रोल नं.
Roll No.

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

नोट

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

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

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

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

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

NOTE

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

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

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

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

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

गणित (बुनियादी)
MATHEMATICS (BASIC)

निर्धारित समय : *3 घण्टे*

Time allowed : 3 hours

अधिकतम अंक : *80*

Maximum Marks : 80

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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** एवं **ङ।**

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

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

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

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

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

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

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

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

खण्ड क

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

1. समांतर श्रेढ़ी $\sqrt{7}$, $\sqrt{28}$, $\sqrt{63}$, ... का अगला पद है :

(A) $\sqrt{81}$ (B) $\sqrt{126}$

(C) $\sqrt{112}$ (D) $5\sqrt{7}$

2. यदि $x \tan 45° \cos 60° = \sqrt{3} \sin 60° \cot 60°$ है, तो x का मान है :

(A) 1

(B) $\dfrac{1}{\sqrt{3}}$

(C) $\sqrt{3}$

(D) $\dfrac{\sqrt{3}}{2}$

General Instructions :

Read the following instructions very carefully and strictly follow them :

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

(ii)   *This question paper is divided into **five** Sections – **A, B, C, D** and **E**.*

(iii) *In **Section A,** Questions no. **1** to **18** are Multiple Choice Questions (MCQs) and questions number **19** and **20** are Assertion-Reason based questions of **1** mark each.*

(iv)   *In **Section B,** Questions no. **21** to **25** are Very Short Answer (VSA) type questions, carrying **2** marks each.*

(v)   *In **Section C,** Questions no. **26** to **31** are Short Answer (SA) type questions, carrying **3** marks each.*

(vi)   *In **Section D,** Questions no. **32** to **35** are Long Answer (LA) type questions carrying **5** marks each.*

(vii) *In **Section E,** Questions no. **36** to **38** are case study based questions carrying **4** marks each. Internal choice is provided in **2** marks questions in each case study.*

(viii) *There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 2 questions in Section C, 2 questions in Section D and 3 questions in Section E.*

(ix)   *Draw neat diagrams wherever required. Take $\pi = \dfrac{22}{7}$ wherever required, if not stated.*

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

SECTION A

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

1.   The next term of the A.P. $\sqrt{7}$, $\sqrt{28}$, $\sqrt{63}$, ... is :

(A) $\sqrt{81}$ (B) $\sqrt{126}$

(C) $\sqrt{112}$ (D) $5\sqrt{7}$

2.   If $x \tan 45° \cos 60° = \sqrt{3} \sin 60° \cot 60°$, then the value of x is :

(A)   1

(B) $\dfrac{1}{\sqrt{3}}$

(C) $\sqrt{3}$

(D) $\dfrac{\sqrt{3}}{2}$

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3. यदि द्विघात समीकरण $ax^2 + ax + c = 0$ $(a \neq 0)$ के मूल वास्तविक तथा समान हैं, तो :

(A) $a = 4c$ (B) $4a = c$

(C) $a = -4c$ (D) $c = -4a$

4. यदि एक समांतर श्रेढ़ी का प्रथम पद 'a' तथा इसका सार्व अंतर 'b' है, तो इसका 10वाँ पद है :

(A) $a + 10b$ (B) $10a + b$

(C) $a + 9b$ (D) $9a + b$

5. दो भिन्न सिक्कों को एक साथ उछाला गया। केवल एक पट आने की प्रायिकता है :

(A) $\dfrac{1}{4}$ (B) $\dfrac{1}{2}$

(C) $\dfrac{3}{4}$ (D)   1

6. एक निष्पक्ष पासा एक बार उछाला गया। 5 से छोटी अभाज्य संख्या प्राप्त होने की प्रायिकता है :

(A) $\dfrac{1}{6}$ (B) $\dfrac{1}{3}$

(C) $\dfrac{1}{2}$ (D)   1

7. यदि बिंदुओं $(-5, k)$ तथा $(6, 3)$ को मिलाने वाले रेखाखण्ड का मध्य-बिंदु $(\dfrac{1}{2}, 6)$ है, तो 'k' का मान है :

(A)   0   (B)   3

(C) $\dfrac{9}{2}$ (D)   9

8. रैखिक समीकरण युग्म $3x + 4y = 5$; $4x + 3y = 9$ का हल है :

(A) $x = -3, y = 1$
(B) $x = 3, y = 1$
(C) $x = 3, y = -1$
(D) $x = -3, y = -1$

9. $3 \cdot 5$ cm त्रिज्या वाले एक वृत्त की दो समांतर स्पर्श-रेखाओं के बीच की दूरी है :

(A) $3 \cdot 5$ cm   (B)   14 cm

(C) $1 \cdot 75$ cm   (D)   7 cm

•••

3. If the quadratic equation $ax^2 + ax + c = 0$ $(a \neq 0)$ has real and equal roots, then :

(A) $a = 4c$ (B) $4a = c$

(C) $a = -4c$ (D) $c = -4a$

4. If the first term of an A.P. is 'a' and its common difference is 'b', then its 10th term is :

(A) $a + 10b$ (B) $10a + b$

(C) $a + 9b$ (D) $9a + b$

5. Two different coins are tossed together. The probability of getting exactly one tail is :

(A) $\dfrac{1}{4}$ (B) $\dfrac{1}{2}$

(C) $\dfrac{3}{4}$ (D)   1

6. A fair die is thrown once. The probability of getting a prime number less than 5 is :

(A) $\dfrac{1}{6}$ (B) $\dfrac{1}{3}$

(C) $\dfrac{1}{2}$ (D)   1

7. If $(\dfrac{1}{2}, 6)$ is the mid-point of the line segment joining $(-5, k)$ and $(6, 3)$, then the value of 'k' is :

(A)   0   (B)   3

(C) $\dfrac{9}{2}$ (D)   9

8. The solution of the pair of linear equations $3x + 4y = 5$; $4x + 3y = 9$ is :
(A) $x = -3, y = 1$
(B) $x = 3, y = 1$
(C) $x = 3, y = -1$
(D) $x = -3, y = -1$

9. The distance between two parallel tangents to a circle of radius 3·5 cm is :

(A)   3·5 cm   (B)   14 cm
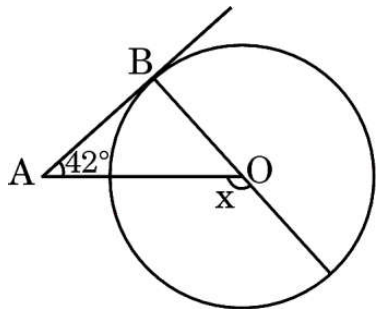
(C)   1·75 cm   (D)   7 cm

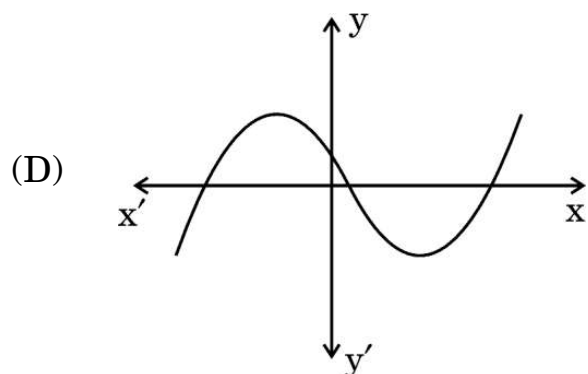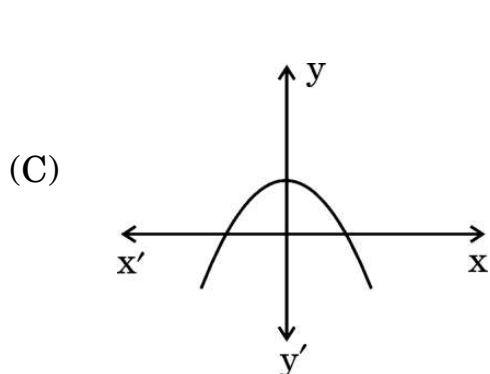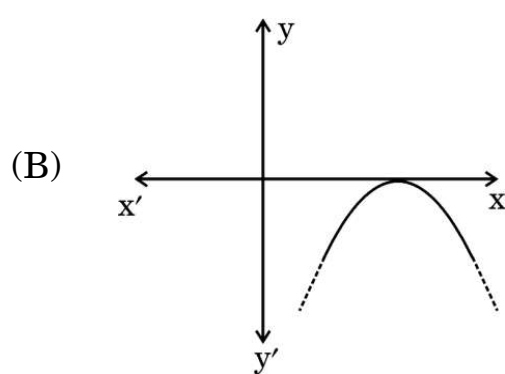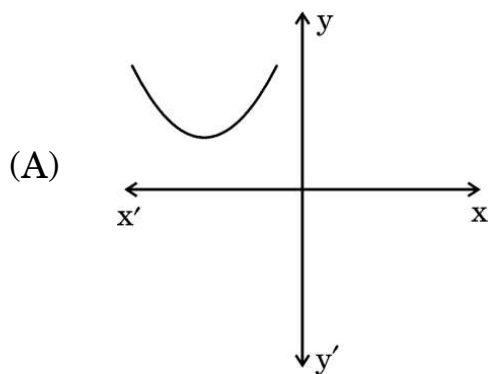**10.** निम्नलिखित में से कौन-सा कथन *असत्य* है ?

    (A)   दो सर्वांगसम त्रिभुज समरूप भी होते हैं ।

    (B)   एक वर्ग तथा समचतुर्भुज समरूप नहीं होते ।

    (C)   दो त्रिभुज समरूप होते हैं, यदि उनकी संगत भुजाएँ समानुपाती हों ।

    (D)   दो बहुभुज समरूप होते हैं यदि और केवल यदि, उनकी संगत भुजाएँ समानुपाती हों ।

11. दी गई आकृति में, केंद्र O वाले वृत्त की AB एक स्पर्श-रेखा है । यदि $\angle$ BAO = 42° है, तो x का मान है :

    (A)   42°   (B)   38°

    (C)   48°   (D)   132°

12. निम्नलिखित में से कौन-सा आलेख एक द्विघात बहुपद का *नहीं* है ?

