 7 such mushrooms.

37. 



In a circular museum hall of radius 14 m, some statues are displayed. Statues are kept inside the inner concentric circle of radius 7 m. One such statue lying in sector OAB, is fenced along line segments OA, AP, PB and BO where P is a point on outer circle.

Based on above information, answer the following questions :

(i) Find m$\angle$AOP. **1**

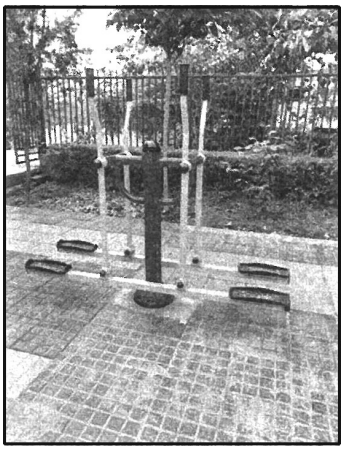
(ii) Prove that $\Delta OAP \cong \Delta OBP$. **1**

(iii) (a) Find the length of fencing required to protect the statue.

(Take $\sqrt{3} = 1.73$) **2**

OR

(b) Find area of quadrilateral OAPB. (Take $\sqrt{3} = 1.73$)

38. 

सीमा प्रतिदिन पार्क में लगी मशीनों पर व्यायाम करने जाती है । जब उसने व्यायाम साइकिल पर 15 मिनट तथा वॉकर (Double Cross Walker) पर 30 मिनट लगाये तो उसे अपनी फिटनेस घड़ी पर 435 कैलोरी खर्च होने का संदेश मिला । जब सीमा ने व्यायाम साइकिल पर 30 मिनट तथा वॉकर पर 40 मिनट लगाये तो उसे 690 कैलोरी खर्च होने का संदेश मिला ।

दोनों मशीनों पर प्रत्येक मिनट खर्च होने वाली कैलोरी की संख्या जानने के लिये निम्न के उत्तर दीजिए :

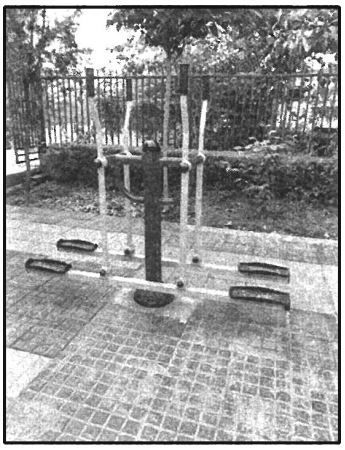
(i) उपरोक्त परिस्थिति को दो चर वाले रैखिक समीकरण युग्म के रूप में प्रस्तुत कीजिए ।

(ii) दर्शाइये कि समीकरणों का अद्वितीय हल है ।

(iii) (a) विलोपन विधि द्वारा दोनों समीकरणों को हल कीजिए तथा चरों के मान ज्ञात कीजिए ।

अथवा

(b) प्रतिस्थापन विधि का प्रयोग करते हुये दोनों समीकरणों को हल कीजिए तथा चरों के मान ज्ञात कीजिए ।

38. 

Seema daily goes to a park to exercise on machines available there. When Seema spent 15 minutes on exercise bicycle and 30 minutes on double cross walker, she received a message of burning 435 calories on her fitness watch. When she spent 30 minutes on exercise bicycle and 40 minutes on double cross walker, she received a message of burning 690 calories.

To find the number of calories burned per minute on each machine, answer the following :

(i) Represent the above situation in terms of a pair of linear equations in two variables.

(ii) Show that the equations have unique solution.

(iii) (a) Solve both equations to find the values of the variables using elimination method.

OR

(b) Solve both equations to find the values of the variables using substitution method.



Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2026 (X^{th})
SUBJECT NAME : MATHEMATICS BASIC (Q.P. CODE 430/5/3)

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. 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 totaled and written in figures and words.
18	The candidates are entitled to obtain photocopy of the Answer Book on request on payment of the prescribed processing fee. All Examiners/Additional Head Examiners/Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme.

