Series : L3NMK

SET ~ 1

रोल नं.
Roll No.

प्रश्न-पत्र कोड
Q.P. Code **30/3/1**

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

नोट / NOTE :

(I) कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ **27** हैं।
Please check that this question paper contains **27** 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 (मानक)

MATHEMATICS (STANDARD)

*निर्धारित समय : **3** घण्टे* | *अधिकतम अंक : **80***
*Time allowed : **3** hours* | *Maximum Marks : **80***

सामान्य निर्देश :

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

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

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

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

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

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

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

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

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

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

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

खण्ड क

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

1. द्विघात समीकरण $(x - 1)^2 = 16$ के मूल हैं :

(A) 5, 3

(B) 4, – 4

(C) 5, – 3

(D) – 5, 3

General Instructions :

Read the following instructions very carefully and strictly follow them :

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

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

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

(iv) *In **Section B,** Questions no. **21** to **25** are very short answer (VSA) type questions, carrying **2** marks each.*

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

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

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

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

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

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

SECTION A

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

1. The roots of the quadratic equation $(x - 1)^2 = 16$ are :

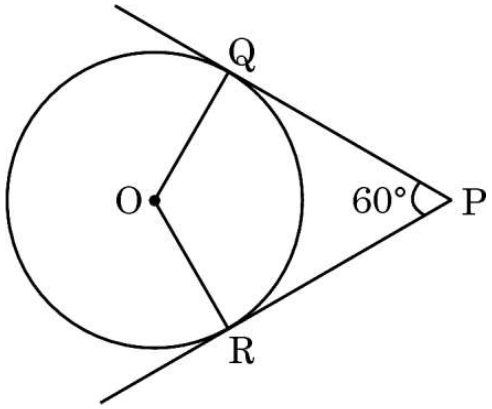
(A) 5, 3

(B) 4, – 4

(C) 5, – 3

(D) – 5, 3

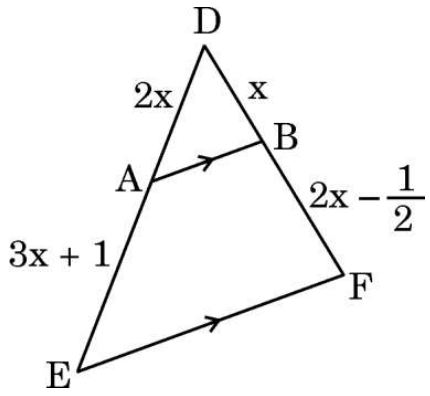
2. दी गई आकृति में, केन्द्र O तथा 3 cm त्रिज्या वाले वृत्त पर दो स्पर्श रेखाएँ PQ तथा PR खींची गई हैं। यदि $\angle QPR = 60°$ है, तो प्रत्येक स्पर्श रेखा की लम्बाई है :



(A) $3\sqrt{3}$ cm (B) 3 cm

(C) 6 cm (D) $\sqrt{3}$ cm

3. त्रिभुज DEF में AB ∥ EF है। x का मान है :



(A) 0, 2 (B) केवल 2

(C) – 2 (D) 1

4. $(3 \times 11 \times 13 + 3)$:

(A) एक अभाज्य संख्या है (B) 13 से विभाजित होती है

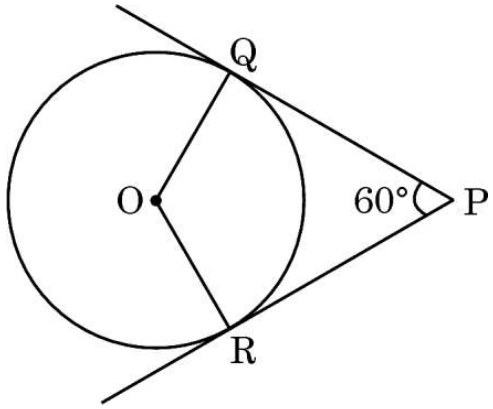
(C) एक भाज्य संख्या है (D) एक विषम संख्या है

5. दो पासे एक साथ फेंके जाते हैं। प्राप्त संख्याओं का योगफल 6 से भाज्य होने की प्रायिकता है :

(A) $\frac{1}{6}$ (B) $\frac{11}{36}$

(C) $\frac{1}{12}$ (D) $\frac{1}{4}$

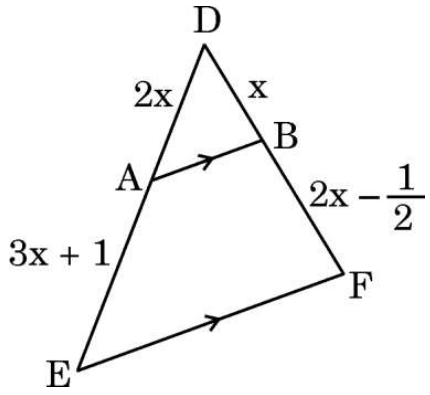
2. In the given figure, PQ and PR are tangents to a circle with centre O and radius 3 cm. If $\angle$ QPR = 60°, then the length of each tangent is :



(A) $3\sqrt{3}$ cm (B) 3 cm

(C) 6 cm (D) $\sqrt{3}$ cm

3. In Δ DEF, AB $\parallel$ EF. The value of x is :



(A) 0, 2 (B) 2 only

(C) – 2 (D) 1

4. $(3 \times 11 \times 13 + 3)$ is :

(A) a prime number (B) divisible by 13

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

5. Two dice are rolled together. The probability that the sum of the numbers obtained is divisible by 6, is :

(A) $\frac{1}{6}$ (B) $\frac{11}{36}$

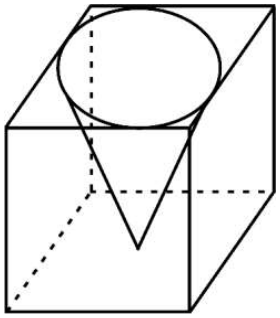
(C) $\frac{1}{12}$ (D) $\frac{1}{4}$

6. 12 तथा 250 के बीच की संख्याओं में 4 के गुणजों की संख्या है :

(A) 59 (B) 59·5

(C) 60 (D) 61

7. एक ठोस घन में से, जिसके प्रत्येक किनारे की लम्बाई l है, अधिकतम आकार का शंकु खोदकर निकाला जाता है। शंकु का आयतन है :



(A) $\frac{\pi l^3}{12}$ (B) $\frac{\pi l^3}{3}$

(C) $l^3\left(1-\frac{\pi}{3}\right)$ (D) $\frac{\pi l^3}{8}$

8. समीकरण $2x - 6y = 7$ को निरूपित करने वाली रेखा के समांतर एक अन्य रेखा का समीकरण है :

(A) $y = 3x - 7$ (B) $2x = 9 - 6y$

(C) $x - 3y = 7$ (D) $x = \frac{7}{2} - 3y$

9. यदि किसी मीनार की छाया की लम्बाई उसकी ऊँचाई की $\sqrt{3}$ गुना है, तो सूर्य का उन्नतांश है :

(A) 45° (B) 30°

(C) 60° (D) 15°

10. यदि द्विघात समीकरण $\sqrt{3}x^2 - kx + 2\sqrt{3} = 0$ के मूल वास्तविक तथा समान हैं, तो k का मान है :

(A) $\pm\sqrt{24}$ (B) 0

(C) 4 (D) – 5

11. समांतर श्रेढ़ी (A.P.) $\frac{-1}{3}, \frac{2}{3}, \frac{5}{3}, \frac{8}{3}, \ldots$ का nवाँ पद है :

(A) $3n - 4$ (B) $n - \frac{4}{3}$

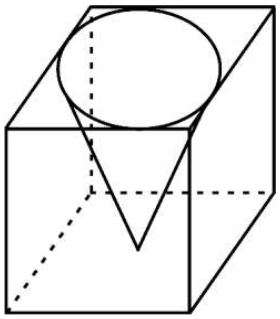
(C) $\frac{n-2}{3}$ (D) $\frac{n-4}{3}$

6. The number of multiples of 4 lying between 12 and 250 is :

(A) 59 (B) 59·5

(C) 60 (D) 61

7. A cone of maximum size is carved out from a solid cube of edge length l. The volume of the cone is :



(A) $\frac{\pi l^3}{12}$ (B) $\frac{\pi l^3}{3}$

(C) $l^3\left(1-\frac{\pi}{3}\right)$ (D) $\frac{\pi l^3}{8}$

8. Equation of another line parallel to the line represented by $2x - 6y = 7$ is :

(A) $y = 3x - 7$ (B) $2x = 9 - 6y$

(C) $x - 3y = 7$ (D) $x = \frac{7}{2} - 3y$

9. If the length of the shadow of a tower is $\sqrt{3}$ times that of its height, then altitude of the Sun is :

(A) 45° (B) 30°

(C) 60° (D) 15°

10. If the roots of the quadratic equation $\sqrt{3}x^2 - kx + 2\sqrt{3} = 0$ are real and equal, then the value(s) of k is/are :

(A) $\pm\sqrt{24}$ (B) 0

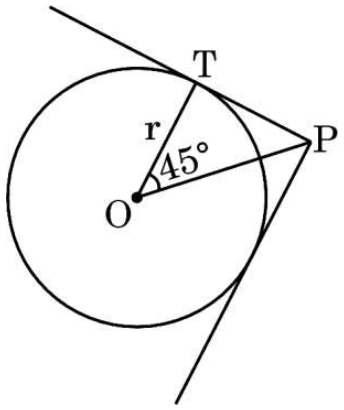
(C) 4 (D) – 5

11. The nth term of the A.P. $\frac{-1}{3}, \frac{2}{3}, \frac{5}{3}, \frac{8}{3}, \ldots$ is :

(A) $3n - 4$ (B) $n - \frac{4}{3}$

(C) $\frac{n-2}{3}$ (D) $\frac{n-4}{3}$

12. दी गई आकृति में, केन्द्र O तथा त्रिज्या r वाले वृत्त पर खींची गई स्पर्श रेखा PT है । यदि $\angle POT = 45°$ है, तो OP की लम्बाई है :



(A) $r\sqrt{2}$ (B) $\sqrt{2r}$

(C) $2r$ (D) r^2

13. दिया गया है कि $\Delta ABC \sim \Delta QRP$ है जहाँ AB = 9 cm, BC = 5 cm तथा PR = 2 cm है। भुजा QR की लम्बाई है :

(A) 0·9 cm (B) $\frac{5}{18}$ cm

(C) $\frac{10}{9}$ cm (D) 3·6 cm

14. द्विघात बहुपद p(x) के शून्यकों का योगफल तथा गुणनफल क्रमश: $\frac{-1}{3}$ तथा 2 है। बहुपद p(x) है :

(A) $3x^2 - x + 6$

(B) $x^2 + \frac{1}{3}x - 2$

(C) $3x^2 - x + 2$

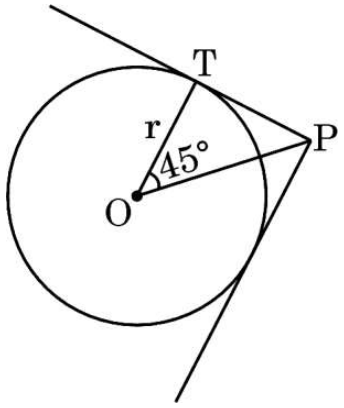
(D) $-3x^2 - x - 6$

15. दिया गया है कि $\sin 2\alpha = \frac{\sqrt{3}}{2}$ है। $\sin 3\alpha$ का मान है :

(A) $\frac{3\sqrt{3}}{4}$ (B) $\frac{1}{2}$

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

12. In the given figure, PT is a tangent to the circle with centre O and radius r. If $\angle$ POT = 45°, then the length of OP is :



(A) $r\sqrt{2}$ (B) $\sqrt{2r}$

(C) $2r$ (D) r^2

13. It is given that Δ ABC ~ Δ QRP such that AB = 9 cm, BC = 5 cm and PR = 2 cm. Length of side QR is :

(A) 0·9 cm (B) $\frac{5}{18}$ cm

(C) $\frac{10}{9}$ cm (D) 3·6 cm

14. The sum and product of zeroes of a quadratic polynomial p(x) are $\frac{-1}{3}$ and 2 respectively. The polynomial p(x) is :

(A) $3x^2 - x + 6$

(B) $x^2 + \frac{1}{3}x - 2$

(C) $3x^2 - x + 2$

(D) $-3x^2 - x - 6$

15. Given that $\sin 2\alpha = \frac{\sqrt{3}}{2}$, the value of $\sin 3\alpha$ is :

(A) $\frac{3\sqrt{3}}{4}$ (B) $\frac{1}{2}$

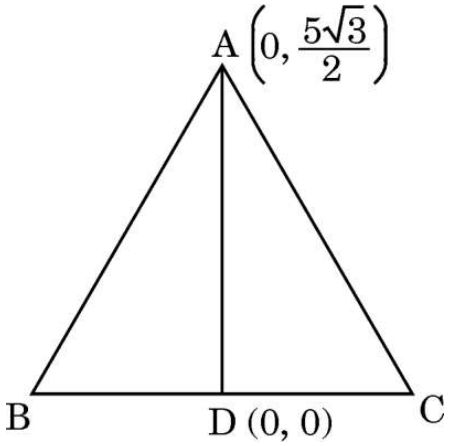
(C) 1 (D) $\frac{\sqrt{3}}{4}$

16. एक बंटन के माध्यक तथा बहुलक क्रमश: 25·2 तथा 26·1 हैं। इस बंटन का माध्य है :

(A) 24·75 (B) 24·25

(C) 24·3 (D) 25·5

17. दी गई आकृति में, Δ ABC एक समबाहु त्रिभुज है। बिंदुओं $A\left(0, \frac{5\sqrt{3}}{2}\right)$ तथा D(0, 0) को जोड़ने वाली माध्यिका AD है। बिंदु B तथा C के निर्देशांक (इसी क्रम में) हैं :



(A) (– 5, 0), (5, 0)

(B) $\left(-\frac{5}{2}, 0\right), \left(\frac{5}{2}, 0\right)$

(C) (– 10, 0), (10, 0)

(D) $(-5\sqrt{3}, 0), (5\sqrt{3}, 0)$

18. $(\frac{1}{2}\tan^2 45° - \cos^2 60°)$ का मान है :

(A) 0

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

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

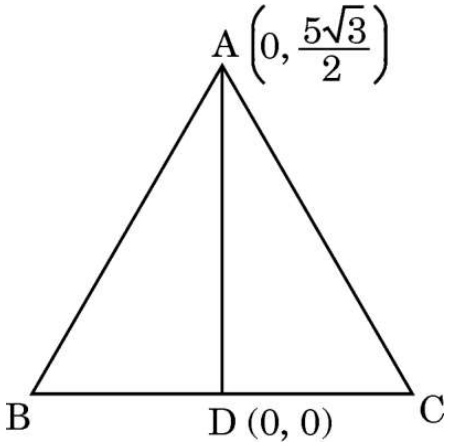
(D) $-\frac{1}{4}$

16. The median and mode of a distribution are 25·2 and 26·1 respectively. The mean of the distribution is :

(A) 24·75 (B) 24·25

(C) 24·3 (D) 25·5

17. In the given figure, Δ ABC is an equilateral triangle. AD is a median of the triangle joining the points $A\left(0, \frac{5\sqrt{3}}{2}\right)$, D(0, 0). Points B and C are (in same order) :



(A) (– 5, 0), (5, 0)

(B) $\left(-\frac{5}{2}, 0\right), \left(\frac{5}{2}, 0\right)$

(C) (– 10, 0), (10, 0)

(D) $(-5\sqrt{3}, 0), (5\sqrt{3}, 0)$

18. The value of $(\frac{1}{2}\tan^2 45° - \cos^2 60°)$ is :

(A) 0

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

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

(D) $-\frac{1}{4}$

*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) :* किसी वृत्त के केन्द्र से स्पर्श रेखा की न्यूनतम दूरी, त्रिज्या के बराबर होती है ।

तर्क (R) : त्रिज्या स्पर्श रेखा के लम्बवत् होती है ।

20. *अभिकथन (A) :* $\theta = 45°$ के लिए, $\tan 2\theta$ का मान परिभाषित नहीं है ।

तर्क (R) : $\sin 90° \neq \cos 90°$.