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10. Which of the following is an *incorrect* statement ?

(A) Two congruent triangles are also similar.

(B) A square and a rhombus are not similar.

(C) Two triangles are similar if their corresponding sides are proportional.

(D) Two polygons are similar if and only if their corresponding sides are in proportion.

11. In the given figure, AB is a tangent to the circle with centre O. If $\angle BAO = 42°$, then the value of x is :
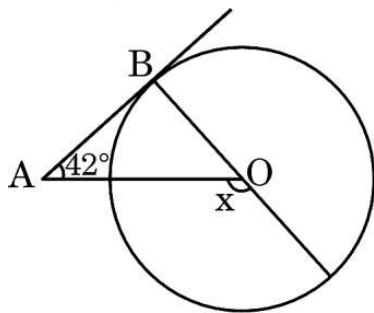
(A) 42°

(B) 38°

(C) 48°

(D) 132°

12. Which of the following is *not* the graph of a quadratic polynomial ?

(A)

(B)

(C)

(D)
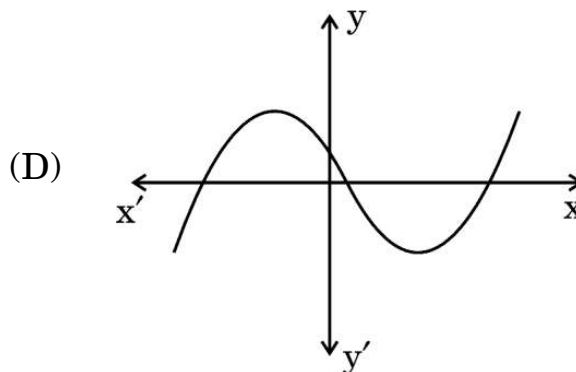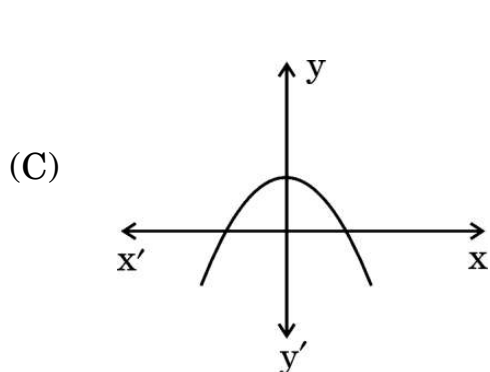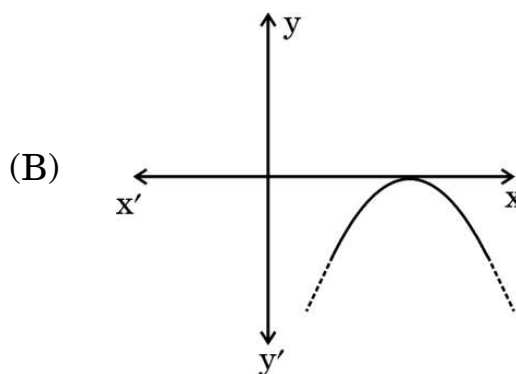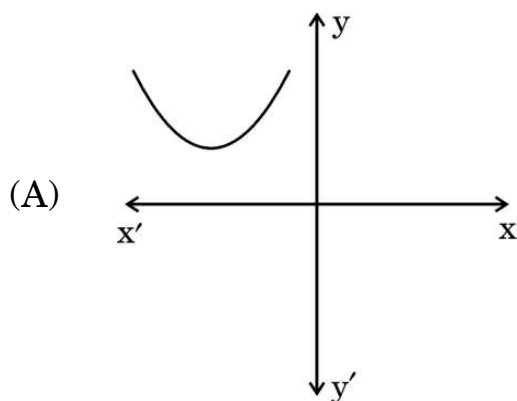
13. दी गई आकृति में, Δ PQR में, ST $||$ QR है। यदि PS = 16 mm तथा PQ = 40 mm है, तो PT : TR है :

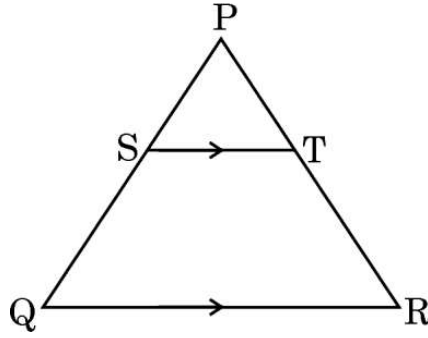(A)　2 : 3 　　　　　　　(B)　3 : 2

(C)　2 : 5 　　　　　　　(D)　5 : 2

14. एक घटना के घटित होने की प्रायिकता 'p' है तथा इसी घटना के न घटित होने की प्रायिकता 'q' है। 'p' तथा 'q' के बीच संबंध है :

(A)　p + q + 1 = 0 　　　　(B)　p = q − 1

(C)　p + q = 1 　　　　　　(D)　p = 1, q = 1

15. यदि बहुपद $p(x) = 2x^2 + 6x - 6$ के शून्यक α तथा β हैं, तो $\dfrac{1}{\alpha} + \dfrac{1}{\beta}$ का मान है :

(A)　− 1 　　　　　　　(B)　1

(C)　− 3 　　　　　　　(D)　3

16. $\dfrac{\sin^2 90° + \cos^2 0°}{\sin^2 30° + \cos^2 30°}$ का मान है :

(A)　1 　　　　　　　　(B)　0

(C)　2 　　　　　　　　(D)　4

17. एक वृत्त के चतुर्थांश के केंद्र पर बने कोण का अंशीय माप होता है :

(A)　30° 　　　　　　　(B)　60°

(C)　90° 　　　　　　　(D)　180°

18. एक वर्गीकृत बारंबारता बंटन में, प्रत्येक वर्ग अंतराल की बारंबारता केंद्रित होती है :

(A)　निचली वर्ग सीमा के चारों ओर 　　　(B)　उपरि वर्ग सीमा के चारों ओर

(C)　मध्य-बिंदु के चारों ओर 　　　　　(D)　उपर्युक्त में से कोई नहीं

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13. In the given figure, in Δ PQR, ST || QR. If PS = 16 mm and PQ = 40 mm, then PT : TR is :
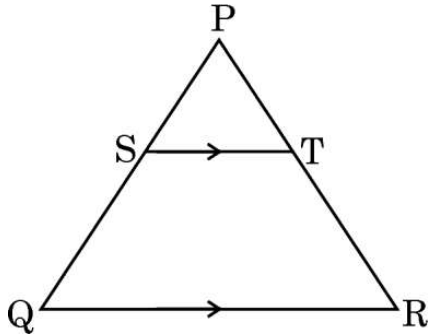
(A) 2 : 3   (B) 3 : 2

(C) 2 : 5   (D) 5 : 2

14. The probability of the happening of an event is 'p' and the probability of non-happening of the same event is 'q'. The relation between 'p' and 'q' is :

(A) p + q + 1 = 0   (B) p = q – 1

(C) p + q = 1   (D) p = 1, q = 1

15. If α and β are the zeroes of the polynomial $p(x) = 2x^2 + 6x - 6$, then the value of $\dfrac{1}{\alpha} + \dfrac{1}{\beta}$ is equal to :

(A) – 1   (B) 1

(C) – 3   (D) 3

16. The value of $\dfrac{\sin^2 90° + \cos^2 0°}{\sin^2 30° + \cos^2 30°}$ is :

(A) 1   (B) 0

(C) 2   (D) 4

17. The degree measure of the angle at the centre of a quadrant of a circle is :

(A) 30°   (B) 60°

(C) 90°   (D) 180°

18. In a grouped frequency distribution, it is assumed that the frequency of each class interval is centered around its :

(A) lower limit   (B) upper limit

(C) mid-point   (D) None of the above

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

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

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

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

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

19.   *अभिकथन (A) :*   यदि दो त्रिभुजों के कोण परस्पर समान हों, तो त्रिभुज समरूप होते हैं ।

   तर्क (R) :   यदि दो त्रिभुज समरूप हैं, तो वे सर्वांगसम होते हैं ।

20.   *अभिकथन (A) :*   त्रिज्या r वाले वृत्त के एक त्रिज्यखंड, जिसका कोण अंशों में θ है, का क्षेत्रफल $\frac{\theta}{360} \times 2\pi r$ होता है ।

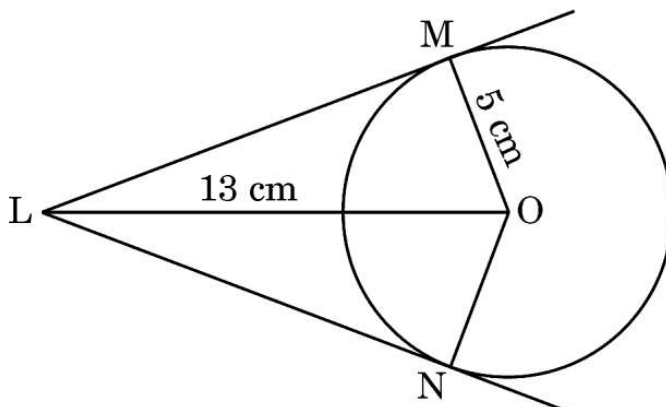   *तर्क (R) :*   एक वृत्तखंड का क्षेत्रफल = संगत त्रिज्यखंड का क्षेत्रफल – संगत त्रिभुज का क्षेत्रफल ।

खण्ड ख

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

21.   दी गई आकृति में, केंद्र O तथा त्रिज्या 5 cm वाले वृत्त पर, O से 13 cm की दूरी पर स्थित बिंदु L से वृत्त पर स्पर्श-रेखाएँ LM तथा LN खींची गई हैं । चतुर्भुज LMON का परिमाप ज्ञात कीजिए ।

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

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

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

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

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

19.   *Assertion (A) :*   If two triangles are equiangular, then they are similar.
        Reason (R) :   If two triangles are similar, then they are congruent.