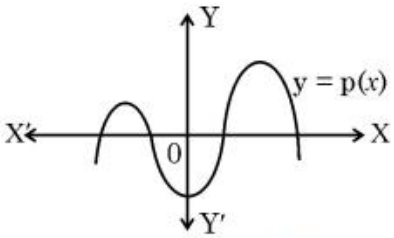
MARKING SCHEME
MATHEMATICS (BASIC)

Section – A

(Multiple Choice Questions) **20 × 1 = 20**

Q. Nos. **1** to **20** are Multiple Choice Questions of **1** mark each.

1. The graph of a polynomial p(x) is shown here. The number of zeroes of the polynomial p(x) is



(A) 5 (B) 1

(C) 0 (D) 4

Answer	(D) 4	1

2. Three coins are tossed together. The probability of getting exactly two tails is

(A) $\frac{2}{8}$ (B) $\frac{1}{2}$

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

Answer	(C) $\frac{3}{8}$	1

3. A bag contains some red and some white balls. A ball is drawn at random from the bag. If the probability of getting a red ball is $\frac{2}{7}$, then the probability of getting a white ball is

(A) $\frac{1}{14}$ (B) $\frac{5}{7}$

(C) $\frac{1}{7}$ (D) $\frac{2}{7}$

Answer	(B) $\frac{5}{7}$	1

4. The total surface area of a solid cone of radius 7 cm and slant height 25 cm, is

(A) 724 cm^2 (B) 704 cm^2

(C) 550 cm^2 (D) 616 cm^2

Answer	(B) 704 cm^2	1

5. The length of a pendulum is 70 cm and it describes an arc of length 88 cm when swings. The angle subtended by the arc at the centre is

(A) 36° (B) 70°

(C) 72° (D) 80°

Answer	(C) 72°	1

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

(A) $7\sqrt{2}$ (B) 14

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

Answer	(A) $7\sqrt{2}$	1

7. $17 \times 11 \times 13 + 11$ is

(A) a prime number. (B) multiple of 17.

(C) a composite number. (D) an odd number.

Answer	(C) a composite number.	1

8. PQ is tangent to a circle at a point P on the circle. The number of tangents which can be drawn to the circle parallel to PQ, is

(A) 2 (B) 1

(C) many (D) zero

Answer	(B) 1	1

9. If –26, x, 2 are in A.P., then the value of x is

(A) 14 (B) –13

(C) –12 (D) –14

Answer	(C) –12	1

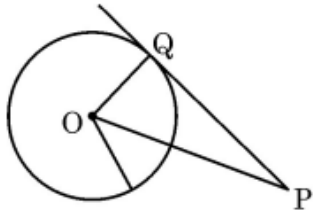
10. The roots of the quadratic equation $x^2 + 9 = 0$ are