खण्ड ख

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

21. लकड़ी के उस पट्टे (Plank) की लम्बाई बताइए जिसकी सहायता से 4 m 20 cm तथा 5 m 4 cm लम्बाई को न्यूनतम समय में पूरा-पूरा नापा जा सके ।

22. (क) एक समांतर श्रेढ़ी (A.P.) में प्रथम पद 32 तथा अन्तिम पद – 10 है । यदि सार्व अन्तर – 2 हो, तो पदों की संख्या एवं उनका योगफल ज्ञात कीजिए ।

अथवा

(ख) उस समांतर श्रेढ़ी (A.P.) के प्रथम 28 पदों का योगफल ज्ञात कीजिए जिसका nवाँ पद $a_n = 3n - 2$ है ।

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

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

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

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

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

19. *Assertion (A) :* Radius is the smallest distance of a tangent from the centre of the circle.

Reason (R) : Radius is perpendicular to the tangent.

20. *Assertion (A) :* $\tan 2\theta$ is not defined at $\theta = 45°$.

Reason (R) : $\sin 90° \neq \cos 90°$.

SECTION B

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

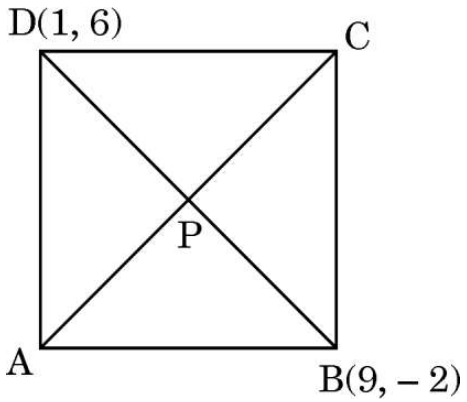
21. Find the length of the plank that can be used to measure the lengths 4 m 20 cm and 5 m 4 cm exactly, in the least time.

22. (a) In an A.P., the first term is 32 and the last term is – 10. If the common difference is – 2, then find the number of terms and their sum.

OR

(b) Find the sum of the first 28 terms of an A.P. whose n^{th} term is given by $a_n = 3n - 2$.

23. (क) वर्ग ABCD के विकर्ण AC तथा BD बिंदु P पर प्रतिच्छेद करते हैं। बिंदु B तथा D के निर्देशांक क्रमश: (9, – 2) तथा (1, 6) हैं।



(i) बिंदु P के निर्देशांक ज्ञात कीजिए।

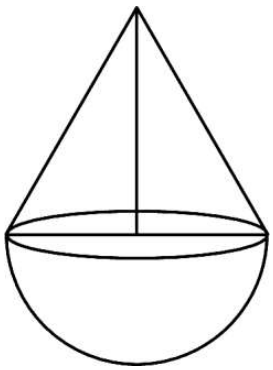
(ii) वर्ग की भुजा की लम्बाई ज्ञात कीजिए।

अथवा

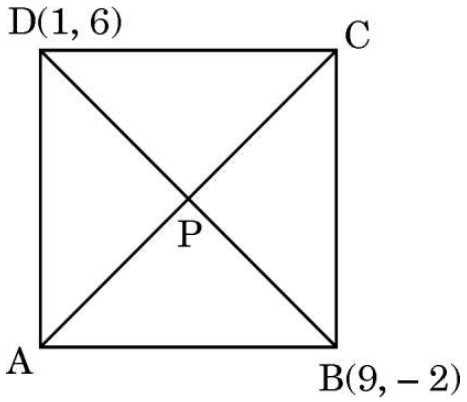
(ख) रेखा $x + y = 5$ पर स्थित उस बिंदु के निर्देशांक बताइए जो (6, 4) तथा (5, 2) से समदूरस्थ हो।

24. चतुर्भुज ABCD के विकर्ण परस्पर बिंदु O पर इस प्रकार प्रतिच्छेद करते हैं कि $\frac{AO}{OC} = \frac{BO}{OD}$ है। दर्शाइए कि चतुर्भुज ABCD एक समलम्ब है।

25. 7 cm त्रिज्या वाले अर्धगोले पर एक शंकु को अध्यारोपित करके एक खिलौना बनाया गया है। खिलौने की कुल ऊँचाई 31 cm है। खिलौने का सम्पूर्ण पृष्ठीय क्षेत्रफल ज्ञात कीजिए।



23. (a) Diagonals AC and BD of square ABCD intersect at P. Coordinates of points B and D are (9, – 2) and (1, 6) respectively.



(i) Find the co-ordinates of point P.

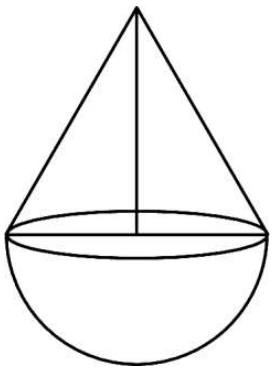
(ii) Find the length of the side of the square.

OR

(b) Find the coordinates of a point on the line $x + y = 5$ which is equidistant from (6, 4) and (5, 2).

24. The diagonals of a quadrilateral ABCD intersect each other at the point O such that $\frac{AO}{OC} = \frac{BO}{OD}$. Show that quadrilateral ABCD is a trapezium.

25. A toy is in the form of a cone mounted on a hemisphere of radius 7 cm. The total height of the toy is 31 cm. Find the total surface area of the toy.



खण्ड ग

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

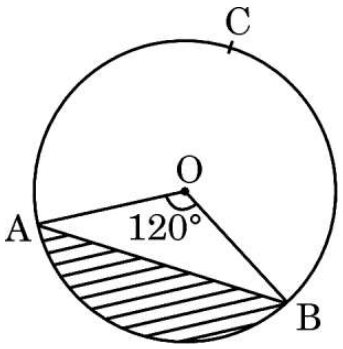
26. (क) यदि $\sin\theta + \cos\theta = \sqrt{3}$ है, तो सिद्ध कीजिए कि $\tan\theta + \cot\theta = 1$ है।

अथवा

(ख) सिद्ध कीजिए :

$$(\sin A + \sec A)^2 + (\cos A + \text{cosec } A)^2 = (1 + \sec A \text{ cosec } A)^2$$

27. दी गई आकृति में, 7 cm त्रिज्या वाले वृत्त के केन्द्र पर जीवा AB 120° का कोण अंतरित करती है। ज्ञात कीजिए (i) दीर्घ त्रिज्यखंड OACB का परिमाप, और (ii) छायांकित भाग का क्षेत्रफल, यदि Δ OAB का क्षेत्रफल $21{\cdot}2\ \text{cm}^2$ है।



28. सिद्ध कीजिए कि $\sqrt{5}$ एक अपरिमेय संख्या है।

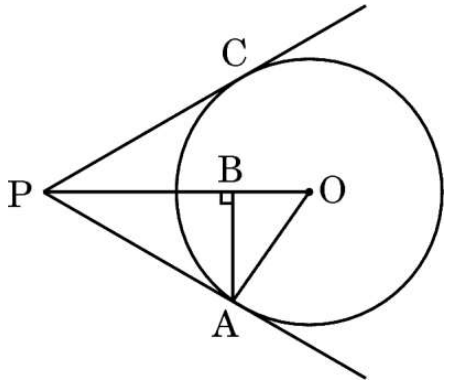
29. दो ऐसे क्रमागत ऋणात्मक पूर्णांक ज्ञात कीजिए जिनके वर्गों का योगफल 481 है।

30. बिंदु P(x, 7), बिंदुओं A(– 5, 4) तथा B(7, 9) को जोड़ने वाले रेखाखंड को एक निश्चित अनुपात में विभाजित करता है। वह अनुपात तथा x का मान ज्ञात कीजिए।

31. (क) बाह्य बिंदु P से, O केन्द्र वाले वृत्त पर स्पर्श रेखाएँ PA तथा PB खींची गई हैं। सिद्ध कीजिए कि $\angle$ APB = 2 $\angle$ OAB है।

अथवा

(ख) दी गई आकृति में, PA, O केन्द्र वाले वृत्त पर खींची गई ऐसी स्पर्श रेखा है कि OA = 10 cm, AB = 8 cm तथा AB $\perp$ OP है। PB की लम्बाई ज्ञात कीजिए।



SECTION C

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

26. (a) If $\sin\theta + \cos\theta = \sqrt{3}$, then prove that

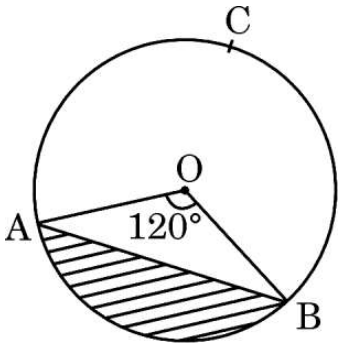
$$\tan\theta + \cot\theta = 1$$

OR

(b) Prove that :

$$(\sin A + \sec A)^2 + (\cos A + \text{cosec } A)^2 = (1 + \sec A \text{ cosec } A)^2$$

27. In the given figure, chord AB subtends an angle of 120° at the centre of the circle with radius 7 cm. Find (i) perimeter of major sector OACB, and (ii) area of the shaded segment, if area of Δ OAB = 21·2 cm^2.



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

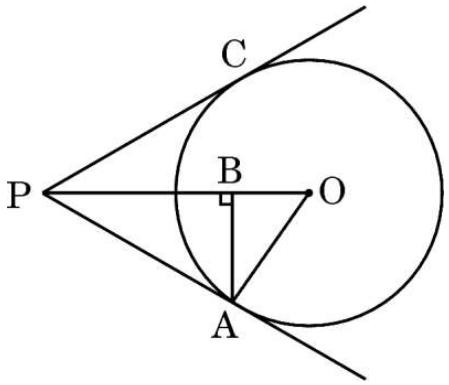
29. Find two consecutive negative integers, sum of whose squares is 481.

30. A point P(x, 7) divides a line segment joining the points A(– 5, 4) and B(7, 9) in a certain ratio. Find the ratio and hence find the value of x.

31. (a) Two tangents PA and PB are drawn to a circle with centre O from an external point P. Prove that $\angle$ APB = 2 $\angle$ OAB.

OR

(b) In the given figure, PA is the tangent to the circle with centre O such that OA = 10 cm, AB = 8 cm and AB $\perp$ OP. Find the length of PB.



खण्ड घ

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

32. (क) निम्नलिखित आँकड़ों का माध्यक 137 है। x तथा y के मान ज्ञात कीजिए, जहाँ सभी बारम्बारताओं का योगफल 68 है।

वर्ग	*बारम्बारता*
65 – 85	4
85 – 105	5
105 – 125	x
125 – 145	20
145 – 165	14
165 – 185	y
185 – 205	4

अथवा

(ख) निम्नलिखित आँकड़ों का माध्य तथा बहुलक ज्ञात कीजिए।

वर्ग	*बारम्बारता*
0 – 10	3
10 – 20	6
20 – 30	11
30 – 40	10
40 – 50	13
50 – 60	3
60 – 70	4

SECTION D

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

32. (a) The median of the following data is 137. Find the values of x and y, given that total of frequencies is 68.

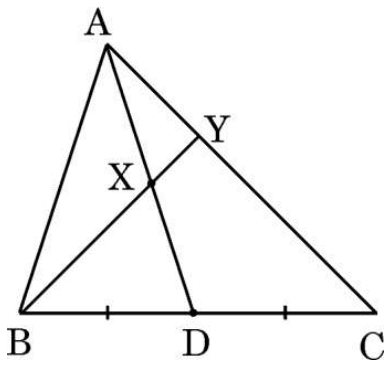
Class	*Frequency*
65 – 85	4
85 – 105	5
105 – 125	x
125 – 145	20
145 – 165	14
165 – 185	y
185 – 205	4

OR

(b) Find mean and mode of the following distribution :

Class	*Frequency*
0 – 10	3
10 – 20	6
20 – 30	11
30 – 40	10
40 – 50	13
50 – 60	3
60 – 70	4

33. बिंदु X, Δ ABC की माध्यिका AD पर स्थित ऐसा बिंदु है कि AX : XD = 2 : 3 है। BX को बढ़ाने पर यह भुजा AC को बिंदु Y पर प्रतिच्छेद करती है। सिद्ध कीजिए कि BX = 4 XY है।



34. (क) निम्नलिखित रैखिक समीकरण युग्म को ग्राफीय विधि से हल कीजिए :

$x - 2y = 3,\ 3x - 8y = 7$

अथवा

(ख) पाँच वर्ष पहले आदिल की उम्र भरत की उम्र की तीन गुना थी और दस वर्ष पश्चात् आदिल की उम्र भरत की उम्र की दोगुना होगी। आदिल तथा भरत की वर्तमान उम्र जानने के लिए :

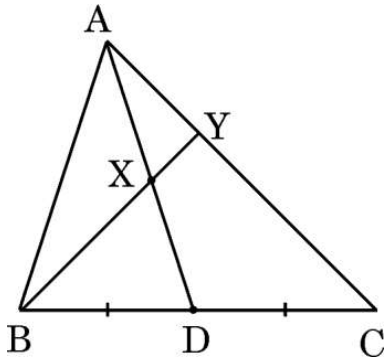
(i) उपर्युक्त परिस्थिति के आधार पर रैखिक समीकरण बनाइए।

(ii) दर्शाइए कि रैखिक समीकरण युग्म संगत है तथा इसका अद्वितीय हल है।

(iii) आदिल तथा भरत की वर्तमान आयु ज्ञात कीजिए।

35. समतल भूमि पर खड़ा एक लड़का 60 m लम्बी डोरी की सहायता से 30° के उन्नयन कोण पर एक पतंग उड़ा रहा है। दूसरा लड़का 20 m ऊँचे भवन की छत पर खड़ा है और उसी पतंग का उन्नयन कोण 45° पाता है। यदि दोनों लड़के पतंग की विपरीत दिशाओं में खड़े हों, तो भवन के आधार से पहले लड़के की दूरी तथा पतंग की भूमि से ऊँचाई ज्ञात कीजिए। ($\sqrt{3}$ = 1·73 लीजिए)

33. In Δ ABC, AD is a median. X is a point on AD such that AX : XD = 2 : 3. BX is extended so that it intersects AC at Y. Prove that BX = 4 XY.