20.   *Assertion (A) :*   Area of a sector of a circle with radius r and angle with degree measure θ is $\dfrac{\theta}{360} \times 2\pi r$.

        Reason (R) :   Area of segment of a circle =
                Area of the corresponding sector – Area of the corresponding triangle.

SECTION B

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

21.   In the given figure, from a point L which is at a distance of 13 cm from the centre O of a circle of radius 5 cm, the pair of tangents LM and LN are drawn to the circle. Find the perimeter of quadrilateral LMON.
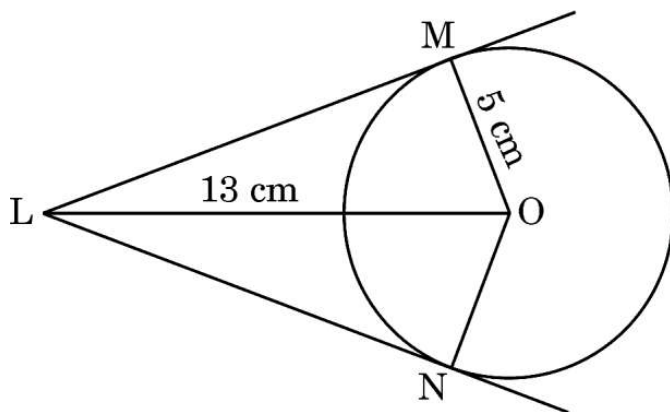
22. यदि $3 \cot A = 4$ है, तो $\cos^2 A - \sin^2 A$ का मान ज्ञात कीजिए।

23. एक स्कूल में कक्षा X के दो सेक्शन A और B हैं। सेक्शन A में 48 विद्यार्थी हैं तथा सेक्शन B में 36 विद्यार्थी हैं। स्कूल की कक्षा लाइब्रेरी के लिए आवश्यक पुस्तकों की वह कम-से-कम संख्या ज्ञात कीजिए ताकि प्रत्येक सेक्शन A या B में विद्यार्थियों को समान रूप में बाँटी जा सके।

24. (क) बिंदुओं (– 1, 7) तथा (4, – 3) को मिलाने वाले रेखाखण्ड को 2 : 3 के अनुपात में बाँटने वाले बिंदु के निर्देशांक ज्ञात कीजिए।

अथवा

(ख) दूरी सूत्र के प्रयोग से सिद्ध कीजिए कि बिंदु A(3, 1), B(6, 4) तथा C(8, 6) संरेख हैं।

25. (क) बहुपद $p(x) = x^2 + \dfrac{1}{6}x - 2$ के शून्यक ज्ञात कीजिए।

अथवा

(ख) वह द्विघात बहुपद ज्ञात कीजिए जिसका एक शून्यक 4 है तथा शून्यकों का गुणनफल – 20 है।

खण्ड ग

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

26. यदि बिंदुओं A (3, 4) तथा B (k, 6) को मिलाने वाले रेखाखण्ड को 1 : 2 के अनुपात में बाँटने वाला बिंदु रेखा $x + y - 10 = 0$ पर स्थित है, तो 'k' का मान ज्ञात कीजिए।

27. सिद्ध कीजिए कि :

$$\sqrt{\dfrac{1 + \sin A}{1 - \sin A}} = \sec A + \tan A$$

28. सिद्ध कीजिए कि किसी वृत्त के परिगत खींचा गया समांतर चतुर्भुज, एक समचतुर्भुज होता है।

22. If $3 \cot A = 4$, then determine the value of $\cos^2 A - \sin^2 A$.

23. In a school, there are two Sections A and B of Class X. There are 48 students in Section A and 36 students in Section B. Determine the minimum number of books required for their class library so that they can be distributed equally among the students of Section A or that of Section B.

24. (a) Find the coordinates of the point which divides the join of $(-1, 7)$ and $(4, -3)$ in the ratio $2 : 3$.

OR

(b) Using distance formula, prove that the points A(3, 1), B(6, 4) and C(8, 6) are collinear.

25. (a) Find the zeroes of the polynomial $p(x) = x^2 + \dfrac{1}{6}x - 2$.

OR

(b) Find a quadratic polynomial whose one zero is 4 and product of zeroes is -20.

SECTION C

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

26. If the point dividing the line segment joining the points A (3, 4) and B (k, 6) in the ratio 1 : 2, lies on the line $x + y - 10 = 0$, then find the value of 'k'.

27. Prove that :

$$\sqrt{\frac{1 + \sin A}{1 - \sin A}} = \sec A + \tan A$$

28. Prove that the parallelogram circumscribing a circle is a rhombus.

• • •

29. (क) निम्नलिखित रैखिक समीकरण निकाय का हल ज्ञात कीजिए :

$$\frac{x}{a} - \frac{y}{b} = 0; \quad ax + by = a^2 + b^2$$

अथवा

(ख) 'p' के किस मान के लिए निम्नलिखित रैखिक समीकरण निकाय

$$(2p - 1)x + (p - 1)y = 2p + 1$$
$$3x + y = 1$$

का कोई हल **नहीं** है ?

30. (क) एक घड़ी की मिनट वाली सुई की लंबाई 14 cm है । इस मिनट वाली सुई द्वारा 5 मिनट में रचित क्षेत्रफल ज्ञात कीजिए ।

अथवा

(ख) पानी के नीचे की चट्टानों के बारे में जहाजों को चेतावनी देने के लिए, एक लाइटहाउस 80° के केंद्रीय कोण के एक त्रिज्यखण्ड पर 16·5 km की दूरी तक लाल रंग की रोशनी डालता है । समुद्र के उस क्षेत्र का क्षेत्रफल ज्ञात कीजिए जहाँ तक जहाजों को चेतावनी दी जाती है ।

31. निम्नलिखित सारणी में एक स्कूल के कक्षा X के 110 छात्रों द्वारा एक विशेष शैक्षिक सत्र में प्राप्त अंक दर्शाए गए हैं । इस बंटन का बहुलक ज्ञात कीजिए ।

प्राप्तांक :	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100
छात्रों की संख्या :	21	25	30	24	10

खण्ड घ

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

32. (क) एक 2-अंकों वाली संख्या के अंकों का गुणनफल 8 है । संख्या में से 18 घटाने पर संख्या के अंक पलट जाते हैं । संख्या ज्ञात कीजिए ।

अथवा

(ख) दो संख्याओं के वर्गों का अंतर 180 है । छोटी संख्या का वर्ग बड़ी संख्या के 8 गुने के समान है । दोनों संख्याएँ ज्ञात कीजिए ।

• • •

29. (a) Solve the following system of linear equations :

$$\frac{x}{a} - \frac{y}{b} = 0; \quad ax + by = a^2 + b^2$$

OR

(b) For what value of 'p' will the following system of linear equations have **no** solution ?

$$(2p - 1)x + (p - 1)y = 2p + 1$$

$$3x + y = 1$$

30. (a) The length of the minute-hand of a clock is 14 cm. Find the area swept by this minute-hand in 5 minutes.

OR

(b) To warn ships for underwater rocks, a lighthouse throws a red coloured light over a sector of central angle 80° up to a distance of 16·5 km. Find the area of the sea over which the ships are warned.

31. The following table shows the marks obtained by 110 students of class X in a school during a particular academic session. Find the mode of the distribution.

Marks Obtained :	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100
Number of Students :	21	25	30	24	10

SECTION D

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

32. (a) A 2-digit number is such that the product of digits is 8. When 18 is subtracted from the number, the digits interchange their places. Find the number.

OR

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

•••

33. सुकृति ने अपने बगीचे के लिए एक पक्षी-स्नानागार बनाया जिसका आकार एक खोखले बेलन जैसा है, जिसके एक सिरे पर एक अर्धगोलाकार बर्तन बना हुआ है, जैसा कि आकृति में दर्शाया गया है । बेलन की ऊँचाई 1·45 m है और इसकी त्रिज्या 30 cm है । इस पक्षी-स्नानागार का संपूर्ण पृष्ठीय क्षेत्रफल ज्ञात कीजिए ।
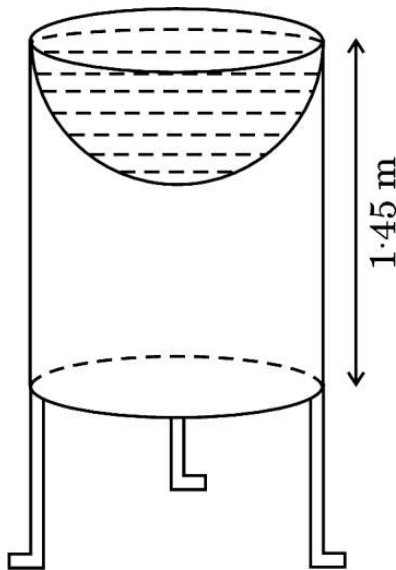
34. **(क)** एक हवाई जहाज जब भूमि से 5000 m की ऊँचाई पर उड़ रहा है, तो वह एक अन्य हवाई जहाज के ऊपर से ऊर्ध्वाधर रूप से उस समय गुजरता है जब भूमि पर एक बिंदु से दोनों जहाजों के उन्नयन कोण क्रमश: 60° तथा 45° हैं । उस समय हवाई जहाजों के बीच की ऊर्ध्वाधर दूरी ज्ञात कीजिए । [√3 = 1·732 प्रयोग कीजिए]

अथवा

(ख) एक नहर के एक किनारे पर एक टीवी टावर सीधा खड़ा है । नहर के दूसरे किनारे के एक सम्मुख बिंदु पर इस टावर के शिखर का उन्नयन कोण 60° है । इसी किनारे पर इस बिंदु से 20 m की दूरी पर स्थित अन्य बिंदु पर टावर के शिखर का उन्नयन कोण 30° है । टावर की ऊँचाई तथा नहर की चौड़ाई ज्ञात कीजिए । [√3 = 1·73 प्रयोग कीजिए]

35. यदि Δ ABC ~ Δ PQR है तथा AD और PM क्रमश: त्रिभुजों ABC तथा PQR की माध्यिकाएँ हैं, तो सिद्ध कीजिए कि $\dfrac{AB}{PQ} = \dfrac{AD}{PM}$.