(A) real and equal (B) not real

(C) real and negative of each other (D) rational numbers

Answer	(B) not real	1

11. PQ is tangent to the circle with centre O such that OP = 2OQ. m∠OPQ is



(A) 15° (B) 60°

(C) 45° (D) 30°

Answer	(D) 30°	1

12. If value of cot θ is $\sqrt{5}$, then sin θ equals

(A) $\frac{1}{\sqrt{6}}$ (B) $\sqrt{6}$

(C) $\frac{\sqrt{5}}{6}$ (D) $\frac{1}{2}$

Answer	(A) $\frac{1}{\sqrt{6}}$	1

13. A card is drawn from a well-shuffled deck of 52 playing cards. The probability of getting a queen of spade is

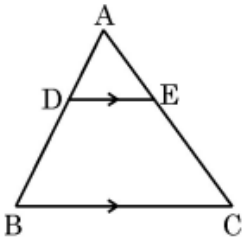
(A) $\frac{1}{26}$ (B) $\frac{1}{52}$

(C) 0 (D) $\frac{1}{4}$

Answer	(B) $\frac{1}{52}$	1

14. In the given figure, DE || BC.

If AD : AB = 1 : 3 and AE = 2.5 cm, then AC equals



(A) 7.5 cm (B) 5 cm

(C) 10 cm (D) 2.5 cm

Answer	(A) 7.5 cm	1

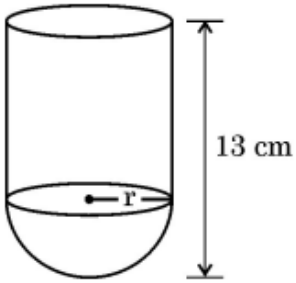
15. If 14^{th} term of an A.P. is 4 and its 15^{th} term is zero, then its first term is

(A) –48 (B) –56

(C) 56 (D) 48

Answer	(C) 56	1

16. A cylinder of radius r is surmounted on a hemisphere of same radius. If total height of the object is 13 cm, then its inner surface area is



(A) $2\pi r(r + 13)$ (B) $13\pi r$

(C) $2\pi(13 + r)^2$ (D) $26\pi r$

Answer	(D) $26\pi r$	1

17. The value of k for which sum of the zeroes of the polynomial $p(x) = 3x^2 - kx + 6$ is 2, is

(A) 2 (B) –6

(C) –2 (D) 6

Answer	(D) 6	1

18. Which of the following statements is not always true ?

(A) Two circles are similar.

(B) Two isosceles right triangles are similar.

(C) Two rectangles are similar.

(D) Two equilateral triangles are similar.

Answer	(C) Two rectangles are similar.	1

(Assertion – Reason based questions)

Directions : In Q. No. **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 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) :** For an acute angle θ, cos θ is always less than 1.

Reason (R) : In a right-angled triangle, hypotenuse is the longest side and $\cos\theta = \frac{\text{Base}}{\text{Hypotenuse}}$.

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

20. **Assertion (A) :** Median of a data is the value of $\frac{N}{2}$, where N represents sum of all frequencies.

Reason (R) : Median divides the whole distribution in two equal parts.

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

Section – B

(Very Short Answer Type Questions) **$5 \times 2 = 10$**

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

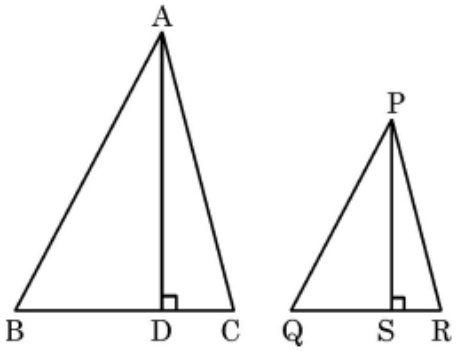
21. (a) Find the probability that a number selected at random from the numbers 30, 31, 32, 33, ..., 60 is (i) a prime number (ii) a multiple of 6.

OR

(b) Slips of letters of the word 'BACKGROUND' are put in a bowl and thoroughly mixed. One slip is picked up at random. Find the probability that picked up slip's letter is (i) a vowel (ii) present in the word 'BALL'.

Solution:(a) (i) Prime numbers are 31, 37, 41, 43, 47, 53, 59 P (a prime number) = $\frac{7}{31}$	1
(ii) Multiples of 6 are 30, 36, 42, 48, 54, 60 P (a multiple of 6) $= \frac{6}{31}$	1
OR	
(b) (i) P (a vowel) $= \frac{3}{10}$	1
(ii) P (present in the word 'BALL') $= \frac{2}{10}$ or $\frac{1}{5}$	1

22. In the given figure, two triangles ABC and PQR are shown such that $\angle A = \angle P$ and $\angle C = \angle R$. If AD $\perp$ BC and PS $\perp$ QR, then prove that (i) $\Delta ADB \sim \Delta PSQ$ (ii) $AD \times QS = BD \times PS$.