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

$x - 2y = 3,\ 3x - 8y = 7$

OR

(b) Five years ago, Adil was thrice as old as Bharat. Ten years later Adil shall be twice as old as Bharat. To know the present ages of Adil and Bharat :

(i) form the linear equations representing the above information.

(ii) show that the system of equations is consistent with unique solution.

(iii) find the present ages of Adil and Bharat.

35. A boy standing on a horizontal plane is flying a kite with a string of length 60 m, at an angle of elevation of 30°. Another boy standing on the roof of a 20 m high building, finds the angle of elevation of same kite to be 45°. If both the boys are on opposite sides of the kite, find the distance of the first boy from the base of the building. Also, find the height of the kite from the ground. (Use $\sqrt{3} = 1{\cdot}73$)

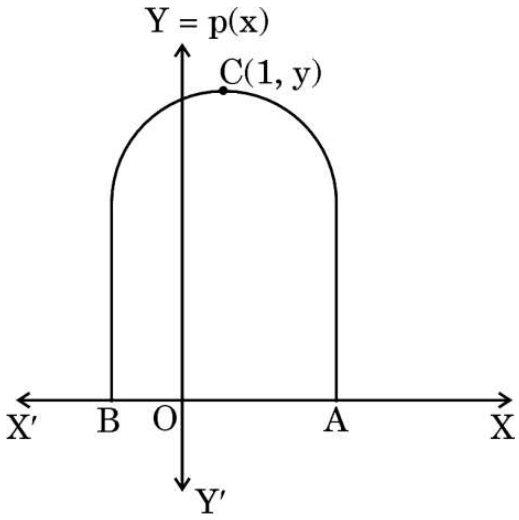
खण्ड ङ

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

प्रकरण अध्ययन – 1

36. रंगमंच के नाटक के दौरान, मंच की पृष्ठभूमि के लिए भवन मेहराब (arches) का प्रयोग किया गया। नीचे दिखाई गई एक मेहराब (arch) के वक्र को बहुपद $p(x) = -x^2 + 2x + 8$ के द्वारा निरूपित किया जा सकता है। यहाँ x मंच की सतह पर लम्बाई (फुट में) को दर्शाता है।





उपर्युक्त आकृति के आधार पर निम्नलिखित प्रश्नों के उत्तर दीजिए।

(i) मेहराब की ऊँचाई ज्ञात कीजिए। *1*

(ii) (क) बहुपद $p(x)$ के शून्यक ज्ञात कीजिए। उपर्युक्त ग्राफ में कौन-से बिंदु शून्यक को दर्शाते हैं ? *2*

अथवा

(ii) (ख) मंच की सतह पर मेहराब का विस्तार (span) ज्ञात कीजिए। *2*

(iii) उपर्युक्त वक्र तथा y-अक्ष के प्रतिच्छेदी बिंदु के निर्देशांक लिखिए। *1*

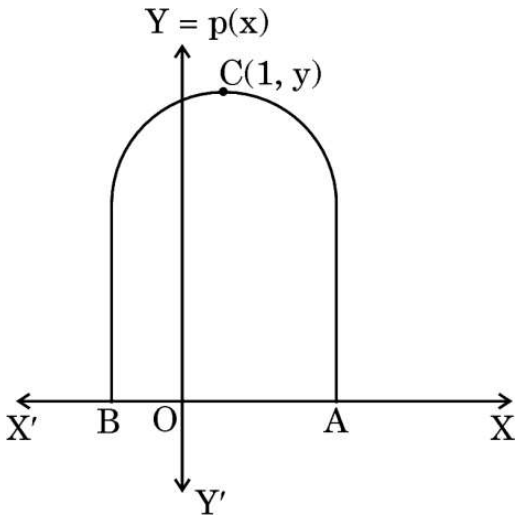
SECTION E

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

Case Study – 1

36. During a theatre drama, a backdrop of building arches was used. The shape of the curve shown below can be represented by the polynomial $p(x) = -x^2 + 2x + 8$, where x is the length (in feet) on stage level.





Based on the figure given above, answer the following questions :

(i) Determine the height of the arch. *1*

(ii) (a) Find zeroes of the polynomial p(x). Which points on the graph represent the zeroes ? *2*

OR

(ii) (b) Find the span of the arch on the stage floor. *2*

(iii) Write the coordinates of the point of intersection of the above curve with the y-axis. *1*

प्रकरण अध्ययन – 2

37. कुछ दोस्त ताश की दो एकसमान गड्डियों को लेकर उनसे ताश खेलना चाहते थे। ताश के पत्तों को फेंटते समय तीन पत्ते नीचे गिर गए। उन्होंने शेष पत्तों को अच्छी प्रकार फेंटकर यादृच्छया एक पत्ता निकाला। यह मानते हुए कि गिरे हुए तीन पत्तों में एक पान की बेगम, एक हुकुम का दस तथा एक चिड़ी का इक्का है, निम्नलिखित प्रश्नों के उत्तर दीजिए :



(i) इसकी क्या प्रायिकता है कि निकाला गया पत्ता एक फेस कार्ड (face card) है ? *1*

(ii) प्रायिकता ज्ञात कीजिए कि निकाला गया पत्ता बेगम या बादशाह है। *1*

(iii) (क) क्या आपको लगता है कि यदि कोई पत्ता नहीं गिरता, तो निकाले गए पत्ते के बेगम होने की प्रायिकता ज्यादा होती ? तर्क सहित उत्तर दीजिए। *2*

अथवा

(iii) (ख) प्रायिकता ज्ञात कीजिए कि निकाला गया पत्ता गुलाम है। इसकी तुलना उस स्थिति में निकाली गई प्रायिकता से कीजिए यदि कोई पत्ता नहीं गिरता। किस परिस्थिति में निकाले गए पत्ते के गुलाम होने की प्रायिकता अधिक है ? *2*

Case Study – 2

37. A group of friends wanted to play cards with two identical packs together. While shuffling the cards, three cards are dropped. Rest of the cards are shuffled and one card is drawn at random. Assuming that the dropped cards were a queen of hearts, a ten of spades and an ace of clubs, answer the following questions :



(i) Find the probability that the drawn card is a face card. *1*

(ii) Find the probability that the drawn card is either a king or a queen. *1*

(iii) (a) Do you think that the probability of getting a queen was higher if none of the cards were dropped ? Justify your answer. *2*

OR

(iii) (b) Find the probability that the drawn card is a jack. Compare it with the probability when none of the cards were dropped. In which case is the probability of getting a jack higher ? *2*

प्रकरण अध्ययन – 3

38. मेज पर रखने के लिए 'लीफी बॉल फाउन्टेन' का एक मॉडल बनाया गया। पानी सहजता से गेंद की सतह से बहता हुआ एक सुसज्जित बेलनाकार टंकी में जाता है जहाँ से पुन: वापस आता है।

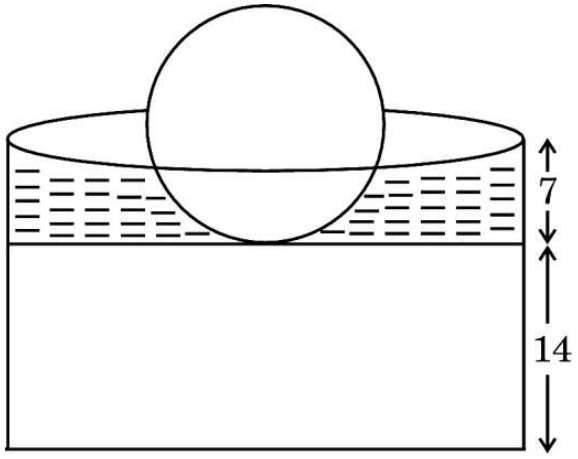
गोलाकार गेंद का व्यास 21 cm है।

बेलनाकार टंकी – बाह्य व्यास 50 cm है तथा आंतरिक व्यास 40 cm है।

ठोस आधार की ऊँचाई 14 cm है।

भरे हुए पानी की ऊँचाई 7 cm है।





उपर्युक्त आकृति के आधार पर निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) फव्वारे की कुल ऊँचाई ज्ञात कीजिए। *1*

(ii) गेंद का आयतन ज्ञात कीजिए। *1*

(iii) (क) यदि गेंद का एक-तिहाई हिस्सा पानी में डूबा हो, तो टंकी में पानी का आयतन ज्ञात कीजिए। *2*

अथवा

(iii) (ख) बेलनाकार भाग का बाह्य वक्र पृष्ठीय क्षेत्रफल तथा गेंद के पृष्ठीय क्षेत्रफल का योगफल ज्ञात कीजिए। *2*

Case Study – 3

38. A model of Leafy Ball Fountain is made to be kept on the tabletop. Water gently cascades down the ball into a decorative cylindrical pool where it is recycled.

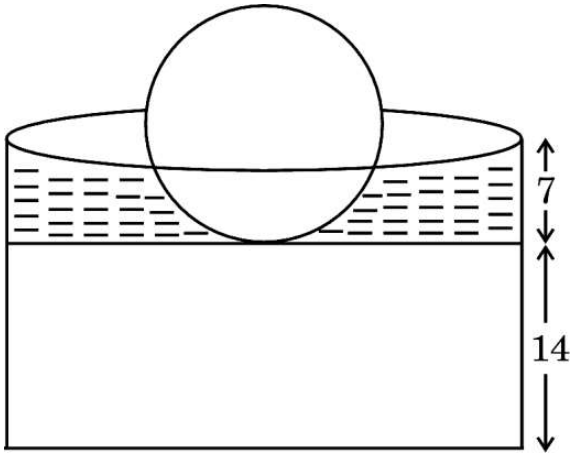
The diameter of spherical ball is 21 cm.

Cylindrical pool – Outer diameter is 50 cm and inner diameter is 40 cm.

Height of solid base is 14 cm.

Height of water filled is 7 cm.





Observe the figure and answer the following questions :

(i) Determine the total height of the fountain. *1*

(ii) Find the volume of the ball. *1*

(iii) (a) If one-third of the ball is submerged in the water, find the volume of the water filled in the pool. *2*

OR

(iii) (b) Find the sum of the outer curved surface area of the cylindrical part and surface area of the ball. *2*

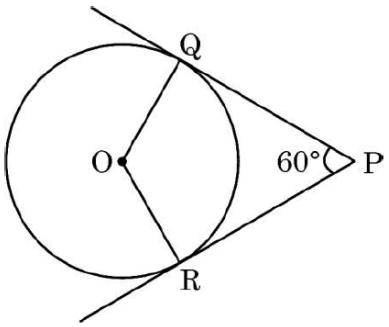
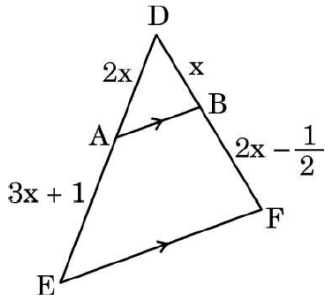
Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2026
MATHEMATICS (STANDARD) (041) (PAPER CODE 30/3/1)

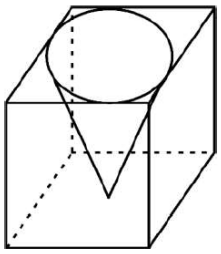
General Instructions: -

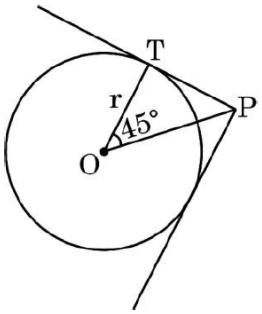
1.	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the Spot Evaluation Guidelines carefully.
2.	**"Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, Evaluation done and several other aspects. 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 BNS."**
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 the 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 totalled up and written on the left-hand margin and encircled. This may be followed strictly.
8.	If a question does not have any parts, marks must be awarded on the left-hand margin and encircled. This may also be followed strictly.

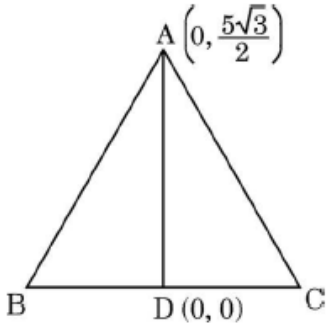
9.	If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note **"Extra Question"**.
10.	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
11.	A full scale of marks **0 to 80** (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 totalling of marks awarded to an answer. ● Wrong transfer of marks from the inside pages of the answer book to the title page. ● Wrong question wise totalling on the title page. ● Wrong totalling of marks of the two columns on the title page. ● Wrong grand total. ● Marks in words and figures not tallying/not same. ● Wrong transfer of marks from the answer book to Online Award List. ● Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.) ● Half or a part of answer marked correct and the rest as wrong, but no marks awarded.
14.	While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0) Marks.
15.	Any unassessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.
16.	The Examiners should acquaint themselves with the guidelines given in the "**Guidelines for spot Evaluation**" before starting the actual evaluation.
17.	Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totalled and written in figures and words.
18.	The candidates are entitled to obtain Photocopy of the Answer Book on request on payment of the prescribed processing fee. All Examiners/Additional Head Examiners/Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme.