33. Sukriti made a bird-bath for her garden in the shape of a hollow cylinder with a hemispherical depression at one end as shown in the figure. The height of the cylinder is 1·45 m and its radius is 30 cm. Find the total surface area of the bird-bath.

34. (a) An aeroplane when flying at a height of 5000 m above the ground passes vertically above another aeroplane at an instant when the angles of elevation of the two planes from a point on the ground are 60° and 45° respectively. Find the vertical distance between the aeroplanes at that instant. [Use $\sqrt{3}$ = 1·732]

OR

(b) A TV tower stands vertically on a bank of a canal. From a point on the other bank directly opposite the tower, the angle of elevation of the top of the tower is 60°. From a point 20 m away from this point on the same bank, the angle of elevation of the top of the tower is 30°. Find the height of the tower and the width of the canal. [Use $\sqrt{3}$ = 1·73]

35. If AD and PM are medians of triangles ABC and PQR respectively, where $\triangle$ ABC ~ $\triangle$ PQR, then prove that $\dfrac{AB}{PQ} = \dfrac{AD}{PM}$.

खण्ड ङ

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

प्रकरण अध्ययन – 1

36. आरव तथा आशिमा भाई बहन हैं तथा आशिमा के जन्मदिन पर आरव ने उसे एक बैग भेंट में दिया जिसमें 8 लाल रंग की टॉफियाँ, 10 हरे रंग की टॉफियाँ तथा 6 नीले रंग की टॉफियाँ हैं। आशिमा ने बैग में से यादृच्छया एक टॉफी निकालने का फैसला किया। यह जानने के लिए कि विशेष रंग की टॉफी निकलने की क्या संभावना है, वह निम्नलिखित प्रश्न पूछती है :
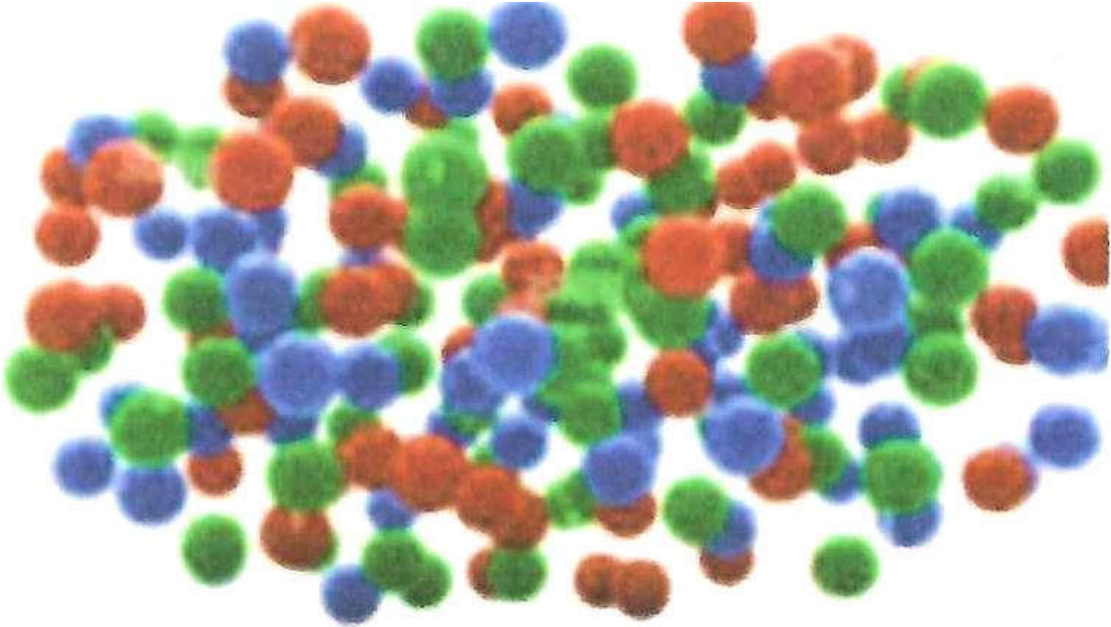
(i)   एक हरी टॉफी प्राप्त करने की क्या प्रायिकता है ?   *1*

(ii)   एक नीली टॉफी प्राप्त करने की क्या प्रायिकता है ?   *1*

(iii)   (क)   एक टॉफी जो लाल न हो, को प्राप्त करने की क्या प्रायिकता है ?   *2*

अथवा

(ख)   एक लाल या एक हरी टॉफी को प्राप्त करने की क्या प्रायिकता है ?   *2*

SECTION E

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

Case Study – 1

36. Aarav and Ashima are brother and sister and on Ashima's birthday, Aarav gifts her a bag filled with 8 red toffees, 10 green toffees and 6 blue toffees. Ashima decides to randomly draw a toffee from the bag. She wants to find the chances of picking a toffee of specific colour and asks the following questions :

(i)   What is the probability of getting a green toffee ?   *1*

(ii)   What is the probability of getting a blue toffee ?   *1*

(iii) (a)   What is the probability of getting a non-red toffee ?   *2*

                OR
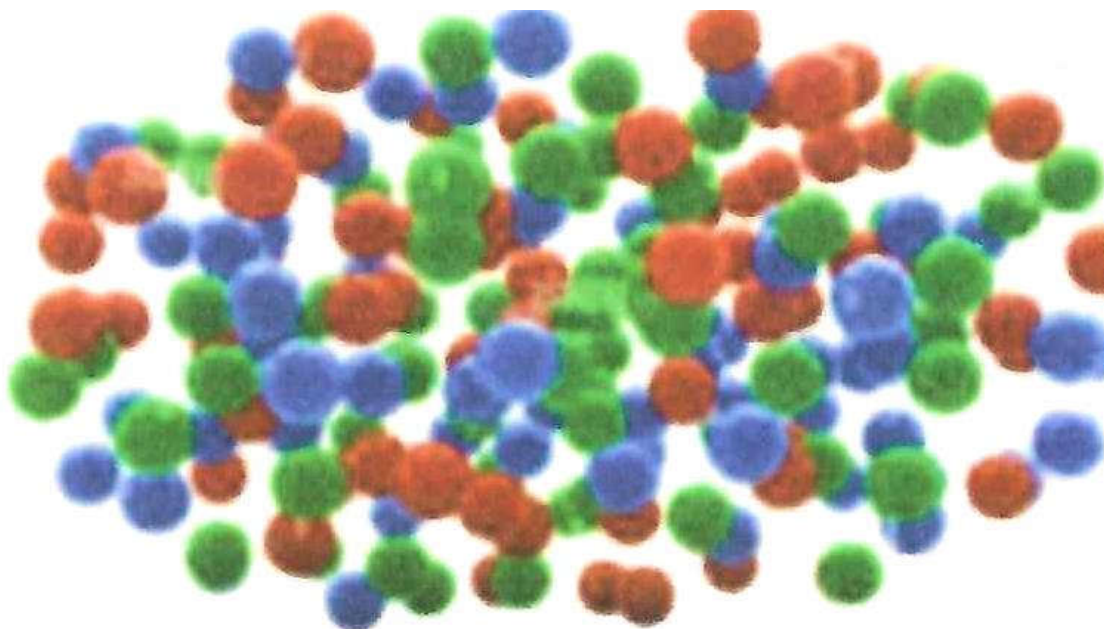
       (b)   What is the probability of getting a red or a green toffee ?   *2*

प्रकरण अध्ययन – 2

37. एक आकर्षक गाँव में, 'मेपलवुड एवेन्यू' नामक एक गली है जिसमें घरों को 1 से 49 तक क्रमांकित किया गया है। एक सामुदायिक समूह ने एक हरित नवीकरण परियोजना शुरू करने का फैसला किया है, जिसमें घरों पर सौर पैनल स्थापित करने हैं।