Solution : (i) $\angle A = \angle P, \angle C = \angle R \Rightarrow \angle B = \angle Q$	½
$\angle ADB = \angle PSQ = 90°$	½
$\therefore$ $\Delta ADB \sim \Delta PSQ$ (by AA similarity)	
(ii) As $\Delta ADB \sim \Delta PSQ$, $\therefore \frac{AD}{PS} = \frac{BD}{QS}$	½
Hence, $AD \times QS = BD \times PS$	½

23. Find the H.C.F. and L.C.M. of 408 and 312.

Solution $408 = 2^3 \times 3 \times 17$	½
$312 = 2^3 \times 3 \times 13$	½
HCF = 24	½
LCM =5304	½

24. (a) If $\sec A = \sqrt{2}$ and $\tan B = \sqrt{3}$, then find the value of $2 \sin A \cos B$.

OR

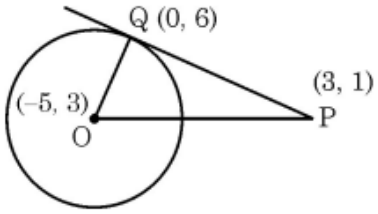
(b) Evaluate : $\frac{4\cos^3 60° + \operatorname{cosec} 30°}{\tan^2 30°}$

Solution: (a) $\sec A = \sqrt{2} \Rightarrow A = 45°$, $\tan B = \sqrt{3} \Rightarrow B = 60°$	½ + ½
$2 \sin A \cos B = 2 \sin 45° \cos 60° = 2 \times \frac{1}{\sqrt{2}} \times \frac{1}{2} = \frac{1}{\sqrt{2}}$ or $\frac{\sqrt{2}}{2}$	1
OR	

(b) $\frac{4\cos^3 60° + \operatorname{cosec} 30°}{\tan^2 30°} = \frac{4\times\left(\frac{1}{2}\right)^3 + 2}{\left(\frac{1}{\sqrt{3}}\right)^2}$ 1½

$= \frac{15}{2}$ ½

25. In the given figure, PQ is a tangent to a circle with centre O(–5, 3). If coordinates of P and Q are (3, 1) and (0, 6) respectively, then using distance formula, show that PQ ⊥ OQ.



Solution:

$PQ^2 = 3^2 + (-5)^2 = 34$ ½

$OP^2 = (-8)^2 + 2^2 = 68$ ½

$OQ^2 = (-5)^2 + (-3)^2 = 34$ ½

$OP^2 = PQ^2 + OQ^2 \Rightarrow PQ \perp OP$ ½

Section – C

(Short Answer Type Questions) $6 \times 3 = 18$

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

26. (a) If α, β are zeroes of the polynomial $p(x) = 5x^2 - 7x - 3$, then form a quadratic polynomial whose zeroes are $\frac{2}{\alpha}$ and $\frac{2}{\beta}$.

OR

(b) Find the zeroes of the polynomial $p(x) = 3x^2 + 7x - 20$ and verify the relationship between its zeroes and the coefficients.

Solution: (a) $\alpha + \beta = \frac{7}{5}$, $\alpha\beta = -\frac{3}{5}$ ½ + ½

Sum of zeroes of required polynomial $= \frac{2}{\alpha} + \frac{2}{\beta} = \frac{-14}{3}$ ½

Product of zeroes of the required polynomial $= \frac{2}{\alpha} \times \frac{2}{\beta} = \frac{-20}{3}$ ½

Required polynomial is

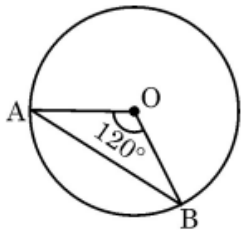
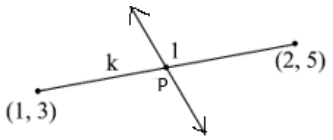
$x^2 + \frac{14}{3}x - \frac{20}{3}$ *or* $k(3x^2 + 14x - 20)$ where k is any non-zero real number. 1