MARKING SCHEME
MATHEMATICS (Subject Code–041)
(PAPER CODE: 30/3/1)

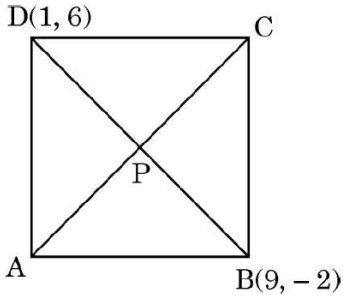
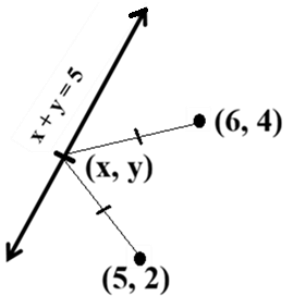
Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Step	Marks
	SECTION A This section has **20** Multiple Choice Questions (MCQs) carrying 1 mark each.		
1.	The roots of the quadratic equation $(x - 1)^2 = 16$ are : (A) 5, 3 (B) 4, – 4 (C) 5, – 3 (D) – 5, 3		
Sol.	(C) 5, – 3		**1**
2.	In the given figure, PQ and PR are tangents to a circle with centre O and radius 3 cm. If $\angle$ QPR = 60°, then the length of each tangent is :  (A) $3\sqrt{3}$ cm (B) 3 cm (C) 6 cm (D) $\sqrt{3}$ cm		
Sol.	(A) $3\sqrt{3}$ cm		**1**
3.	In Δ DEF, AB $\parallel$ EF. The value of x is :  (A) 0, 2 (B) 2 only (C) – 2 (D) 1		
Sol.	(B) 2 only		**1**

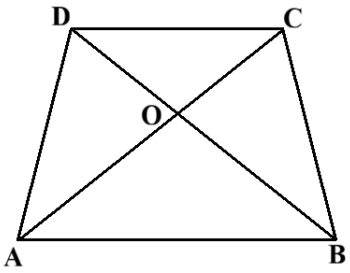
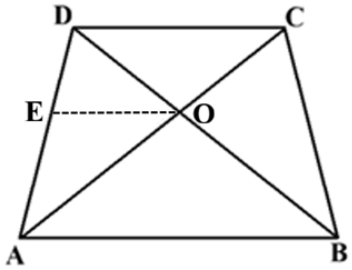
4.	$(3 \times 11 \times 13 + 3)$ is : (A) a prime number (B) divisible by 13 (C) a composite number (D) an odd number		
Sol.	(C) a composite number		**1**
5.	Two dice are rolled together. The probability that the sum of the numbers obtained is divisible by 6, is : (A) $\frac{1}{6}$ (B) $\frac{11}{36}$ (C) $\frac{1}{12}$ (D) $\frac{1}{4}$		
Sol.	(A) $\frac{1}{6}$		**1**
6.	The number of multiples of 4 lying between 12 and 250 is : (A) 59 (B) 59·5 (C) 60 (D) 61		
Sol.	(A) 59		**1**
7.	A cone of maximum size is carved out from a solid cube of edge length l. The volume of the cone is :  (A) $\frac{\pi l^3}{12}$ (B) $\frac{\pi l^3}{3}$ (C) $l^3\left(1-\frac{\pi}{3}\right)$ (D) $\frac{\pi l^3}{8}$		
Sol.	(A) $\frac{\pi l^3}{12}$		**1**
8.	Equation of another line parallel to the line represented by $2x - 6y = 7$ is : (A) $y = 3x - 7$ (B) $2x = 9 - 6y$ (C) $x - 3y = 7$ (D) $x = \frac{7}{2} - 3y$		
Sol.	(C) $x - 3y = 7$		**1**
9.	If the length of the shadow of a tower is $\sqrt{3}$ times that of its height, then altitude of the Sun is : (A) 45° (B) 30° (C) 60° (D) 15°		
Sol.	(B) 30°		**1**

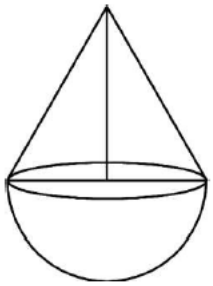
10.	If the roots of the quadratic equation $\sqrt{3}x^2 - kx + 2\sqrt{3} = 0$ are real and equal, then the value(s) of k is/are : (A) $\pm\sqrt{24}$ (B) 0 (C) 4 (D) -5		
Sol.	(A) $\pm\sqrt{24}$		**1**
11.	The nth term of the A.P. $\frac{-1}{3}, \frac{2}{3}, \frac{5}{3}, \frac{8}{3}, \ldots$ is : (A) $3n - 4$ (B) $n - \frac{4}{3}$ (C) $\frac{n-2}{3}$ (D) $\frac{n-4}{3}$		
Sol.	(B) $n - \frac{4}{3}$		**1**
12.	In the given figure, PT is a tangent to the circle with centre O and radius r. If $\angle POT = 45°$, then the length of OP is :  (A) $r\sqrt{2}$ (B) $\sqrt{2r}$ (C) $2r$ (D) r^2		
Sol.	(A) $r\sqrt{2}$		**1**
13.	It is given that $\Delta ABC \sim \Delta QRP$ such that AB = 9 cm, BC = 5 cm and PR = 2 cm. Length of side QR is : (A) 0·9 cm (B) $\frac{5}{18}$ cm (C) $\frac{10}{9}$ cm (D) 3·6 cm		
Sol.	(D) 3.6 cm		**1**
14.	The sum and product of zeroes of a quadratic polynomial p(x) are $\frac{-1}{3}$ and 2 respectively. The polynomial p(x) is : (A) $3x^2 - x + 6$ (B) $x^2 + \frac{1}{3}x - 2$ (C) $3x^2 - x + 2$ (D) $-3x^2 - x - 6$		
Sol.	(D) $-3x^2 - x - 6$		**1**

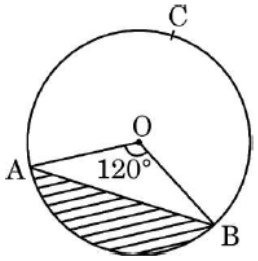
15.	Given that $\sin 2\alpha = \frac{\sqrt{3}}{2}$, the value of $\sin 3\alpha$ is : (A) $\frac{3\sqrt{3}}{4}$ (B) $\frac{1}{2}$ (C) 1 (D) $\frac{\sqrt{3}}{4}$		
Sol.	(C) 1		**1**
16.	The median and mode of a distribution are 25·2 and 26·1 respectively. The mean of the distribution is : (A) 24·75 (B) 24·25 (C) 24·3 (D) 25·5		
Sol.	(A) 24.75		**1**
17.	In the given figure, Δ ABC is an equilateral triangle. AD is a median of the triangle joining the points $A\left(0, \frac{5\sqrt{3}}{2}\right)$, D(0, 0). Points B and C are (in same order) :  (A) (– 5, 0), (5, 0) (B) $\left(-\frac{5}{2}, 0\right), \left(\frac{5}{2}, 0\right)$ (C) (– 10, 0), (10, 0) (D) $(-5\sqrt{3}, 0), (5\sqrt{3}, 0)$		
Sol.	(B) $\left(-\frac{5}{2}, 0\right), \left(\frac{5}{2}, 0\right)$		**1**
18.	The value of $(\frac{1}{2}\tan^2 45° - \cos^2 60°)$ is : (A) 0 (B) $-\frac{1}{2}$ (C) $\frac{1}{4}$ (D) $-\frac{1}{4}$		
Sol.	(C) $\frac{1}{4}$		**1**

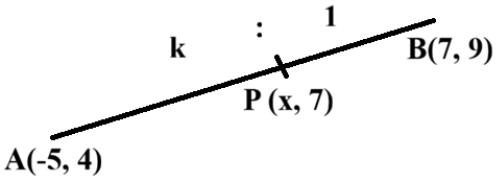
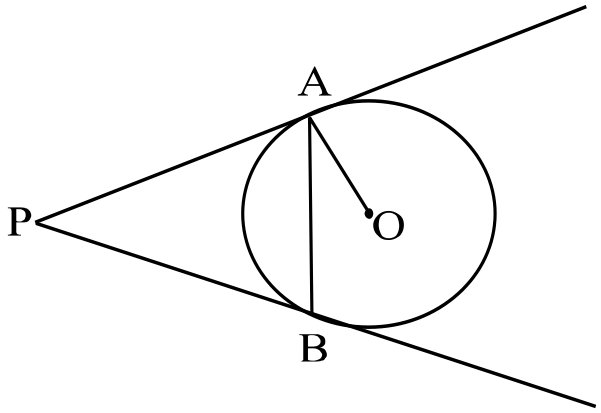
	*Questions number **19** and **20** are Assertion and Reason based questions. Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.* (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A). (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is ***not*** the correct explanation of the Assertion (A). (C) Assertion (A) is true, but Reason (R) is false. (D) Assertion (A) is false, but Reason (R) is true.		
19.	*Assertion (A) :* Radius is the smallest distance of a tangent from the centre of the circle. *Reason (R) :* Radius is perpendicular to the tangent.		
Sol.	(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).		**1**
20.	*Assertion (A) :* $\tan 2\theta$ is not defined at $\theta = 45°$. *Reason (R) :* $\sin 90° \neq \cos 90°$.		
Sol.	(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).		**1**
	SECTION B This section has **5** Very Short Answer (VSA) type questions carrying 2 marks each.		
21.	Find the length of the plank that can be used to measure the lengths 4 m 20 cm and 5 m 4 cm exactly, in the least time.		
Sol.	4 m 20 cm = 420 cm and 5 m 4 cm = 504 cm Size of plank should be maximum, so we will find HCF (420, 504) $420 = 2^2 \times 3 \times 5 \times 7$ and $504 = 2^3 \times 3^2 \times 7$ HCF (420, 504) = 84 $\therefore$ the required length of the plank is 84 cm	**I** **II** **III**	½ **1** ½
22 (a)	In an A.P., the first term is 32 and the last term is – 10. If the common difference is – 2, then find the number of terms and their sum.		
Sol.	Here a = 32, $l = -10$ and d = – 2 $\therefore 32 + (n-1)(-2) = -10$ $\Rightarrow n = 22$ $S_{22} = \frac{22}{2} \times [32 + (-10)]$ $= 242$	 **I** **II** **III** **IV**	 ½ ½ ½ ½
	OR		

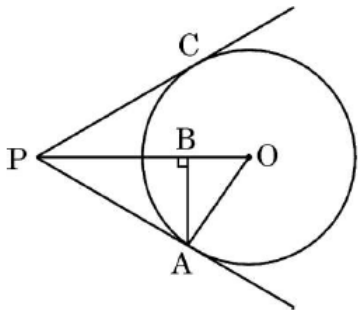
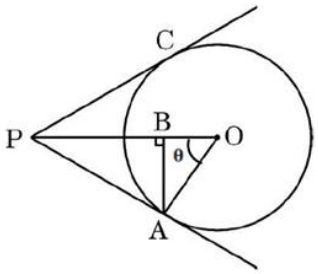
22 (b)	Find the sum of the first 28 terms of an A.P. whose n^{th} term is given by $a_n = 3n - 2$.		
Sol.	$a_1 = 3(1) - 2 = 1$	**I**	½
	and $a_{28} = 3(28) - 2 = 82$	**II**	½
	$S_{28} = \frac{28}{2} \times (1 + 82)$	**III**	½
	$= 1162$	**IV**	½
23 (a)	Diagonals AC and BD of square ABCD intersect at P. Coordinates of points B and D are (9, – 2) and (1, 6) respectively.  (i) Find the co-ordinates of point P. (ii) Find the length of the side of the square.		
Sol.	(i) Coordinates of P are $\left(\frac{9+1}{2}, \frac{-2+6}{2}\right) = (5, 2)$	**I**	**1**
	(ii) $2\,AB^2 = BD^2$		
	$\Rightarrow 2\,AB^2 = (9 - 1)^2 + (-2 - 6)^2$	**II**	½
	$\Rightarrow AB = 8$	**III**	½
	Hence, the length of the side of square is 8 units.		
	OR		
23 (b)	Find the coordinates of a point on the line $x + y = 5$ which is equidistant from (6, 4) and (5, 2).		
Sol.	 Let the required point be (x, y) which is equidistant from (6, 4) and (5, 2) $\therefore (6 - x)^2 + (4 - y)^2 = (5 - x)^2 + (2 - y)^2$	**I**	**1**

	⇒ 2x + 4y = 23 --- (i) Since point (x, y) also lies on the line x + y = 5 ∴ x + y = 5 --- (ii) Solving (i) and (ii), we get x = $-\frac{3}{2}$ and y = $\frac{13}{2}$ So, the coordinates of the required point are $\left(-\frac{3}{2}, \frac{13}{2}\right)$	**II** **III**	½ ½
24.	The diagonals of a quadrilateral ABCD intersect each other at the point O such that $\frac{AO}{OC} = \frac{BO}{OD}$. Show that quadrilateral ABCD is a trapezium.		
Sol.	 Correct figure Δ AOB ~ Δ COD ∴ ∠OAB = ∠OCD As alternate angles are equal, so DC ‖ AB Therefore, ABCD is a trapezium. **Alternate solution:**  Correct figure. Draw EO ‖ AB to intersect AD at E. In ΔABD, EO ‖ AB ∴ $\frac{AE}{ED} = \frac{BO}{OD}$ Given, $\frac{AO}{OC} = \frac{BO}{OD}$ So, $\frac{AE}{ED} = \frac{AO}{OC}$ ∴ EO‖ DC So, DC ‖ AB Therefore, ABCD is a trapezium.	**I** **II** **III** **I** **II** **III** **IV**	½ **1** ½ ½ ½ ½ ½