परियोजना शुरू करने से पहले उनके निम्नलिखित कुछ प्रश्न हैं।
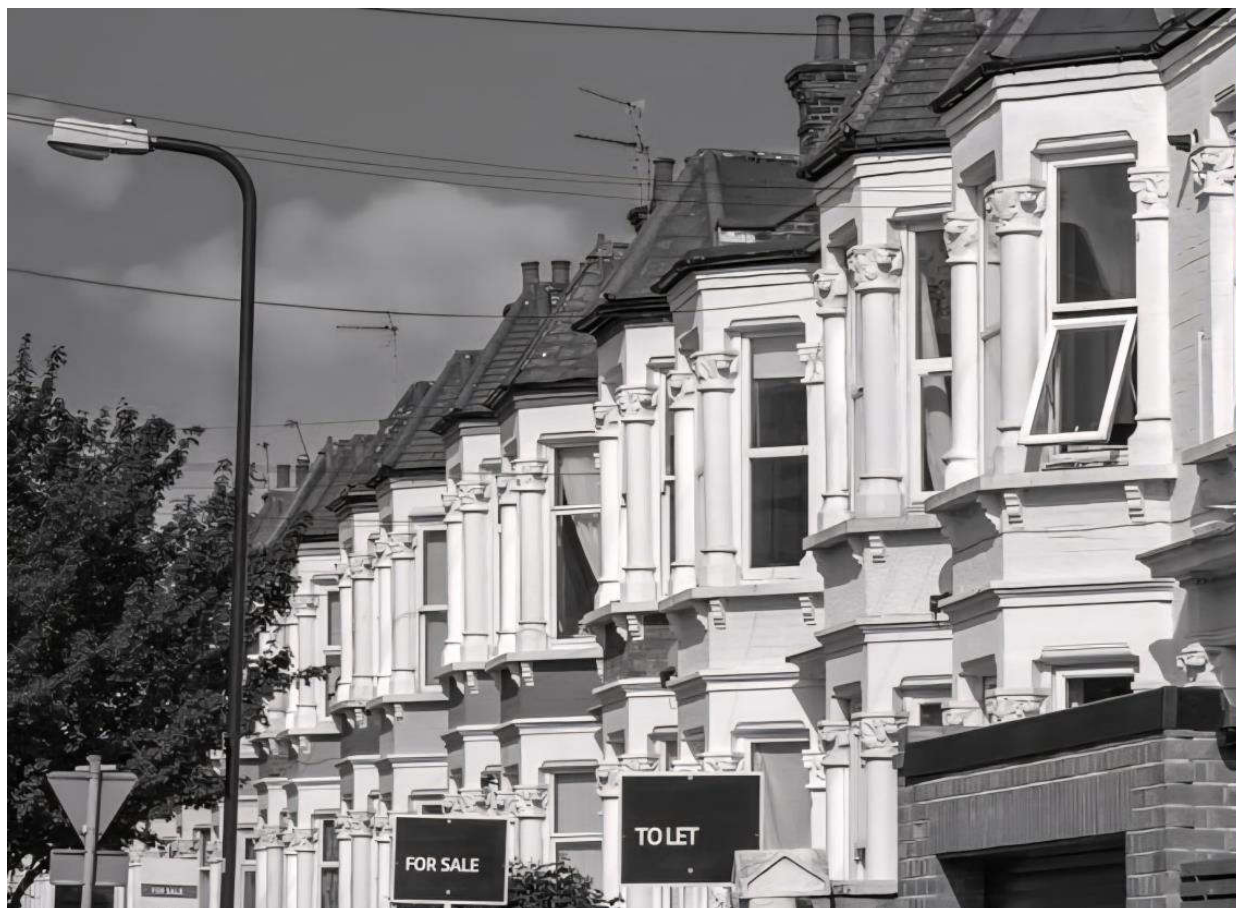
(i)   'मेपलवुड एवेन्यू' में कुल कितने घर हैं ?   *1*

(ii)   घरों के नम्बर एक समांतर श्रेढ़ी बनाते हैं। समांतर श्रेढ़ी का प्रथम पद तथा सार्व अंतर क्या है ?   *1*

(iii)   (क)   यदि यह समूह 1 से 49 वाले सभी घरों के नम्बरों का योगफल परिकलित करना चाहता है, तो वह कितना होगा ?   *2*

अथवा

(ख)   15 से 30 तक के बीच के घरों के नम्बरों का योगफल क्या है ?   *2*

Case Study – 2

37. In a charming village, there is a street called 'Maplewood Avenue', where the houses are numbered from 1 to 49. A community group has decided to undertake a green renovation project, aiming to install solar panels on the houses.

They have a few questions before they begin the project.

(i) How many houses are there on 'Maplewood Avenue' ? *1*

(ii) The house numbers follow an Arithmetic Progression. What is the first term of the A.P. and the common difference ? *1*

(iii) (a) If the group wanted to calculate the sum of all house numbers from 1 to 49, how much would that be ? *2*

OR

(b) What is the sum of the house numbers between 15 and 30 ? *2*

प्रकरण अध्ययन – 3

38. आपके स्कूल में एक गणित प्रदर्शनी का आयोजन किया गया है तथा आपके एक मित्र ने 'गुणनखण्ड वृक्ष' का एक मॉडल बनाया है । उसे कुछ कठिनाई आ रही है जिसके लिए उसने आपकी सहायता माँगी है, ताकि वह दर्शकों के लिए एक क्विज़ पूरा कर सके ।

निम्नलिखित 'गुणनखण्ड वृक्ष' का अवलोकन कीजिए तथा निम्नलिखित प्रश्नों के उत्तर दीजिए :
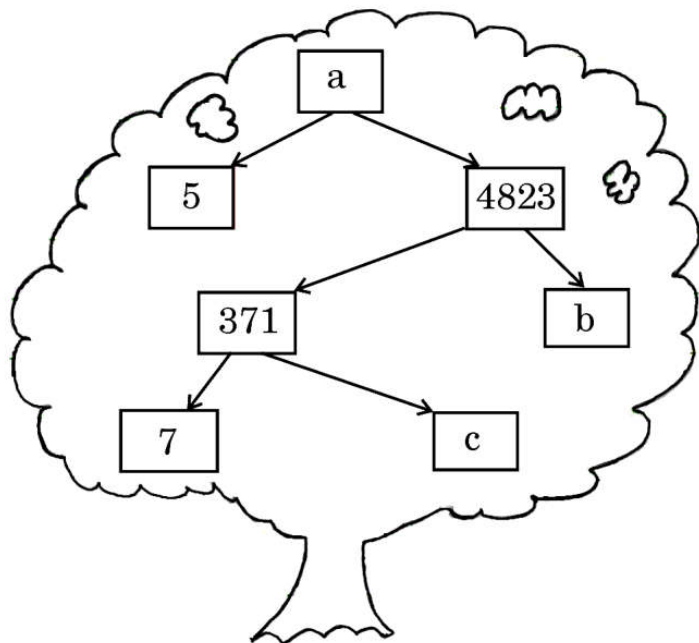
(i)	a का मान क्या है ?	*1*
(ii)	(क)	b का मान क्या है ?	*2*

अथवा

(ख) c का मान क्या है ? *2*

(iii) 24115 का अभाज्य गुणनखण्डन लिखिए । *1*

Case Study – 3

38. A Mathematics exhibition is being conducted in your school and one of your friends is making a model of a 'factor tree'. He has some difficulty and asks for your help in completing a quiz for the audience.

   Observe the following 'factor tree' and answer the following questions :

   (i) What is the value of a ? *1*

   (ii) (a) What is the value of b ? *2*

   OR
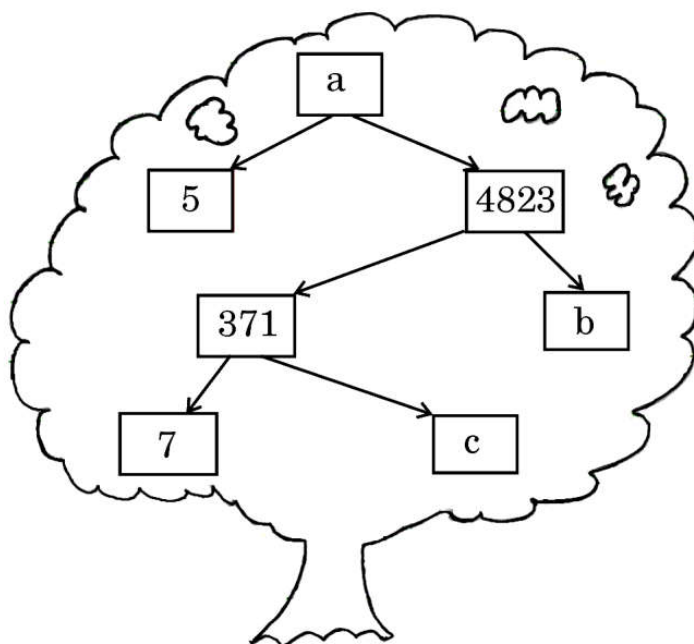
   (b) What is the value of c ? *2*

   (iii) Write the prime factorisation of 24115. *1*

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Marking Scheme
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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.**
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 ($\checkmark$) wherever answer is correct. For wrong answer CROSS 'X" be marked. Evaluators will not put right ($\checkmark$) while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing.**
7	If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totaled up and written in the left-hand margin and encircled. This may be followed strictly.
8	If a question does not have any parts, marks must be awarded in the left-hand margin and encircled. This may also be followed strictly.
9	If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note **"Extra Question"**.
10	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
11	A full scale of marks _(example 0 to 80/70/60/50/40/30 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.
12	Every examiner has to necessarily do evaluation work for full working hours i.e., 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines).This is in view of the reduced syllabus and number of questions in question paper.

13	Ensure that you do not make the following common types of errors committed by the Examiner in the past:- Leaving answer or part thereof unassessed in an answer book. Giving more marks for an answer than assigned to it. Wrong totaling of marks awarded on an answer. Wrong transfer of marks from the inside pages of the answer book to the title page. Wrong question wise totaling on the title page. Wrong totaling of marks of the two columns on the title page. Wrong grand total. Marks in words and figures not tallying/not same. Wrong transfer of marks from the answer book to online award list. Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.) Half or a part of answer marked correct and the rest as wrong, but no marks awarded.
14	While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0) Marks.
15	Any unassessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.
16	The Examiners should acquaint themselves with the guidelines given in the "**Guidelines for spot Evaluation**" before starting the actual evaluation.
17	Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totaled and written in figures and words.
18	The candidates are entitled to obtain photocopy of the Answer Book on request on payment of the prescribed processing fee. All Examiners/Additional Head Examiners/Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme.