OR

(b) $p(x) = 3x^2 + 7x - 20$

Zeroes are $-4, \frac{5}{3}$ 1

Sum of the zeroes $= -4 + \frac{5}{3} = \frac{-7}{3} = -\frac{\text{coefficient of } x}{\text{coefficient of } x^2}$ 1

Product of zeroes $= -4 \times \frac{5}{3} = \frac{-20}{3} = \frac{\text{constant term}}{\text{coefficient of } x^2}$	1
27. (a) The 4th and 10th term of an A.P. are 13 and 25 respectively. Find its 24th term. **OR** (b) From 232 to 540, find the number of multiples of 3.	
Solution: (a) $a + 3d = 13$ --------- (i) $a + 9d = 25$ --------- (ii) solving (i) & (ii) to get $d = 2$, $a = 7$ therefore $a_{24} = 53$ **OR** (b) Multiples of 3 from 232 to 540 are 234, 237, 240, …… 540 This forms an AP with $a=234, d=3$ $540 = 234 + (n - 1)3$ $\Rightarrow \quad n = 103$	½ ½ 1 1 1 1 1
28. Chord AB of a circle subtends an angle of 120° at the centre O of the circle. Find the length of arc AB, if radius of the circle is 21 cm.  	
Solution: Length of arc AB $= \frac{120}{360} \times 2 \times \frac{22}{7} \times 21$ $= 44$ cm	2 1
29. Determine the ratio in which the line $2x + y = 6$ divides the line segment joining the points (1, 3) and (2, 5).	
Solution:  Let the line divides the line segment in the ratio k : 1 at P $\therefore$ Coordinates of P are $\left(\frac{2k+1}{k+1}, \frac{5k+3}{k+1}\right)$ P lies on $2x + y = 6$ $\Rightarrow \quad 2(2k + 1) + (5k + 3) = 6(k + 1)$ $\Rightarrow \quad k = \frac{1}{3}$ Required ratio is 1 : 3	½ 1 ½ 1

30. Prove that $\sqrt{2}$ is an irrational number.

Solution:

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

$\sqrt{2}b = a$
$2b^2 = a^2$
2 divides a^2
2 divides a as well — 1

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

$\therefore$ 2 is a common factor of a and b which is a contradiction as a and b are coprime numbers. — ½

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

31. Prove that : $\sqrt{\frac{1-\cos A}{1+\cos A}} = \frac{\tan A}{\sec A + 1}$.

Solution: LHS $= \sqrt{\frac{1-\frac{1}{\sec A}}{1+\frac{1}{\sec A}}}$ — 1

$= \sqrt{\frac{\sec A - 1}{\sec A + 1} \times \frac{\sec A + 1}{\sec A + 1}}$ — 1

$= \sqrt{\frac{sec^2 A - 1}{(\sec A + 1)^2}} = \frac{\tan A}{\sec A + 1}$ = RHS — 1

Section – D

(Long Answer Type Questions) $4 \times 5 = 20$

32. Find the missing frequencies p and q in the following frequency distribution, when sum of frequencies is 40 and mean is 19 :

Class	0-5	5-10	10-15	15-20	20-25	25-30	30-35
Frequency	2	5	6	p	10	q	4

Solution:

Class Interval	x_i	f_i	u_i	$f_i u_i$
0-5	2.5	2	– 3	– 6
5-10	7.5	5	– 2	– 10
10-15	12.5	6	– 1	– 6
15-20	17.5	p	0	0
20-25	22.5	10	1	10
25-30	27.5	q	2	2q
30-35	32.5	4	3	12
		27+p+q		2q