25.	A toy is in the form of a cone mounted on a hemisphere of radius 7 cm. The total height of the toy is 31 cm. Find the total surface area of the toy. 		
Sol.	Height of conical part = 31 – 7 = 24 cm Slant height of conical part = $\sqrt{(7)^2 + (24)^2}$ = 25 cm TSA of the toy = CSA of conical part + CSA of hemispherical part $= \frac{22}{7} \times 7 \times 25 + 2 \times \frac{22}{7} \times 7 \times 7$ $= 858 \text{ cm}^2$ So, the total surface area of the toy is 858 cm^2.	**I** **II** **III**	½ **1** ½
	SECTION C This section has **6** Short Answer (SA) type questions carrying 3 marks each.		
26 (a)	If $\sin\theta + \cos\theta = \sqrt{3}$, then prove that $\tan\theta + \cot\theta = 1$		
Sol.	$(\sin\theta + \cos\theta)^2 = (\sqrt{3})^2$ $\Rightarrow \sin^2\theta + \cos^2\theta + 2\sin\theta\cos\theta = 3$ $\Rightarrow \sin\theta\cos\theta = 1$ --- (i) LHS = $\tan\theta + \cot\theta = \frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta} = \frac{\sin^2\theta + \cos^2\theta}{\cos\theta\sin\theta} = \frac{1}{\cos\theta\sin\theta}$ $= 1$ [using (i)] = RHS	**I** **II** **III** **IV**	½ **1** **1** ½
	OR		
26 (b)	Prove that : $(\sin A + \sec A)^2 + (\cos A + \text{cosec } A)^2 = (1 + \sec A \text{ cosec } A)^2$		
Sol.	LHS = $\left(\sin A + \frac{1}{\cos A}\right)^2 + \left(\cos A + \frac{1}{\sin A}\right)^2$ $= \sin^2 A + \frac{1}{\cos^2 A} + \frac{2\sin A}{\cos A} + \cos^2 A + \frac{1}{\sin^2 A} + \frac{2\cos A}{\sin A}$ $= 1 + \left(\frac{1}{\sin^2 A} + \frac{1}{\cos^2 A}\right) + 2\left(\frac{\sin A}{\cos A} + \frac{\cos A}{\sin A}\right)$ $= 1 + \frac{1}{\cos^2 A \sin^2 A} + \frac{2}{\cos A \sin A}$ $= 1 + \sec^2 A \text{ cosec}^2 A + 2 \sec A \text{ cosec } A$ $= (1 + \sec A \text{ cosec } A)^2$ = RHS	**I** **II** **III** **IV**	½ **1** **1** ½

27.	In the given figure, chord AB subtends an angle of 120° at the centre of the circle with radius 7 cm. Find (i) perimeter of major sector OACB, and (ii) area of the shaded segment, if area of Δ OAB = 21·2 cm^2.  		
Sol.	(i) Perimeter of major sector = length of major arc ACB + 2 × radius		
	$= \frac{(360-120)}{360} \times 2 \times \frac{22}{7} \times 7 + 2 \times 7$	**I**	**1**
	$= \frac{130}{3}$ cm or 43.3 cm	**II**	½
	So, perimeter of major sector is $\frac{130}{3}$ cm or 43.3 cm		
	(ii) Area of shaded segment = Area of minor sector – Area of ΔOAB		
	$= \frac{120}{360} \times \frac{22}{7} \times 7 \times 7 - 21.2$	**III**	**1**
	= 30.1 cm^2	**IV**	½
	So, area of shaded segment is 30.1 cm^2.		
28.	Prove that $\sqrt{5}$ is an irrational number.		
Sol.	Let $\sqrt{5}$ be a rational number.		
	$\therefore \sqrt{5} = \frac{p}{q}$, where q ≠ 0 and p & q are coprime.	**I**	½
	$5q^2 = p^2 \implies p^2$ is divisible by 5 $\implies$ p is divisible by 5 ----- (i)	**II**	**1**
	Let p = 5a, where 'a' is some integer		
	$25a^2 = 5q^2 \implies q^2 = 5a^2 \implies q^2$ is divisible by 5 $\implies$ q is divisible by 5 ----- (ii)	**III**	**1**
	(i) and (ii) leads to contradiction as 'p' and 'q' are coprime.	**IV**	½
	$\therefore \sqrt{5}$ is an irrational number.		
29.	Find two consecutive negative integers, sum of whose squares is 481.		
Sol.	Let two consecutive negative integers be x and (x + 1)		
	According to given statement,		
	$x^2 + (x + 1)^2 = 481$	**I**	**1**
	$\Rightarrow x^2 + x - 240 = 0$	**II**	½
	$\Rightarrow (x + 16)(x - 15) = 0$	**III**	**1**
	$\therefore$ x = – 16 or 15		
	x = 15 does not satisfy the given condition.		
	So, required integers are – 16 and – 15.	**IV**	½

30.	A point P(x, 7) divides a line segment joining the points A(– 5, 4) and B(7, 9) in a certain ratio. Find the ratio and hence find the value of x.		
Sol.			
	Let AP : PB = k : 1	**I**	½
	$\therefore 7 = \frac{9k+4}{k+1} \Rightarrow k = \frac{3}{2}$	**II**	**1**
	So, required ratio is 3 : 2	**III**	½
	Hence, $x = \frac{7\times3+(-5)\times2}{3+2} = \frac{11}{5}$	**IV**	**1**
31 (a)	Two tangents PA and PB are drawn to a circle with centre O from an external point P. Prove that $\angle APB = 2\angle OAB$.		
Sol.			
	Correct figure.	**I**	½
	OA ⊥ AP		
	$\therefore \angle PAB = 90° - \angle OAB$ --- (i)	**II**	½
	PA = PB		
	$\therefore \angle PAB = \angle PBA$		
	Hence, $\angle APB = 180° - 2\angle PAB$	**III**	**1**
	Using (i), $\angle APB = 180° - 2(90° - \angle OAB)$	**IV**	½
	$\Rightarrow \angle APB = 2\angle OAB$	**V**	½
	OR		

31 (b)	In the given figure, PA is the tangent to the circle with centre O such that OA = 10 cm, AB = 8 cm and AB ⊥ OP. Find the length of PB.  		
Sol.	 		
	In right angled ΔOBA, OB = $\sqrt{(10)^2-(8)^2}$ = 6 cm	**I**	½
	Let ∠AOB = θ		
	So, tan θ = $\frac{8}{6}$ --- (i)	**II**	½
	In right angled ΔOAP		
	$\frac{AP}{10}$ = tan θ		
	∴ $\frac{AP}{10}=\frac{8}{6}$ [using (i)]	**III**	½
	⇒ AP = $\frac{40}{3}$ cm	**IV**	½
	∴ OP = $\sqrt{\left(\frac{40}{3}\right)^2+(10)^2}=\frac{50}{3}$ cm	**V**	½
	PB = OP – OB = $\frac{50}{3}-6=\frac{32}{3}$ cm or 10.6 cm	**VI**	½
	Alternate solution:		
	In right angled ΔOBA,		
	OB = $\sqrt{(10)^2-(8)^2}$ = 6 cm	**I**	½
	In right angled ΔPBA		
	$PA^2 = PB^2 + (8)^2 = PB^2 + 64$ --- (i)	**II**	½
	In right angled ΔPAO		
	$PA^2 = OP^2 - (10)^2 = (PB + 6)^2 - 100$ --- (ii)	**III**	**1**
	From (i) and (ii), we have		
	$PB^2 + 64 = (PB + 6)^2 - 100 \Rightarrow PB = \frac{32}{3}$ cm or 10.6 cm	**IV**	**1**

SECTION D

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

32 (a) The median of the following data is 137. Find the values of x and y, given that total of frequencies is 68.

Class	*Frequency*
65 – 85	4
85 – 105	5
105 – 125	x
125 – 145	20
145 – 165	14
165 – 185	y
185 – 205	4

Sol.

Class	***f***	***cf***
65 – 85	4	4
85 – 105	5	9
105 – 125	x	9 + x
125 – 145	20	29 + x
145 – 165	14	43 + x
165 – 185	y	43 + x + y
185 – 205	4	47 + x + y

Correct table — **I** — **1½**

Given, Median = 137

∴ Median Class is 125 – 145. — **II** — **½**

$125 + \left[\frac{\frac{68}{2} - (9+x)}{20}\right] \times 20 = 137$ — **III** — **1**

$\Rightarrow x = 13$ — **IV** — **1**

Also, $47 + x + y = 68$

$\therefore 47 + 13 + y = 68 \Rightarrow y = 8$ — **V** — **1**

OR

32 (b) Find mean and mode of the following distribution :

Class	*Frequency*
0 – 10	3
10 – 20	6
20 – 30	11
30 – 40	10
40 – 50	13
50 – 60	3
60 – 70	4

Sol.

Class	x_i	f_i	$u_i = \frac{x_i - 35}{10}$	$f_i u_i$
0 – 10	5	3	–3	– 9
10 – 20	15	6	–2	– 12
20 – 30	25	11	–1	– 11
30 – 40	35	10	0	0
40 – 50	45	13	1	13
50 – 60	55	3	2	6
60 – 70	65	4	3	12
Total		**50**		**– 1**

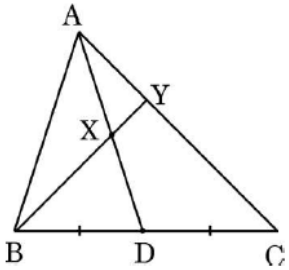
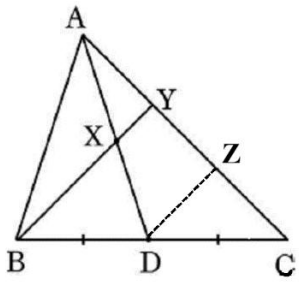
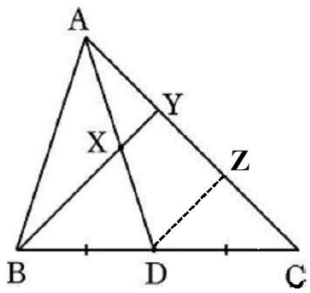
Correct table **I** **2**

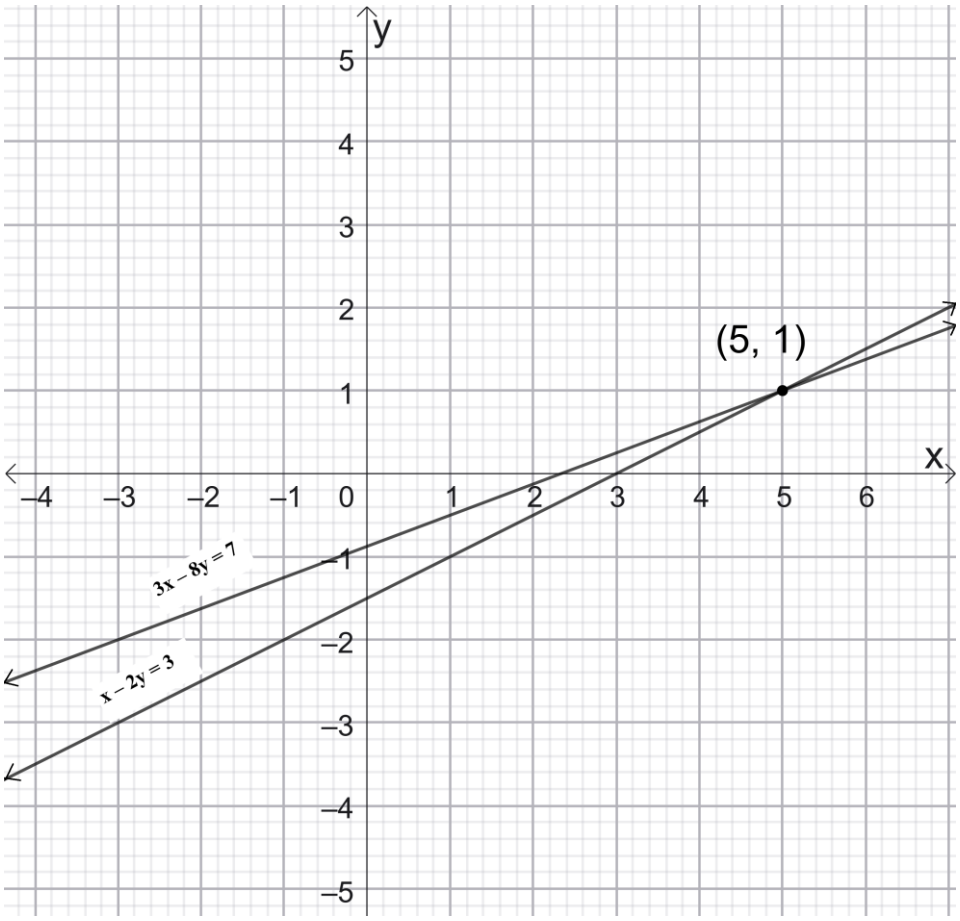
Mean = $35 + \frac{(-1)}{50} \times 10 = 34.8$ **II** **1**

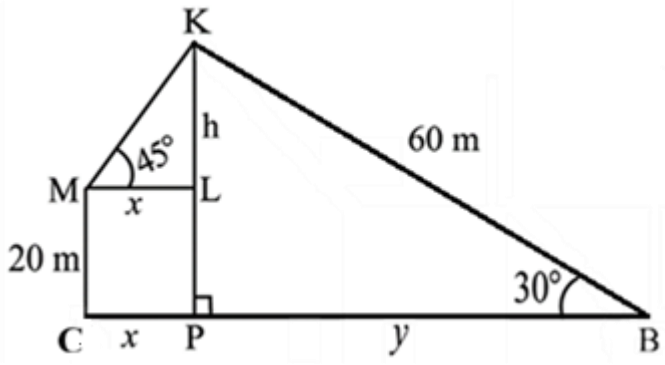
Modal class is 40 – 50. **III** ½

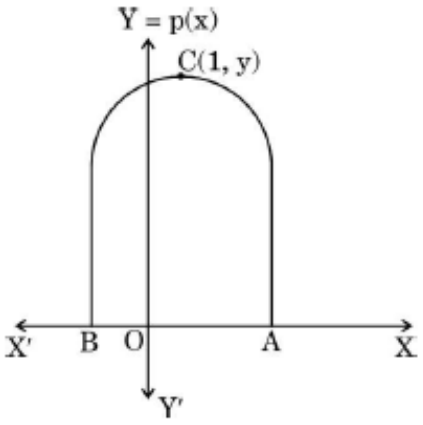
Mode = $40 + \left(\frac{13-10}{2\times13-10-3}\right) \times 10$ **IV** **1**

= 42.3 (approx.) **V** ½

33.	In Δ ABC, AD is a median. X is a point on AD such that AX : XD = 2 : 3. BX is extended so that it intersects AC at Y. Prove that BX = 4 XY.  		
Sol.	 		
	Draw DZ ‖ BY.	**I**	½
	In ΔCBY, DZ ‖ BY		
	$\therefore \frac{CD}{DB} = \frac{CZ}{ZY} = 1$	**II**	**1**
	Therefore, DZ = $\frac{1}{2}$ BY --- (i)	**III**	½
	In ΔADZ, DZ ‖ XY		
	So, Δ AXY ~ Δ ADZ		
	$\therefore \frac{AX}{AD} = \frac{XY}{DZ}$	**IV**	**1**
	$\Rightarrow \frac{2}{5} = \frac{XY}{DZ}$ or DZ = $\frac{5}{2}$ XY ---- (ii)	**V**	½
	Using (i) and (ii),		
	BY = 5 XY	**VI**	**1**
	Therefore BX = BY – XY = 4 XY	**VII**	½
	Alternate solution:		
	 		