MARKING SCHEME
MATHEMATICS (BASIC)

SECTION A
*This section has **20** Multiple Choice Questions (MCQs) carrying 1 mark each.* $20 \times 1 = 20$

1. The next term of the A.P. $\sqrt{7}$, $\sqrt{28}$, $\sqrt{63}$, ... is :

    (A) $\sqrt{81}$ (B) $\sqrt{126}$

    (C) $\sqrt{112}$ (D) $5\sqrt{7}$

Answer : (C) $\sqrt{112}$	1

2. If $x \tan 45° \cos 60° = \sqrt{3} \sin 60° \cot 60°$, then the value of x is :

    (A)   1

    (B) $\dfrac{1}{\sqrt{3}}$

    (C) $\sqrt{3}$

    (D) $\dfrac{\sqrt{3}}{2}$

Answer : (C) $\sqrt{3}$	1

3. If the quadratic equation $ax^2 + ax + c = 0$ $(a \neq 0)$ has real and equal roots, then :

    (A)   a = 4c   (B)   4a = c

    (C)   a = – 4c   (D)   c = – 4a

Answer : (A) a = 4c	1

4. If the first term of an A.P. is 'a' and its common difference is 'b', then its 10th term is :

    (A)   a + 10b   (B)   10a + b

    (C)   a + 9b   (D)   9a + b

Answer : (C) a + 9b	1

5. Two different coins are tossed together. The probability of getting exactly one tail is :

(A) $\dfrac{1}{4}$

(B) $\dfrac{1}{2}$

(C) $\dfrac{3}{4}$

(D) 1

Answer : (B) $\dfrac{1}{2}$ | 1

6. A fair die is thrown once. The probability of getting a prime number less than 5 is :

(A) $\dfrac{1}{6}$

(B) $\dfrac{1}{3}$

(C) $\dfrac{1}{2}$

(D) 1

Answer : (B) $\dfrac{1}{3}$ | 1

7. If $(\dfrac{1}{2}, 6)$ is the mid-point of the line segment joining $(-5, k)$ and $(6, 3)$, then the value of 'k' is :

(A) 0

(B) 3

(C) $\dfrac{9}{2}$

(D) 9

Answer : (D) 9 | 1

8. The solution of the pair of linear equations $3x + 4y = 5$; $4x + 3y = 9$ is :
(A) $x = -3, y = 1$
(B) $x = 3, y = 1$
(C) $x = 3, y = -1$
(D) $x = -3, y = -1$

Answer : (C) $x = 3, y = -1$ | 1

9. The distance between two parallel tangents to a circle of radius 3·5 cm is :
(A) 3·5 cm
(B) 14 cm
(C) 1·75 cm
(D) 7 cm

Answer : (D) 7 cm | 1

10. Which of the following is an *incorrect* statement ?

(A) Two congruent triangles are also similar.

(B) A square and a rhombus are not similar.

(C) Two triangles are similar if their corresponding sides are proportional.

(D) Two polygons are similar if and only if their corresponding sides are in proportion.

Answer: (D) Two polygons are similar if and only if their corresponding sides are in proportion.	1

11. In the given figure, AB is a tangent to the circle with centre O. If ∠ BAO = 42°, then the value of x is :
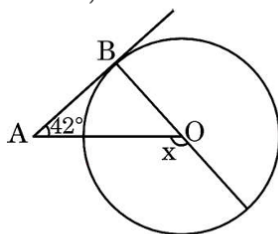
(A) 42°

(B) 38°

(C) 48°

(D) 132°

Answer: (D) 132°	1

12. Which of the following is *not* the graph of a quadratic polynomial ?

(A)

(B)

(C)

(D)
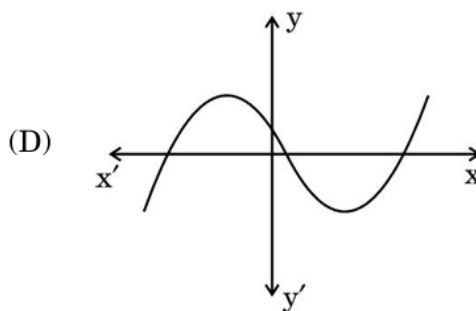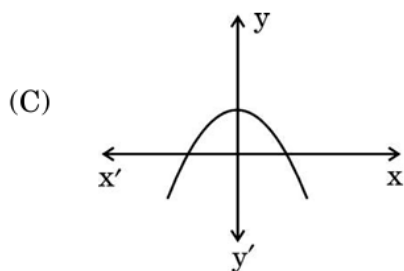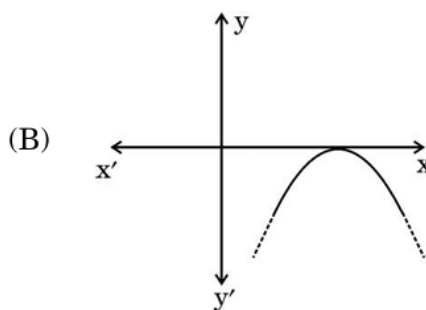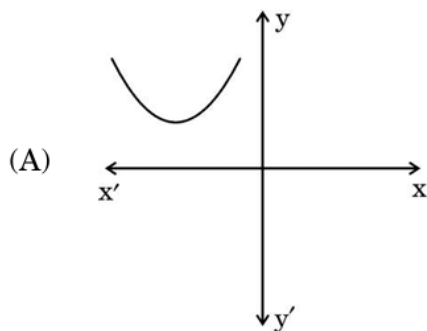
Answer : (D)	1

13. In the given figure, in △ PQR, ST ‖ QR. If PS = 16 mm and PQ = 40 mm, then PT : TR is :
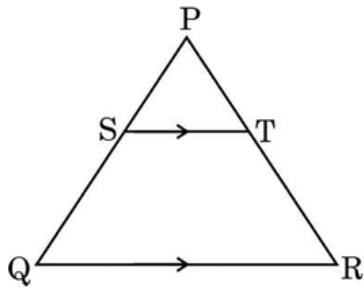
(A)   2 : 3   (B)   3 : 2

(C)   2 : 5   (D)   5 : 2

Answer : (A) 2 : 3	1

14. The probability of the happening of an event is 'p' and the probability of non-happening of the same event is 'q'. The relation between 'p' and 'q' is :

(A)   p + q + 1 = 0   (B)   p = q – 1

(C)   p + q = 1   (D)   p = 1, q = 1

Answer : (C) p + q =1	1

15. If α and β are the zeroes of the polynomial $p(x) = 2x^2 + 6x - 6$, then the value of $\frac{1}{\alpha} + \frac{1}{\beta}$ is equal to :

(A)   – 1   (B)   1

(C)   – 3   (D)   3

Answer : (B) 1	1

16. The value of $\dfrac{\sin^2 90° + \cos^2 0°}{\sin^2 30° + \cos^2 30°}$ is :

(A)   1   (B)   0

(C)   2   (D)   4

Answer : (C) 2	1

17. The degree measure of the angle at the centre of a quadrant of a circle is :

(A)   30°   (B)   60°

(C)   90°   (D)   180°

Answer : (C) 90°	1

18. In a grouped frequency distribution, it is assumed that the frequency of each class interval is centered around its :

(A)   lower limit   (B)   upper limit

(C)   mid-point   (D)   None of the above

Answer : (C) mid-point	1

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

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

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

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

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

19.   *Assertion (A) :* If two triangles are equiangular, then they are similar.
      Reason (R) :   If two triangles are similar, then they are congruent.

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

20.   *Assertion (A) :* Area of a sector of a circle with radius r and angle with degree measure θ is $\frac{\theta}{360} \times 2\pi r$.

      Reason (R) :   Area of segment of a circle =
      Area of the corresponding sector – Area of the corresponding triangle.

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

SECTION B

*This section has **5** very short answer (VSA) type questions carrying **2** marks each.*   *5×2=10*

21. In the given figure, from a point L which is at a distance of 13 cm from the centre O of a circle of radius 5 cm, the pair of tangents LM and LN are drawn to the circle. Find the perimeter of quadrilateral LMON.

Solution: In Δ OLM,   ∠OML = 90°

∴ LM = $\sqrt{(13)^2 - (5)^2}$ = 12 (By Pythagoras. theorem)   **1**

LM = LN = 12 cm (tangents from external point to the circle are equal in length)

OM = ON = 5 cm

∴ Perimeter of quadrilateral LMON = 12 + 12 + 5 + 5 = 34 cm.   **1**

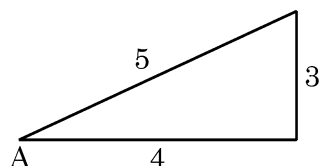
22. If 3 cot A = 4, then determine the value of $\cos^2 A - \sin^2 A$.

Solution:

$$\cos^2 A - \sin^2 A = \left(\frac{4}{5}\right)^2 - \left(\frac{3}{5}\right)^2$$

½ + ½

$$= \frac{7}{25}$$ **1**

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23. In a school, there are two Sections A and B of Class X. There are 48 students in Section A and 36 students in Section B. Determine the minimum number of books required for their class library so that they can be distributed equally among the students of Section A or that of Section B.

Solution: 48 = 2 × 2 × 2 × 2 × 3   **½**

36 = 2 × 2 × 3 × 3   **½**

LCM of (48, 36) = 2 × 2 × 2 × 2 × 3 × 3 = 144   **1**

Minimum number of books required for their class library so that they can be distributed equally among the students of Section A or that of Section B are144
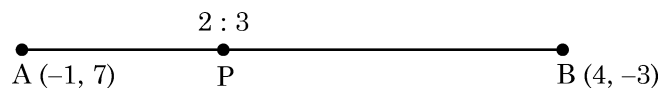
24. **(a)** Find the coordinates of the point which divides the join of $(-1, 7)$ and $(4, -3)$ in the ratio $2 : 3$.

OR

(b) Using distance formula, prove that the points A(3, 1), B(6, 4) and C(8, 6) are collinear.

Solution: **(a)**

$$2 : 3$$

A (–1, 7)　　　P　　　　　　　　B (4, –3)

Let   P (x, y) divides AB in the ratio 2: 3 internally

$$x = \frac{2(4) + 3\,(-1)}{2 + 3} = 1$$　　　　　　　　**1**

$$y = \frac{2(-3) + 3(7)}{2 + 3} = 3$$　　　　　　　　**1**

$\therefore$ Coordinate of the point P (1, 3)

OR

(b)

$$AB = \sqrt{18} = 3\sqrt{2}$$　　　　　　　½

$$BC = \sqrt{8} = 2\sqrt{2}$$　　　　　　　½

$$AC = \sqrt{50} = 5\sqrt{2}$$　　　　　　　½

$$3\sqrt{2} + 2\sqrt{2} = 5\sqrt{2}$$　　　　　　　½

$$AB + BC = AC$$

$\Rightarrow$ A, B and C are collinear.