Here assumed mean = 17.5

Correct table 2

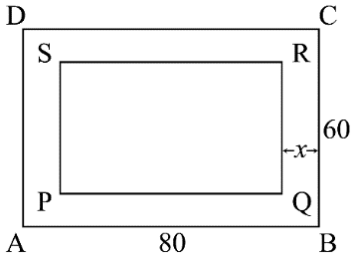
$N = 40 \quad \Rightarrow \quad p + q = 13$	1
$19 = 17.5 + 5 \times \frac{2q}{40}$	1
$\Rightarrow \quad q = 6$ and $p = 7$	½+½

33. (a) ABCD is a rectangle of dimensions 80 cm × 60 cm. Another rectangle PQRS is drawn inside ABCD leaving space of equal width x cm along the edges of ABCD. If area PQRS is half of the area ABCD, then find the value of x.

OR

(b) A train covers a distance of 90 km at a uniform speed. Had the speed been 15 km/h more, it would have taken 30 minutes less for the same journey. Find the original speed of the train.

Solution:



(a) $PQ = (80 - 2x)\ cm, \ QR = (60 - 2x)\ cm$ — 2

Area PQRS $= \frac{1}{2}$ Area ABCD

$2 \times (80 - 2x)(60 - 2x) = 80 \times 60$ — 1

$4x^2 - 280x + 2400 = 0$ or $x^2 - 70x + 600 = 0$ — 1

$x = 10, 60$ (rejected) — 1

$\therefore \ x = 10\ cm$

OR

(b) Let the original speed of train be $x\ km/hr$.

According to the Question, $\frac{90}{x} - \frac{90}{x+15} = \frac{30}{60}$ — 2

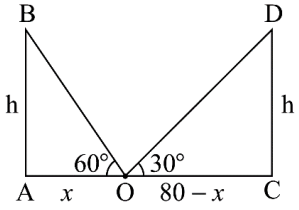
$\Rightarrow \ x^2 + 15x - 2700 = 0$ — 2

$\Rightarrow \ x = 45, -60$ (rejected) — 1

$\therefore$ The original speed of the train $= 45\ km/hr$

34. Two poles of equal heights are standing opposite each other on either side of the road, which is 80 m wide. From a point between them on the road, the angles of elevation of the top of the poles are 60° and 30° respectively. Find the height of the poles and the distance of the point from the poles.

Solution:



correct figure — 1

Let AB and CD be the poles of height $h\ m$ and O is the observation point.

In ΔDCO, $\tan 30° = \frac{h}{80-x}$ — 1

$\Rightarrow \quad 80 - x = h\sqrt{3}$ _____(i) — ½

In ΔBAO, $\tan 60° = \frac{h}{x}$ — 1

$\Rightarrow$ $h = x\sqrt{3}$ _____(ii)

Using (i) and (ii) we get $x = 20$, i.e., AO = 20 m and $h = 20\sqrt{3}$ m. — ½+½

$\therefore$ CO = 60 m. — ½

$\therefore$ The height of the pole is $20\sqrt{3}$ m and the distance of the point from the poles is 20 m and 60 m

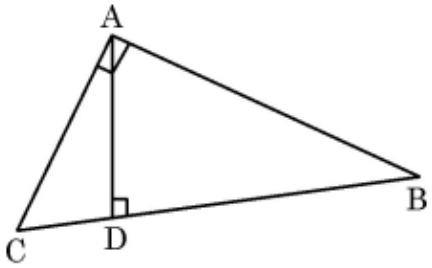
35. (a) In the given figure, ΔABC is right angled triangle with $\angle A = 90°$. AD is perpendicular to BC.

Prove that :

(i) $\Delta DBA \sim \Delta DAC$

(ii) $DA^2 = DB \times DC$

(iii) Find the area of ΔABC when DB = 9 cm and DC = 16 cm.



OR

(b) If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, then prove that the other two sides are divided in the same ratio.