	Draw DZ ‖ BY.	**I**	½
	Δ AXY ~ Δ ADZ	**II**	½
	$\therefore \frac{AX}{AD} = \frac{XY}{DZ} \Rightarrow \frac{2}{2+3} = \frac{XY}{DZ}$		

	$\Rightarrow$ 2 DZ = 5 XY --- (i)	**III**	**1**
	Now, Δ CDZ $\sim$ Δ CBY		
	$\therefore \frac{CD}{CB} = \frac{DZ}{BY}$	**IV**	**½**
	But CD = $\frac{1}{2}$ BC		
	So, $\frac{DZ}{BY} = \frac{1}{2} \Rightarrow$ BY = 2 DZ --- (ii)	**V**	**1**
	From (i) and (ii), we get		
	BY = 5 XY	**VI**	**1**
	$\Rightarrow$ (BX + XY) = 5 XY		
	$\Rightarrow$ BX = 4 XY	**VII**	**½**
34 (a)	Solve the following system of equations graphically : $x - 2y = 3,\ 3x - 8y = 7$		
Sol.			
	Correct graph of equation x – 2y = 3	**I**	**2**
	Correct graph of equation 3x – 8y = 7	**II**	**2**
	Correct solution x = 5 and y = 1	**III**	**½ + ½**
	OR		

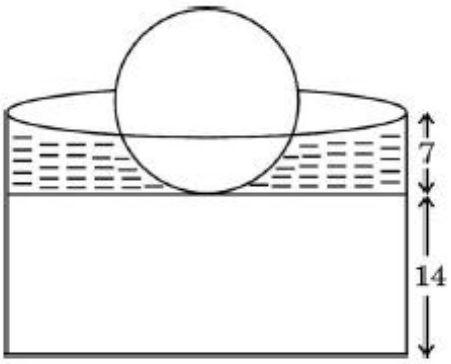
34 (b)	Five years ago, Adil was thrice as old as Bharat. Ten years later Adil shall be twice as old as Bharat. To know the present ages of Adil and Bharat : (i) form the linear equations representing the above information. (ii) show that the system of equations is consistent with unique solution. (iii) find the present ages of Adil and Bharat.		
Sol.	Let the present ages of Adil and Bharat be 'x' years and 'y' years respectively. (i) According to the given statements $(x - 5) = 3 \times (y - 5)$ $\Rightarrow x - 3y = -10$ --- ① $(x + 10) = 2 \times (y + 10)$ $\Rightarrow x - 2y = 10$ --- ② (ii) Here, $\frac{a_1}{a_2} = \frac{1}{1}, \frac{b_1}{b_2} = \frac{-3}{-2}$ or $\frac{3}{2}$ Since $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ Therefore, system of equations is consistent with unique solution. (iii) Solving equations ① & ②, we get $x = 50$ and $y = 20$ Therefore, the present ages of Adil and Bharat are 50 years and 20 years respectively.	**I** **II** **III** **IV**	**1** **1** **1** **1 + 1**
35.	A boy standing on a horizontal plane is flying a kite with a string of length 60 m, at an angle of elevation of 30°. Another boy standing on the roof of a 20 m high building, finds the angle of elevation of same kite to be 45°. If both the boys are on opposite sides of the kite, find the distance of the first boy from the base of the building. Also, find the height of the kite from the ground. (Use $\sqrt{3} = 1{\cdot}73$)		
Sol.	 Correct figure	**I**	**1**

	Let K be the position of kite. Let KL = h, CP = x & PB= y In rt. angled ΔKPB		
	$\frac{h+20}{60} = \sin 30° = \frac{1}{2}$	**II**	½
	$\Rightarrow$ h = 10	**III**	½
	Also, $\frac{y}{60} = \cos 30° = \frac{\sqrt{3}}{2}$	**IV**	½
	$\Rightarrow$ $y = 30\sqrt{3} = 30 \times 1.73 = 51.9$	**V**	½
	In rt. angled ΔKLM		
	$\frac{10}{x} = \tan 45° = 1$	**VI**	½
	$\Rightarrow$ $x = 10$	**VII**	½
	Height of kite from ground is 10 + 20 = 30 m	**VIII**	½
	Distance of first boy from the base of the building = 51.9 + 10 = 61.9 m	**IX**	½
	SECTION E This section has **3** case study based questions carrying 4 marks each.		
36.	**Case Study – 1** During a theatre drama, a backdrop of building arches was used. The shape of the curve shown below can be represented by the polynomial $p(x) = -x^2 + 2x + 8$, where x is the length (in feet) on stage level.   Based on the figure given above, answer the following questions : (i) Determine the height of the arch. (ii) (a) Find zeroes of the polynomial p(x). Which points on the graph represent the zeroes ? **OR**		

	(ii) (b) Find the span of the arch on the stage floor. (iii) Write the coordinates of the point of intersection of the above curve with the y-axis.		
Sol.	(i) $p(1) = -(1)^2 + 2 \times 1 + 8 = 9$ So, height of the arch is 9 feet. (ii) (a) $p(x) = -x^2 + 2x + 8$ $= -(x - 4)(x + 2)$ $\therefore$ zeroes are -2 and 4. Points B and A on the graph represent the zeroes. **OR** (ii) (b) $p(x) = -x^2 + 2x + 8$ $= -(x - 4)(x + 2)$ $\therefore$ zeroes are -2 and 4. Hence, Coordinates of point A and B are (4, 0) and (– 2, 0) respectively. Span of the arch on the stage floor, AB = 4 + 2 = 6 So, span of the arch on the stage floor is 6 feet. (iii) $p(0) = -(0)^2 + 2 \times 0 + 8 = 8$ $\therefore$ the given curve intersects y-axis at (0, 8)	**I** **I** **II** **III** **I** **II** **III** **I** **II**	**1** **1** ½ ½ ½ ½ **1** ½ ½
37.	**Case Study – 2** A group of friends wanted to play cards with two identical packs together. While shuffling the cards, three cards are dropped. Rest of the cards are shuffled and one card is drawn at random. Assuming that the dropped cards were a queen of hearts, a ten of spades and an ace of clubs, answer the following questions : 		

	(i) Find the probability that the drawn card is a face card. (ii) Find the probability that the drawn card is either a king or a queen. (iii) (a) Do you think that the probability of getting a queen was higher if none of the cards were dropped ? Justify your answer. **OR** (iii) (b) Find the probability that the drawn card is a jack. Compare it with the probability when none of the cards were dropped. In which case is the probability of getting a jack higher ?		
Sol.	Total number of cards = $2 \times 52 - 3 = 101$		
	(i) P (a face card) = $\frac{23}{101}$	**I**	**1**
	(ii) P (either a king or a queen) = $\frac{15}{101}$	**I**	**1**
	(iii) (a)Yes	**I**	½
	P (a queen when no cards were dropped) = $\frac{8}{104}$	**II**	½
	P (a queen when cards were dropped) = $\frac{7}{101}$	**III**	½
	$\because \frac{8}{104} > \frac{7}{101}$ as 808 > 728	**IV**	½
	So probability of getting a queen was higher if none of the cards were dropped.		
	OR		
	(iii) (b) P (a jack when cards were dropped) = $\frac{8}{101}$	**I**	½
	P (a jack when no cards were dropped) = $\frac{8}{104}$	**II**	½
	Since $\frac{8}{101} > \frac{8}{104}$ as 101 < 104		
	Therefore probability of getting a jack is higher when 3 cards were dropped.	**III**	**1**
38.	**Case Study – 3** A model of Leafy Ball Fountain is made to be kept on the tabletop. Water gently cascades down the ball into a decorative cylindrical pool where it is recycled. The diameter of spherical ball is 21 cm. Cylindrical pool – Outer diameter is 50 cm and inner diameter is 40 cm. Height of solid base is 14 cm. Height of water filled is 7 cm.		





Observe the figure and answer the following questions :

(i) Determine the total height of the fountain.

(ii) Find the volume of the ball.

(iii) (a) If one-third of the ball is submerged in the water, find the volume of the water filled in the pool.

OR

(iii) (b) Find the sum of the outer curved surface area of the cylindrical part and surface area of the ball.

Sol.	(i) Total height of the fountain = 14 + 21 = 35 cm	**I**	**1**
	(ii) Volume of the ball = $\frac{4}{3} \times \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2} \times \frac{21}{2}$	**I**	**½**
	$= 4851 \text{ cm}^3$	**II**	**½**
	(iii) (a) Volume of water = Volume of inner upper part $- \frac{1}{3} \times$ Volume of the ball		
	$= \frac{22}{7} \times 20 \times 20 \times 7 - \frac{1}{3} \times 4851$	**I**	**1**
	$= 7183 \text{ cm}^3$	**II**	**1**
	OR		
	(iii) (b) Required area = Outer CSA of cylinderical part + Surface area of the ball		
	$= 2 \times \frac{22}{7} \times 25 \times (14 + 7) + 4 \times \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2}$	**I**	**1**
	$= 4686 \text{ cm}^2$	**II**	**1**

Series : GE1FH

SET~1

रोल नं.
Roll No.

प्रश्न-पत्र कोड
Q.P. Code 30/1/1

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

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नोट

(I) कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ **27** हैं।

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

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

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

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

NOTE

(I) Please check that this question paper contains **27** printed pages.

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

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

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

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

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गणित (मानक)

MATHEMATICS (STANDARD)

निर्धारित समय : ***3*** *घण्टे* | *अधिकतम अंक :* ***80***

Time allowed : ***3*** *hours* | *Maximum Marks :* ***80***

• • •

सामान्य निर्देश :

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

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

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

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

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

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

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

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

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

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

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

खण्ड क

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

1. यदि α तथा β, बहुपद $3x^2 + 6x + k$ के शून्यक हैं तथा $\alpha + \beta + \alpha\beta = -\frac{2}{3}$ है, तो k का मान है :

(A) – 8

(B) 8

(C) – 4

(D) 4

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General Instructions :

Read the following instructions very carefully and strictly follow them :

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

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

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

(iv) *In **Section B,** Questions no. **21** to **25** are very short answer (VSA) type questions, carrying **2** marks each.*

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

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

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

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

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

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

SECTION A

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

1. If α and β are the zeroes of polynomial $3x^2 + 6x + k$ such that $\alpha + \beta + \alpha\beta = -\frac{2}{3}$, then the value of k is :

(A) -8

(B) 8

(C) -4

(D) 4

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2. यदि $x = 1$ तथा $y = 2$, रैखिक समीकरण युग्म $2x - 3y + a = 0$ तथा $2x + 3y - b = 0$ का एक हल है, तो :

(A) $a = 2b$

(B) $2a = b$

(C) $a + 2b = 0$

(D) $2a + b = 0$

3. बिंदुओं $P(-4, 5)$ तथा $Q(4, 6)$ को मिलाने वाले रेखाखण्ड का मध्य-बिंदु स्थित है :

(A) x-अक्ष पर

(B) y-अक्ष पर

(C) मूल-बिंदु पर

(D) न x-अक्ष पर और न ही y-अक्ष पर

4. यदि θ न्यूनकोण है तथा $7 + 4 \sin \theta = 9$ है, तो θ का मान है :

(A) $90°$

(B) $30°$

(C) $45°$

(D) $60°$

5. $\tan^2 \theta - \left(\frac{1}{\cos \theta} \times \sec \theta \right)$ का मान है :

(A) 1

(B) 0

(C) -1

(D) 2

6. यदि HCF(98, 28) = m तथा LCM(98, 28) = n है, तो $n - 7m$ का मान है :

(A) 0

(B) 28

(C) 98

(D) 198

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2. If $x = 1$ and $y = 2$ is a solution of the pair of linear equations $2x - 3y + a = 0$ and $2x + 3y - b = 0$, then :

(A) $a = 2b$

(B) $2a = b$

(C) $a + 2b = 0$

(D) $2a + b = 0$

3. The mid-point of the line segment joining the points $P(-4, 5)$ and $Q(4, 6)$ lies on :

(A) x-axis

(B) y-axis

(C) origin

(D) neither x-axis nor y-axis

4. If θ is an acute angle and $7 + 4 \sin \theta = 9$, then the value of θ is :

(A) $90°$

(B) $30°$

(C) $45°$

(D) $60°$

5. The value of $\tan^2 \theta - \left(\frac{1}{\cos \theta} \times \sec \theta \right)$ is :

(A) 1

(B) 0

(C) -1

(D) 2

6. If HCF(98, 28) = m and LCM(98, 28) = n, then the value of $n - 7m$ is :

(A) 0

(B) 28

(C) 98

(D) 198

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7. किसी वृत्त के व्यास के छोरों पर खींची गई स्पर्श-रेखाएँ सदैव परस्पर :

(A) समांतर होती हैं

(B) लंबवत होती हैं

(C) समान होती हैं

(D) प्रतिच्छेदी होती हैं

8. त्रिभुज ABC तथा DEF में, $\angle B = \angle E$, $\angle F = \angle C$ तथा $AB = 3DE$ है, तो दोनों त्रिभुज :

(A) सर्वांगसम हैं परन्तु समरूप नहीं हैं

(B) सर्वांगसम तथा समरूप हैं

(C) न तो सर्वांगसम और न ही समरूप हैं

(D) समरूप हैं परन्तु सर्वांगसम नहीं हैं

9. यदि $(-1)^n + (-1)^8 = 0$ है, तो n :

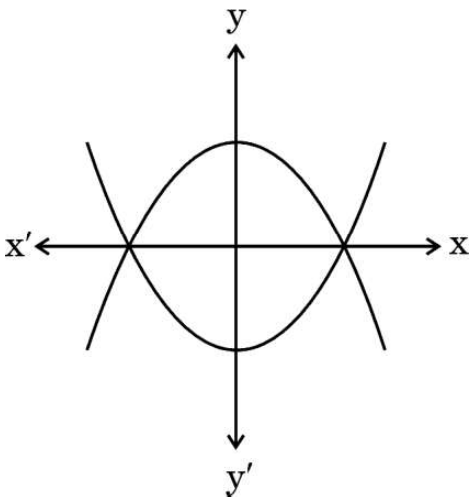
(A) कोई धन पूर्णांक है

(B) कोई ऋण पूर्णांक है

(C) कोई विषम संख्या है

(D) कोई सम संख्या है

10. नीचे दिए गए ग्राफ में, दो बहुपदों को दिखाया गया है। इन दोनों बहुपदों के भिन्न शून्यकों की संख्या है :