25. **(a)** Find the zeroes of the polynomial $p(x) = x^2 + \frac{1}{6}x - 2$.

OR

(b) Find a quadratic polynomial whose one zero is 4 and product of zeroes is $- 20$.

Solution : **(a)** $p(x) = x^2 + \frac{1}{6}x - 2$

$$= \frac{1}{6}\,(6x^2 + x - 12)$$

$$= \frac{1}{6}\,[(2x + 3)\,(3x - 4)]$$　　　　　　　**1**

$$p(x) = 0$$

$$\Rightarrow x = \frac{-3}{2}, \frac{4}{3}$$

$\therefore$ zeroes are $\frac{-3}{2}, \frac{4}{3}$

½ + ½

OR

(b) One zero $= 4$, Product of zeroes $= -20$

$\therefore$ 2nd Zero $= \frac{-20}{4} = -5$

½

½

Sum of zeroes $= 4 + (-5) = -1$

$\therefore$ Quadratic Polynomial is $x^2 + x - 20$

1

SECTION C

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

26. If the point dividing the line segment joining the points A (3, 4) and B (k, 6) in the ratio 1 : 2, lies on the line x + y – 10 = 0, then find the value of 'k'.

Solution : A(3, 4), B(k, 6)

Point dividing AB in the ratio $1 : 2$ is $\left(\frac{6 + k}{3}, \frac{14}{3}\right)$

1

It lies on $x + y - 10 = 0$

$\therefore \frac{6 + k}{3} + \frac{14}{3} - 10 = 0$

1

$6 + k + 14 - 30 = 0$

$k = 10$

1

27. Prove that :

$$\sqrt{\frac{1 + \sin A}{1 - \sin A}} = \sec A + \tan A$$

Solution : LHS $= \sqrt{\frac{1 + \sin A}{1 - \sin A}} = \sqrt{\frac{(1 + \sin A)\,(1 + \sin A)}{(1 - \sin A)\,(1 + \sin A)}}$

1

$= \sqrt{\frac{(1 + \sin A)^2}{1 - \sin^2 A}} = \sqrt{\frac{(1 + \sin A)^2}{\cos^2 A}}$

1

$= \dfrac{1 + \sin A}{\cos A} = \dfrac{1}{\cos A} + \dfrac{\sin A}{\cos A} = \sec A + \tan A = \text{RHS}$	**1**
Hence proved	

28. Prove that the parallelogram circumscribing a circle is a rhombus.

Solution:
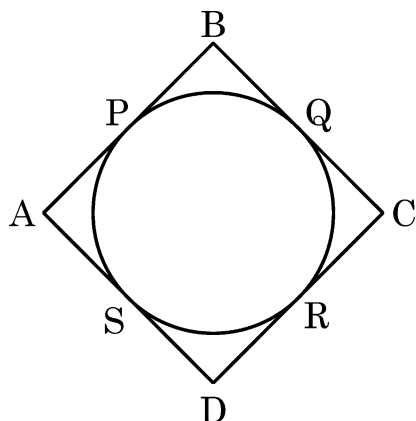
The lengths of tangents drawn from an external point to a circle are equal.

∴   AP = AS   (i)

      BP = BQ   (ii)

      CR = CQ   (iii)

      DR = DS   (iv)

1

Adding (i), (ii), (iii) and (iv)

AP + BP + CR + DR = AS + BQ + CQ + DS

∴ AB + CD = AD + BC

      ⇒ 2AB = 2 BC [As ABCD is parallelogram ∴ AB = CD, AD = BC]

1

      ⇒ AB = BC

      ∴ AB = BC = CD = DA

   ∴ Parallelogram ABCD is a rhombus.

1

29. (a)   Solve the following system of linear equations :

$$\frac{x}{a} - \frac{y}{b} = 0; \quad ax + by = a^2 + b^2$$

OR

(b)   For what value of 'p' will the following system of linear equations have **no** solution ?

$$(2p - 1)x + (p - 1)y = 2p + 1$$

$$3x + y = 1$$

Solution: (a) Solving the given equations to get x = a	1½
and y = b	1½

OR

(b)

For no solution,

$\dfrac{2p - 1}{3} = \dfrac{p - 1}{1} \neq \dfrac{2p + 1}{1}$	1
$\dfrac{2p - 1}{3} = \dfrac{p - 1}{1} \Rightarrow p = 2 \quad$ and $\quad \dfrac{p - 1}{1} \neq \dfrac{2p + 1}{1} \Rightarrow p \neq -2$	2

30. (a)   The length of the minute-hand of a clock is 14 cm. Find the area swept by this minute-hand in 5 minutes.

OR

(b)   To warn ships for underwater rocks, a lighthouse throws a red coloured light over a sector of central angle 80° up to a distance of 16·5 km. Find the area of the sea over which the ships are warned.

Solution: (a)Angle made by minute hand in 5 minutes = $\dfrac{360}{60} \times 5 = 30°$	
$\therefore \theta = 30°$	1
Length of minute hand = radius = 14 cm	
Area swept by minute hand in 5 minutes =Area of sector = $\dfrac{\pi r^2 \theta}{360°}$	
$= \dfrac{22}{7} \times 14 \times 14 \times \dfrac{30}{360}$	1
$= \dfrac{154}{3} \text{ cm}^2$ or 51.33 cm^2	1

OR

(b) $\theta = 80°$, $r = 16.5$ km.

Area of the sector $= \dfrac{\pi r^2 \theta}{360°}$

$= \dfrac{22}{7} \times 16.5 \times 16.5 \times \dfrac{80}{360}$ **2**

$= \dfrac{1331}{7}$ km^2 or 190.14 km^2 **1**

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31. The following table shows the marks obtained by 110 students of class X in a school during a particular academic session. Find the mode of the distribution.

Marks Obtained :	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100
Number of Students :	21	25	30	24	10

Solution: Modal Class is 40 – 60

$l = 40$, $f_1 = 30$, $f_0 = 25$, $f_2 = 24$, $h = 20$

Mode $= l + \left(\dfrac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h$

$= 40 + \left(\dfrac{30 - 25}{60 - 25 - 24} \right) \times 20$ **2½**

$= 40 + 9.1 = 49.1$ **½**

SECTION D

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

32. (a) A 2-digit number is such that the product of digits is 8. When 18 is subtracted from the number, the digits interchange their places. Find the number.

OR

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

Solution : (a) Let digit at unit place = x

$\therefore$ Digit at ten's place $= \dfrac{8}{x}$

ATQ

$\dfrac{80}{x} + x - 18 = 10x + \dfrac{8}{x}$ **2**

$9x^2 + 18x - 72 = 0$ or $x^2 + 2x - 8 = 0$

$(x - 2)(x + 4) = 0$

$x = 2, \; x = -4$ (rejecting)

$\therefore \; x = 2$, tens digit $= 4$ **2**

Two digit number $= 42$ **1**

OR

(b) Let larger number $= x$

Smaller number $= y$

ATQ;

$x^2 - y^2 = 180$ and $y^2 = 8x$ **2**

Put $y^2 = 8x$

$\Rightarrow x^2 - 8x - 180 = 0$

$x^2 - 18x + 10x - 180 = 0$

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

$x = 18, \; x = -10$ (rejecting)   **2**

$\therefore y^2 = 8x = 144 \Rightarrow y = \pm 12$

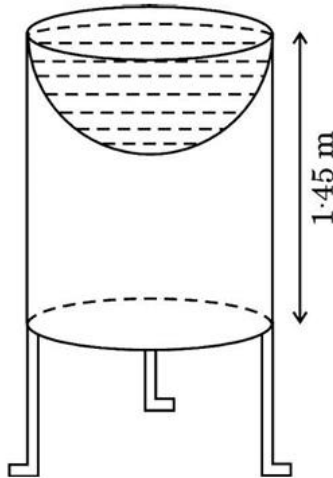$\therefore$ Numbers are   18 and - 12   or   18 and 12   **1**

33. Sukriti made a bird-bath for her garden in the shape of a hollow cylinder with a hemispherical depression at one end as shown in the figure. The height of the cylinder is 1·45 m and its radius is 30 cm. Find the total surface area of the bird-bath.

Solution :

Total surface area of bird-bath

= curved surface area of cylinder + curved surface area of hemisphere

= $2\pi rh + 2\pi r^2 = 2\pi r(h + r)$

$= \dfrac{22}{7} \times 30\ (145 + 30)$ 2+2

$= 2 \times \dfrac{22}{7} \times 30 \times 175 = 33000 \text{ cm}^2$ 1

34. (a) An aeroplane when flying at a height of 5000 m above the ground passes vertically above another aeroplane at an instant when the angles of elevation of the two planes from a point on the ground are 60° and 45° respectively. Find the vertical distance between the aeroplanes at that instant. [Use $\sqrt{3}$ = 1·732]

OR

(b) A TV tower stands vertically on a bank of a canal. From a point on the other bank directly opposite the tower, the angle of elevation of the top of the tower is 60°. From a point 20 m away from this point on the same bank, the angle of elevation of the top of the tower is 30°. Find the height of the tower and the width of the canal. [Use $\sqrt{3}$ = 1·73]

Solution: (a)
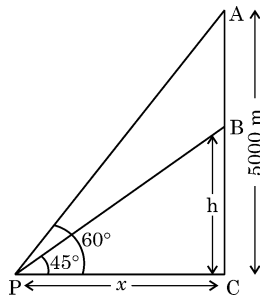
Let A and B be the positions of two aeroplanes.