Solution: (a) (i) In Δ DBA and Δ DAC

$\angle BDA = \angle CDA = 90°$ — 1

$\angle BAD = 90° - \angle B = \angle ACB$ — 1

Δ DBA ~ Δ DAC (by AA similarity)

(ii) As Δ DBA ~ Δ DAC $\therefore \frac{DA}{DC} = \frac{DB}{DA}$ — 1

$\Rightarrow$ $DA^2 = DC \times DB$

(iii) taking DC = 16 cm and DB = 9 cm, $DA^2 = 9 \times 16$

$\Rightarrow$ DA = 12 cm — 1

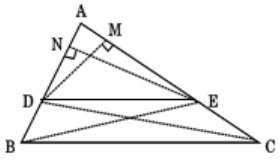
Area $\Delta ABC = \frac{1}{2} \times 25 \times 12 = 150$ cm^2 — 1

OR

(b) Correct Given, To Prove, Construction, Figure — 4 × ½ = 2

Given: In Δ ABC, DE $\parallel$ BC intersecting AB at D and AC at E.

To Prove: $\frac{AD}{DB} = \frac{AE}{EC}$



Construction: Draw DM $\perp$ AC, EN $\perp$ AB, join BE and CD

Proof : $\frac{ar(\Delta ADE)}{ar(\Delta DBE)} = \frac{\frac{1}{2} \times AD \times EN}{\frac{1}{2} \times DB \times EN} = \frac{AD}{DB}$.....(i) — 1

$\frac{ar(\Delta ADE)}{ar(\Delta DCE)} = \frac{\frac{1}{2} \times AE \times DM}{\frac{1}{2} \times EC \times DM} = \frac{AE}{EC}$.....(ii) — 1

As ΔDBE and ΔDCE lie on the same base and between same parallels BC and DE

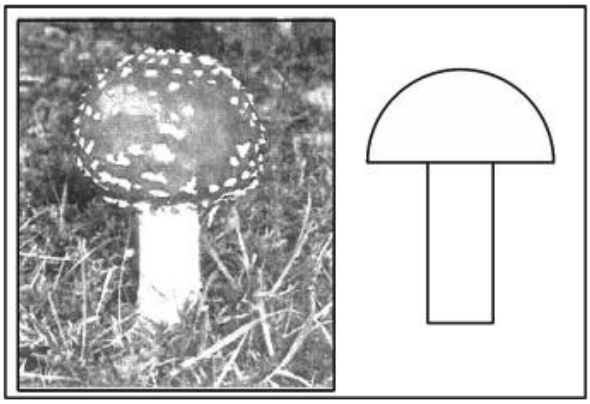
$\therefore$ ar(ΔDBE) = ar(ΔDCE). Thus, $\frac{ar(\Delta ADE)}{ar(\Delta DBE)} = \frac{ar(\Delta ADE)}{ar(\Delta DCE)}$.....(iii) From (i), (ii) and (iii), we get $\frac{AD}{DB} = \frac{AE}{EC}$	½ ½

Section – E

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

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

36.



There are many varieties of mushrooms available in the world. One such mushroom 'Amanita muscaria' has a upper part which is like red cap (hemispherical) and lower part is like white stem (cylinderical).

The hemispherical cap's radius = 3 cm and cylindrical stem is 2 cm high with diameter 1.4 cm. Considering mushroom a solid object, answer the following questions :

(i) What is the total height of a mushroom ?

(ii) Find the volume of the stem.

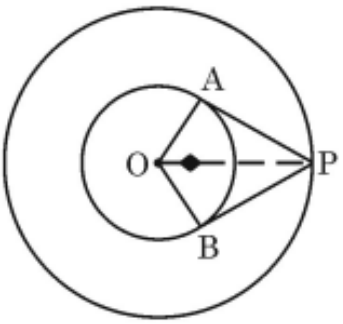
(iii) (a) Determine the volume of 7 such mushrooms.

OR

(b) Find the total surface area of 7 such mushrooms.