(A) 3 (B) 5

(C) 2 (D) 4

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7. The tangents drawn at the extremities of the diameter of a circle are always :

(A) parallel

(B) perpendicular

(C) equal

(D) intersecting

8. In triangles ABC and DEF, $\angle B = \angle E$, $\angle F = \angle C$ and AB = 3 DE. Then, the two triangles are :

(A) congruent but not similar

(B) congruent as well as similar

(C) neither congruent nor similar

(D) similar but not congruent

9. If $(-1)^n + (-1)^8 = 0$, then n is :

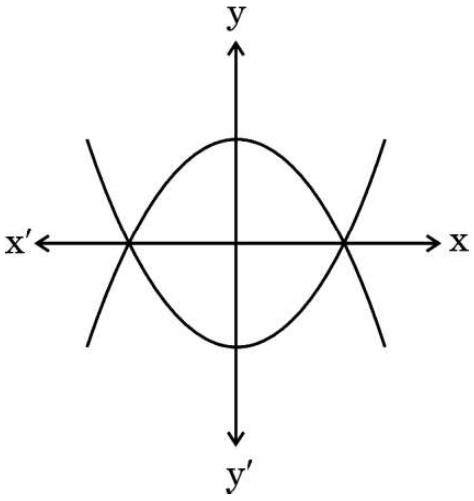
(A) any positive integer

(B) any negative integer

(C) any odd number

(D) any even number

10. Two polynomials are shown in the graph below. The number of distinct zeroes of both the polynomials is :



(A) 3 (B) 5

(C) 2 (D) 4

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11. यदि किसी समांतर श्रेढ़ी के प्रथम m पदों का योगफल $2m^2 + 3m$ है, तो इसका दूसरा पद है :

(A) 10

(B) 9

(C) 12

(D) 4

12. किन्हीं आँकड़ों के बहुलक तथा माध्य क्रमश: 15x तथा 18x हैं। तो इन आँकड़ों का माध्यक है :

(A) x

(B) 11x

(C) 17x

(D) 34x

13. ताश की 52 पत्तों की गड्डी में से यादृच्छया एक पत्ता निकाला गया। इस पत्ते के एक लाल रंग की तस्वीर वाला पत्ता होने की प्रायिकता है :

(A) $\frac{3}{13}$

(B) $\frac{2}{13}$

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

(D) $\frac{3}{26}$

14. निम्नलिखित में से कौन-सी परिमेय संख्या $\sqrt{3}$ तथा $\sqrt{5}$ के बीच की एक संख्या है ?

(A) 1·4142387954012 ....

(B) $2{\cdot}32\overline{6}$

(C) π

(D) 1·857142

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11. If the sum of first m terms of an AP is $2m^2 + 3m$, then its second term is :

(A) 10

(B) 9

(C) 12

(D) 4

12. Mode and Mean of a data are 15x and 18x, respectively. Then the median of the data is :

(A) x

(B) 11x

(C) 17x

(D) 34x

13. A card is selected at random from a deck of 52 playing cards. The probability of it being a red face card is :

(A) $\frac{3}{13}$

(B) $\frac{2}{13}$

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

(D) $\frac{3}{26}$

14. Which of the following is a rational number between $\sqrt{3}$ and $\sqrt{5}$?

(A) 1·4142387954012 ....

(B) $2{\cdot}32\overline{6}$

(C) π

(D) 1·857142

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15. यदि एक वृत्त के त्रिज्यखण्ड का क्षेत्रफल 40π वर्ग इकाई है तथा केंद्र पर बना कोण $72°$ है, तो वृत्त की त्रिज्या है :

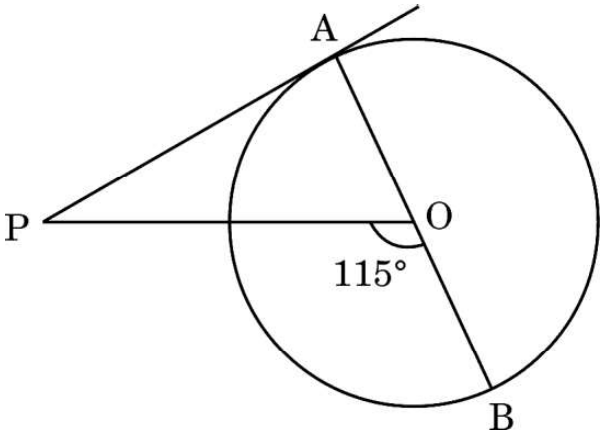
(A) 200 इकाई

(B) 100 इकाई

(C) 20 इकाई

(D) $10\sqrt{2}$ इकाई

16. दी गई आकृति में, केंद्र O वाले वृत्त पर एक बाह्य बिंदु P से एक स्पर्श-रेखा PA खींची गई है। यदि $\angle POB = 115°$ है, तो $\angle APO$ बराबर है :



(A) $25°$

(B) $65°$

(C) $90°$

(D) $35°$

17. एक पतंग भूमि से 150 m की ऊँचाई पर उड़ रही है। यह जिस डोरी से जुड़ी है वह भूमि की क्षैतिज दिशा से $30°$ का कोण बनाती है। डोरी की लंबाई है :

(A) $100\sqrt{3}$ m

(B) 300 m

(C) $150\sqrt{2}$ m

(D) $150\sqrt{3}$ m

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15. If a sector of a circle has an area of 40π sq. units and a central angle of $72°$, the radius of the circle is :

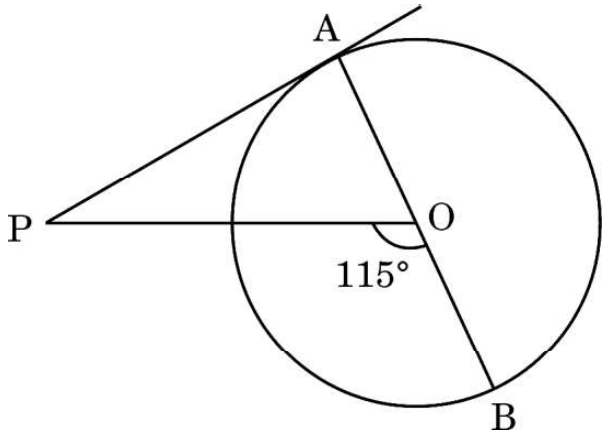
(A) 200 units

(B) 100 units

(C) 20 units

(D) $10\sqrt{2}$ units

16. In the given figure, PA is a tangent from an external point P to a circle with centre O. If $\angle POB = 115°$, then $\angle APO$ is equal to :



(A) $25°$

(B) $65°$

(C) $90°$

(D) $35°$

17. A kite is flying at a height of 150 m from the ground. It is attached to a string inclined at an angle of $30°$ to the horizontal. The length of the string is :

(A) $100\sqrt{3}$ m

(B) 300 m

(C) $150\sqrt{2}$ m

(D) $150\sqrt{3}$ m

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18. 20 cm लंबे तार के एक टुकड़े को $\frac{60}{\pi}$ cm त्रिज्या वाले वृत्त की एक चाप के रूप में मोड़ा गया। इस वृत्त के केन्द्र पर चाप द्वारा अंतरित कोण है :

(A) 30°

(B) 60°

(C) 90°

(D) 50°

*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)* : 1 से 20 तक की संख्याओं में से यादृच्छया एक संख्या चुनने की प्रायिकता 1 है।

तर्क (R) : किसी घटना E के लिए, यदि $P(E) = 1$ है, तो E एक निश्चित घटना होती है।

20. *अभिकथन (A)* : यदि हम समान त्रिज्या वाले दो अर्धगोलों को उनके आधारों से जोड़ते हैं, तो हमें एक गोला प्राप्त होता है।

तर्क (R) : r त्रिज्या वाले गोले का संपूर्ण पृष्ठीय क्षेत्रफल $3\pi r^2$ होता है।

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18. A piece of wire 20 cm long is bent into the form of an arc of a circle of radius $\frac{60}{\pi}$ cm. The angle subtended by the arc at the centre of the circle is :

(A) 30°

(B) 60°

(C) 90°

(D) 50°

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

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

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

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

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

19. *Assertion (A) :* The probability of selecting a number at random from the numbers 1 to 20 is 1.

Reason (R): For any event E, if P(E) = 1, then E is called a sure event.

20. *Assertion (A) :* If we join two hemispheres of same radius along their bases, then we get a sphere.

Reason (R): Total Surface Area of a sphere of radius r is $3\pi r^2$.

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खण्ड ख

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

21. (क) यदि $x \cos 60° + y \cos 0° + \sin 30° - \cot 45° = 5$ है, तो $x + 2y$ का मान ज्ञात कीजिए।

अथवा

(ख) $\dfrac{\tan^2 60°}{\sin^2 60° + \cos^2 30°}$ का मान ज्ञात कीजिए।

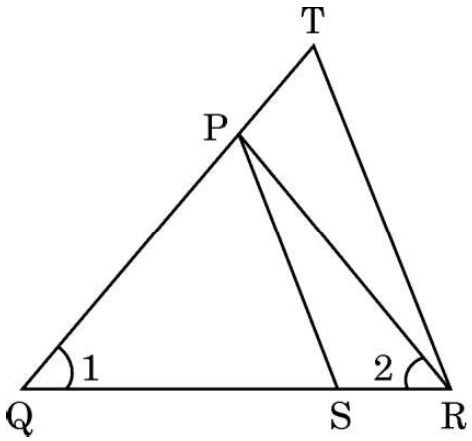
22. बहुपद $p(x) = x^2 + \dfrac{4}{3}x - \dfrac{4}{3}$ के शून्यक ज्ञात कीजिए।

23. एक वृत्त के केंद्र के निर्देशांक $(2a, a - 7)$ हैं। यदि यह वृत्त बिंदु $(11, -9)$ से होकर जाता है तथा इसका व्यास $10\sqrt{2}$ इकाई है, तो 'a' का/के मान ज्ञात कीजिए।

24. (क) यदि $\Delta ABC \sim \Delta PQR$ है जिसमें AB = 6 cm, BC = 4 cm, AC = 8 cm तथा PR = 6 cm हैं, तो (PQ + QR) की लंबाई ज्ञात कीजिए।

अथवा

(ख) दी गई आकृति में, $\dfrac{QR}{QS} = \dfrac{QT}{PR}$ तथा $\angle 1 = \angle 2$ है, तो दर्शाइए कि $\Delta PQS \sim \Delta TQR$.



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SECTION B

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

21. (a) If $x \cos 60° + y \cos 0° + \sin 30° - \cot 45° = 5$, then find the value of $x + 2y$.

OR

(b) Evaluate : $\dfrac{\tan^2 60°}{\sin^2 60° + \cos^2 30°}$

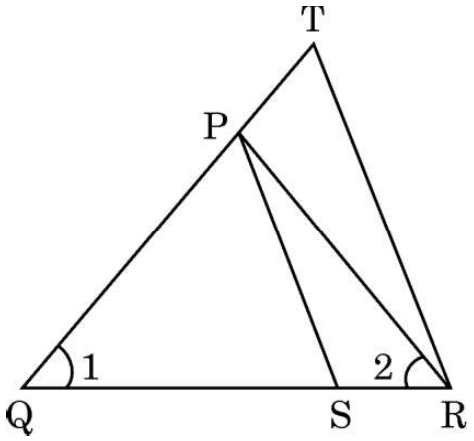
22. Find the zeroes of the polynomial $p(x) = x^2 + \dfrac{4}{3}x - \dfrac{4}{3}$.

23. The coordinates of the centre of a circle are (2a, a – 7). Find the value(s) of 'a' if the circle passes through the point (11, – 9) and has diameter $10\sqrt{2}$ units.

24. (a) If $\Delta ABC \sim \Delta PQR$ in which AB = 6 cm, BC = 4 cm, AC = 8 cm and PR = 6 cm, then find the length of (PQ + QR).

OR

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



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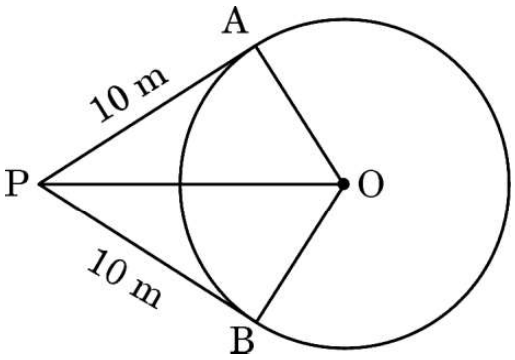
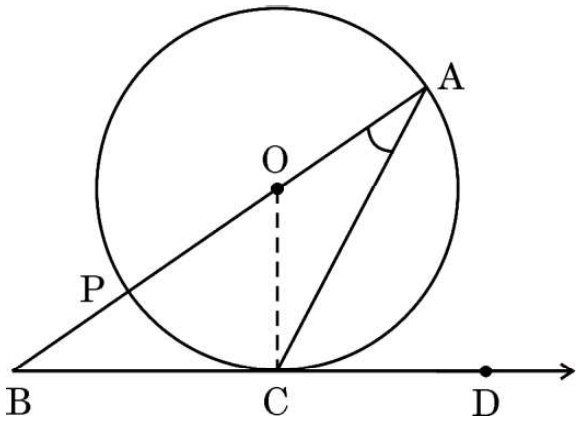
25. एक व्यक्ति एक वृत्ताकार मैदान के केंद्र से 26 m की दूरी पर स्थित एक बाह्य बिंदु P पर खड़ा है। वह देखता है कि मैदान के दो बिंदुओं A तथा B से उसकी दूरी 10 m है (PA और PB वृत्त पर स्पर्श-रेखाएँ हैं)। वृत्ताकार मैदान की त्रिज्या ज्ञात कीजिए।



खण्ड ग

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

26. (क) दी गई आकृति में, O वृत्त का केंद्र है तथा BCD बिंदु C पर स्पर्श-रेखा है। सिद्ध कीजिए कि $\angle BAC + \angle ACD = 90°$.