Let BC = h, PC = x

In right Δ BCP,

$$\tan 45° = \frac{h}{x} \qquad \Rightarrow x = h \qquad\qquad\text{(i)}$$

In right Δ ACP,

$$\tan 60° = \frac{5000}{x} \quad \Rightarrow \quad \sqrt{3}\, x = 5000$$

$$\sqrt{3}\, h = 5000 \text{ (using (i) } x = h)$$

$$h = \frac{5000}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{5000\sqrt{3}}{3}$$

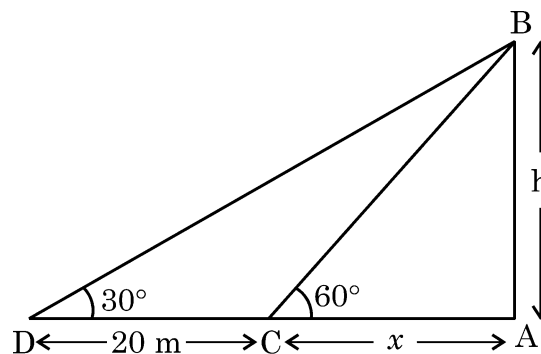$\therefore$ Vertical distance between aeroplanes = AB = 5000 – h

$$= 5000 - \frac{5000\sqrt{3}}{3}$$

$$= 5000 - \frac{5000\,(1.732)}{3}$$

$$= 2113.33 \text{ m}$$

OR

(b)

1 For Figure	
1½	
1½	
1	
1 For Figure	

In right $\triangle$ BAC, $\dfrac{h}{x} = \tan 60° \Rightarrow \quad h = \sqrt{3}\,x$ (i)   **1½**

In right $\triangle$ BAD, $\dfrac{h}{20 + x} = \tan 30°$

$\sqrt{3}\,h = 20 + x$

$\sqrt{3}\,(\sqrt{3}x) = 20 + x$ (Using (i) $h = \sqrt{3}\,x$)   **1½**

$3x = 20 + x$

$x = 10$ m

$\therefore$ Width of canal = 10 m.

Height of tower $\quad h = \sqrt{3}\,x$

$h = 10\sqrt{3}$ m
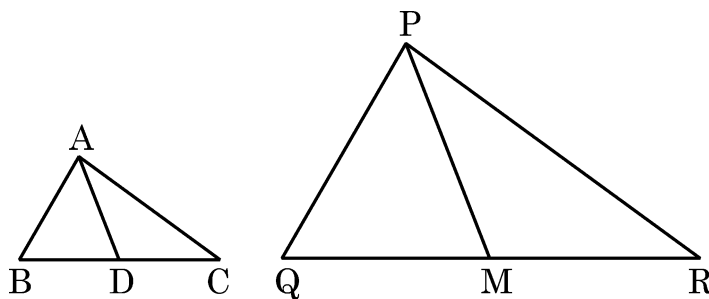
$h = 10(1.73) = 17.3$ m   **1**

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35. If AD and PM are medians of triangles ABC and PQR respectively, where $\triangle$ ABC ~ $\triangle$ PQR, then prove that $\dfrac{AB}{PQ} = \dfrac{AD}{PM}$.

Solution:

Given: AD and PM are medians of $\triangle$ABC and $\triangle$PQR respectively.

Also $\triangle$ ABC ~ $\triangle$ PQR

To Prove: $\dfrac{AB}{PQ} = \dfrac{AD}{PM}$

Proof:

$\triangle$ ABC ~ $\triangle$ PQR

$\Rightarrow \dfrac{AB}{PQ} = \dfrac{BC}{QR}$ **1**

$$\frac{AB}{PQ} = \frac{\frac{1}{2}\ BC}{\frac{1}{2}\ QR}$$

$$\frac{AB}{PQ} = \frac{BD}{QM} \qquad (\because D \text{ is midpoint of } BC \text{ and } M \text{ is midpoint of } QR)$$

In $\triangle ABD$ and $\triangle PQM$,

$\angle B = \angle Q \quad (\because \triangle ABC \sim \triangle PQR)$

$\dfrac{AB}{PQ} = \dfrac{BD}{QM}$ (Proved above)

$\therefore\ \triangle ABD \sim \triangle PQM$ (SAS similarity)

$\therefore$ Their corresponding sides are proportional

$\Rightarrow \dfrac{AB}{PQ} = \dfrac{AD}{PM}$ Hence proved

	1
	2
	1

SECTION E

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

Case Study – 1

36. Aarav and Ashima are brother and sister and on Ashima's birthday, Aarav gifts her a bag filled with 8 red toffees, 10 green toffees and 6 blue toffees. Ashima decides to randomly draw a toffee from the bag. She wants to find the chances of picking a toffee of specific colour and asks the following questions :
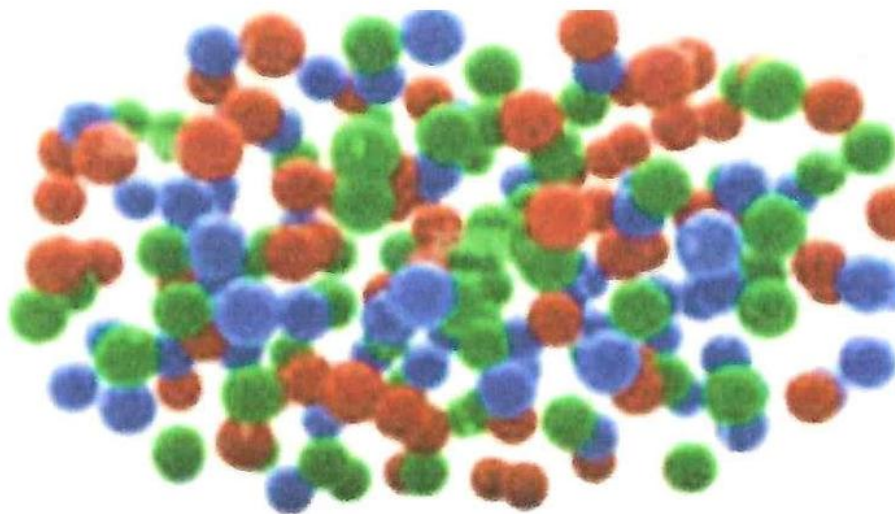
(i) What is the probability of getting a green toffee ?	1
(ii) What is the probability of getting a blue toffee ?	1
(iii) (a) What is the probability of getting a non-red toffee ?	2
OR	
(b) What is the probability of getting a red or a green toffee ?	2

Solution: (i) P (green toffee) = $\dfrac{10}{24}$ *or* $\dfrac{5}{12}$	1
(ii) P (blue toffee) = $\dfrac{6}{24}$ *or* $\dfrac{1}{4}$	1
(iii) (a) P (non-red toffee) = $\dfrac{10+6}{24}$ = $\dfrac{16}{24}$ *or* $\dfrac{2}{3}$	
OR	2
(iii) (b) P (Red or Green toffee) = $\dfrac{8+10}{24}$ = $\dfrac{18}{24}$ *or* $\dfrac{3}{4}$	2

Case Study – 2

37. In a charming village, there is a street called 'Maplewood Avenue', where the houses are numbered from 1 to 49. A community group has decided to undertake a green renovation project, aiming to install solar panels on the houses.

They have a few questions before they begin the project.

(i) How many houses are there on 'Maplewood Avenue' ?   1

(ii) The house numbers follow an Arithmetic Progression. What is the first term of the A.P. and the common difference ?   1

(iii) (a) If the group wanted to calculate the sum of all house numbers from 1 to 49, how much would that be ?   2

OR

(b) What is the sum of the house numbers between 15 and 30 ?   2

Solution: (i) 49 houses   1

(ii) First term 'a' = 1, common difference = 1   1

(iii) (a)   Sum (S_{49}) $= \dfrac{n}{2} [a + l]$

$$= \frac{49}{2} [1 + 49]$$

$$= 1225$$

OR

(iii) (b) Sum of house numbers between 15 & 30

16 + 17 + 18 + ... + 29

$$= \frac{n}{2} [2a + (n - 1) d] = \frac{14}{2} [2 \times 16 + 13]$$

$$= 315$$
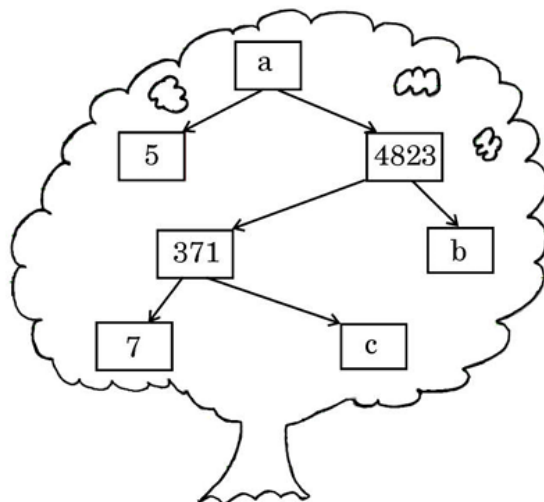
Case Study – 3

38. A Mathematics exhibition is being conducted in your school and one of your friends is making a model of a 'factor tree'. He has some difficulty and asks for your help in completing a quiz for the audience.

Observe the following 'factor tree' and answer the following questions :

(i) What is the value of a ?   1

(ii) (a) What is the value of b ?   2

OR

(b) What is the value of c ?   2

(iii) Write the prime factorisation of 24115.   1

Solution:	
(i) a = 5 × 4823 = 24115	1

(ii) (a) $4823 = 371 \times b$

$b = \dfrac{4823}{371} = 13$

OR

(ii) (b) $371 = 7 \times c$

$c = \dfrac{371}{7} = 53$

(iii) $24115 = 5 \times 7 \times 13 \times 53$

2

2

1