Solution: (i) Height of a mushroom = 2 + 3 = 5 cm	1
(ii) Volume of the stem $= \frac{22}{7} \times \frac{1.4}{2} \times \frac{1.4}{2} \times 2$	
$= \frac{8624}{2800}\ cm^3$ or $3.08\ cm^3$	1
(iii) (a) Volume of 7 mushrooms = $7 \times \left(\frac{2}{3}\pi R^3 + \pi r^2 h\right)$, where R = 3 cm, r = 0.7 cm, h = 2 cm.	
$= 7\left(\frac{2}{3} \times \frac{22}{7} \times 3^3 + \frac{22}{7} \times (0.7)^2 \times 2\right)$	1
$= \frac{41756}{100}\ cm^3$ or $417.56\ cm^3$	1
OR	
(b) TSA = $7\{2\pi R^2 + (\pi R^2 - \pi r^2) + 2\pi rh + \pi r^2\} = 7(3\pi R^2 + 2\pi rh)$	
$= 7 \times \left(3 \times \frac{22}{7} \times 3 \times 3 + 2 \times \frac{22}{7} \times \frac{7}{10} \times 2\right)$	1
$= \frac{6556}{10}\ cm^2$ or $655.6\ cm^2$	1





In a circular museum hall of radius 14 m, some statues are displayed. Statues are kept inside the inner concentric circle of radius 7 m. One such statue lying in sector OAB, is fenced along line segments OA, AP, PB and BO where P is a point on outer circle.

Based on above information, answer the following questions :

(i) Find m∠AOP. **1**

(ii) Prove that $\Delta OAP \cong \Delta OBP$. **1**

(iii) (a) Find the length of fencing required to protect the statue.

(Take $\sqrt{3} = 1.73$) **2**

OR

(b) Find area of quadrilateral OAPB. (Take $\sqrt{3} = 1.73$)

Solution:

(i) OA = 7 m, OP = 14 m

If $\angle AOP = \theta \quad \therefore \cos\theta = \frac{7}{14} = \frac{1}{2}$

$\Rightarrow$ $m\angle AOP = 60°$ 1

(ii) In ΔOAP and ΔOBP

$\angle A = \angle B = 90°$ (radius $\perp$ to tangent at the point of contact)

OP =OP (common)

OA = OB (radii of the same circle)

Thus, $\Delta OAP \cong \Delta OBP$ (by RHS congruency) 1

(iii) (a) $\sin 60° = \frac{AP}{14}$

$\Rightarrow$ $AP = 7\sqrt{3}\ m$ or $12.11\ m$ 1

Total fencing required = $2(OA + AP) = 38.22\ m$ 1

OR

(b) $\sin 60° = \frac{AP}{14}$

$\Rightarrow$ $AP = 7\sqrt{3}\ m$ or $12.11\ m$ 1

Area OAPB = $2 \times \frac{1}{2} \times OA \times AP = 84.77\ m^2$ 1

38. 

Seema daily goes to a park to exercise on machines available there. When Seema spent 15 minutes on exercise bicycle and 30 minutes on double cross walker, she received a message of burning 435 calories on her fitness watch. When she spent 30 minutes on exercise bicycle and 40 minutes on double cross walker, she received a message of burning 690 calories.

To find the number of calories burned per minute on each machine, answer the following :

(i) Represent the above situation in terms of a pair of linear equations in two variables.

(ii) Show that the equations have unique solution.

(iii) (a) Solve both equations to find the values of the variables using elimination method.

OR

(b) Solve both equations to find the values of the variables using substitution method.

Solution: (i)	Let x and y be number of calories burned per minute on bicycle and walker respectively	
	$\therefore 15x + 30y = 435 \quad , \quad 30x + 40y = 690$	1
(ii)	We get,	
	$\frac{15}{30} \neq \frac{30}{40}$	1
	Thus, equations have unique solution	
(iii)	a) Using elimination method, $x = 11$ and $y = 9$	2
	OR	
	b) Using Substitution method, $x = 11$ and $y = 9$	2