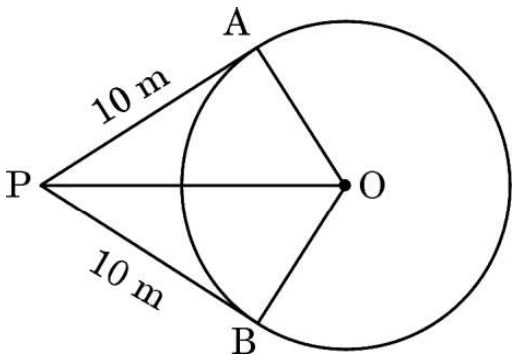


अथवा

(ख) सिद्ध कीजिए कि वृत्त के परिगत बने चतुर्भुज की आमने-सामने की (सम्मुख) भुजाएँ वृत्त के केंद्र पर संपूरक कोण अंतरित करती हैं।

• • •

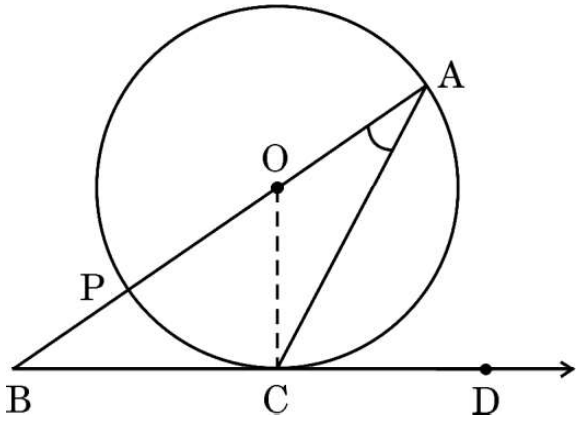
25. A person is standing at P outside a circular ground at a distance of 26 m from the centre of the ground. He found that his distances from the points A and B on the ground are 10 m (PA and PB are tangents to the circle). Find the radius of the circular ground.



SECTION C

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

26. (a) In the given figure, O is the centre of the circle and BCD is tangent to it at C. Prove that $\angle BAC + \angle ACD = 90°$.



OR

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

• • •

27. (क) सिद्ध कीजिए कि : $\frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta} = 1 + \sec\theta\,\text{cosec}\,\theta$

अथवा

(ख) सिद्ध कीजिए कि : $\frac{\sin A + \cos A}{\sin A - \cos A} + \frac{\sin A - \cos A}{\sin A + \cos A} = \frac{2}{2\sin^2 A - 1}$

28. वह अनुपात ज्ञात कीजिए जिसमें y-अक्ष बिंदुओं $(5, -6)$ तथा $(-1, -4)$ को मिलाने वाले रेखाखण्ड को विभाजित करता है। प्रतिच्छेदन बिंदु भी ज्ञात कीजिए।

29. सिद्ध कीजिए कि $\frac{1}{\sqrt{5}}$ एक अपरिमेय संख्या है।

30. एक कमरा बेलन के आकार का है जिसके ऊपर एक अर्धगोलाकार गुंबद अध्यारोपित है। अर्धगोले के आधार की त्रिज्या, बेलनाकार भाग की ऊँचाई की आधी है। यदि इस कमरे में $\frac{1408}{21}$ m^3 वायु है, तो बेलनाकार भाग की ऊँचाई ज्ञात कीजिए। ($\pi = \frac{22}{7}$ प्रयोग कीजिए)

31. दो पासे एक साथ उछाले गए। दोनों पासों पर आई संख्याओं का अन्तर 2 होने की प्रायिकता ज्ञात कीजिए।

खण्ड घ

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

32. विजय ने दो योजनाओं A तथा B में, जो क्रमश: 8% वार्षिक तथा 9% वार्षिक ब्याज देती हैं, में कुछ-कुछ राशियाँ निवेश कीं। उसे कुल ₹ 1,860 वार्षिक ब्याज प्राप्त हुआ। यद्यपि, अगर उसने दो योजनाओं में निवेश की राशियों को आपस में बदल दिया होता, तो उसे वार्षिक ब्याज ₹ 20 अधिक प्राप्त होता। ज्ञात कीजिए कि उसने प्रत्येक योजना में कितनी राशि निवेश की।

• • •

27. (a) Prove that : $\frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta} = 1 + \sec\theta \operatorname{cosec}\theta$

OR

(b) Prove that : $\frac{\sin A + \cos A}{\sin A - \cos A} + \frac{\sin A - \cos A}{\sin A + \cos A} = \frac{2}{2\sin^2 A - 1}$

28. Find the ratio in which the y-axis divides the line segment joining the points $(5, -6)$ and $(-1, -4)$. Also find the point of intersection.

29. Prove that $\frac{1}{\sqrt{5}}$ is an irrational number.

30. A room is in the form of a cylinder surmounted by a hemispherical dome. The base radius of the hemisphere is half of the height of the cylindrical part. If the room contains $\frac{1408}{21}\text{m}^3$ of air, find the height of the cylindrical part. (Use $\pi = \frac{22}{7}$).

31. Two dice are thrown at the same time. Determine the probability that the difference of the numbers on the two dice is 2.

SECTION D

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

32. Vijay invested certain amounts of money in two schemes A and B, which offer interest at the rate of 8% per annum and 9% per annum, respectively. He received ₹ 1,860 as the total annual interest. However, had he interchanged the amounts of investments in the two schemes, he would have received ₹ 20 more as annual interest. How much money did he invest in each scheme ?

• • •

33. (क) एक समांतर चतुर्भुज ABCD का विकर्ण BD, रेखाखण्ड AE को बिंदु F पर काटता है, जहाँ E भुजा BC पर स्थित कोई बिंदु है। सिद्ध कीजिए कि $DF \times EF = FB \times FA$.

अथवा

(ख) ΔABC में, यदि $AD \perp BC$ तथा $AD^2 = BD \times DC$ है, तो सिद्ध कीजिए कि $\angle BAC = 90°$.

34. (क) एक समकोण त्रिभुज का परिमाप 60 cm है तथा इसके कर्ण की लंबाई 25 cm है। त्रिभुज की अन्य दो भुजाओं की लंबाइयाँ ज्ञात कीजिए।

अथवा

(ख) एक रेलगाड़ी 480 km की दूरी एकसमान चाल से तय करती है। यदि इसकी चाल 8 km/h कम होती, तो इसे वही दूरी तय करने में 3 घंटे अधिक लगते। रेलगाड़ी की चाल ज्ञात कीजिए।

35. निम्नलिखित सारणी में लुप्त बारंबारता 'f' ज्ञात कीजिए, यदि दिए गए आँकड़ों का माध्य 18 है। अत: आँकड़ों का बहुलक ज्ञात कीजिए।

दैनिक भत्ता	*बच्चों की संख्या*
11 – 13	7
13 – 15	6
15 – 17	9
17 – 19	13
19 – 21	f
21 – 23	5
23 – 25	4

• • •

33. (a) The diagonal BD of a parallelogram ABCD intersects the line segment AE at the point F, where E is any point on the side BC. Prove that $DF \times EF = FB \times FA$.

OR

(b) In ΔABC, if $AD \perp BC$ and $AD^2 = BD \times DC$, then prove that $\angle BAC = 90°$.

34. (a) The perimeter of a right triangle is 60 cm and its hypotenuse is 25 cm. Find the lengths of other two sides of the triangle.

OR

(b) A train travels a distance of 480 km at a uniform speed. If the speed had been 8 km/h less, then it would have taken 3 hours more to cover the same distance. Find the speed of the train.

35. Find the missing frequency 'f' in the following table, if the mean of the given data is 18. Hence find the mode.

Daily Allowance	*Number of Children*
11 – 13	7
13 – 15	6
15 – 17	9
17 – 19	13
19 – 21	f
21 – 23	5
23 – 25	4

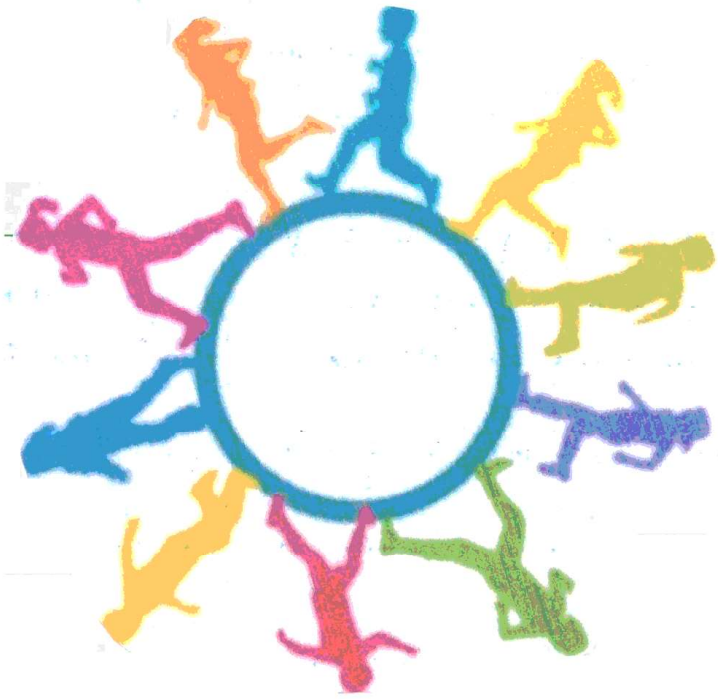
• • •

खण्ड ङ

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

प्रकरण अध्ययन – 1

36. एक विद्यालय स्थानीय अस्पताल के लिए धन जुटाने हेतु चैरिटी दौड़ का आयोजन कर रहा है। दौड़ की योजना एक ट्रैक के चारों ओर कई चक्करों की श्रृंखला के रूप में बनाई गई है, जिसमें प्रत्येक चक्कर 300 मीटर का होगा। इस आयोजन को और अधिक चुनौतीपूर्ण और आकर्षक बनाने के लिए, आयोजकों ने अगले प्रत्येक चक्कर की दूरी को 50 मीटर बढ़ाने का फैसला किया। उदाहरण के लिए, दूसरा चक्कर 350 मीटर, तीसरा चक्कर 400 मीटर और इसी प्रकार आगे। योजनाबद्ध चक्करों की कुल संख्या 10 है।



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

(i) इस प्रकार बनी समांतर श्रेढ़ी का चौथा, पाँचवाँ तथा छठा पद लिखिए। *1*

(ii) 8वें चक्कर में तय की गई दूरी ज्ञात कीजिए। *1*

(iii) (क) 10 चक्कर पूरे करने पर तय की गई कुल दूरी ज्ञात कीजिए। *2*

अथवा

(iii) (ख) यदि एक दौड़ने वाला केवल पहले 6 चक्कर पूरे कर पाए, तो उसके द्वारा तय की गई कुल दूरी ज्ञात कीजिए। *2*

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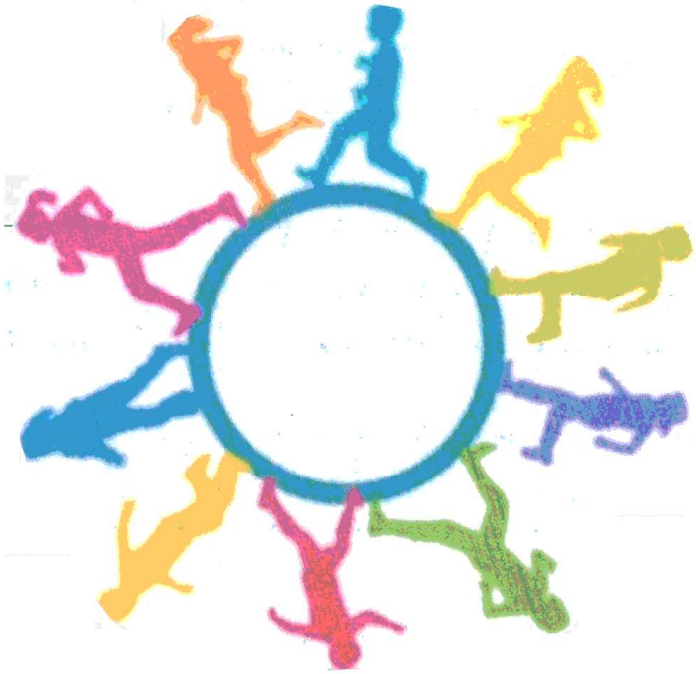
SECTION E

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

Case Study – 1

36. A school is organizing a charity run to raise funds for a local hospital. The run is planned as a series of rounds around a track, with each round being 300 metres. To make the event more challenging and engaging, the organizers decide to increase the distance of each subsequent round by 50 metres. For example, the second round will be 350 metres, the third round will be 400 metres and so on. The total number of rounds planned is 10.



Based on the information given above, answer the following questions :

(i) Write the fourth, fifth and sixth term of the Arithmetic Progression so formed. *1*

(ii) Determine the distance of the 8th round. *1*

(iii) (a) Find the total distance run after completing all 10 rounds. *2*

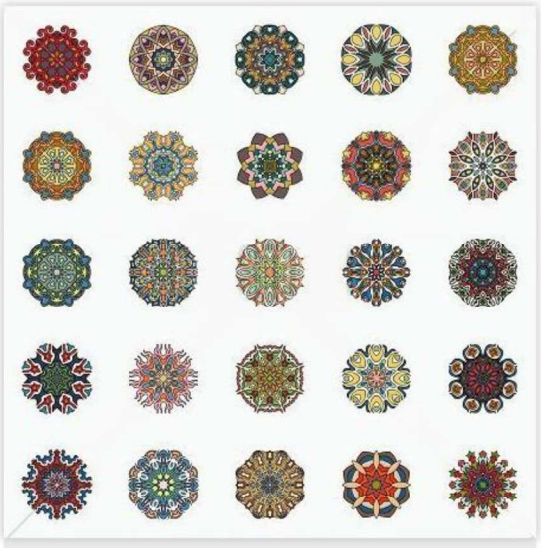
OR

(iii) (b) If a runner completes only the first 6 rounds, what is the total distance run by the runner ? *2*

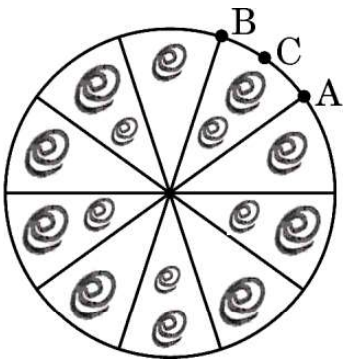
• • •

प्रकरण अध्ययन – 2

37. ब्रोच एक सजावटी वस्तु है जिसे अकसर जैकेट, ब्लाउज़ या ड्रेस जैसे कपड़ों पर पहना जाता है ताकि सुंदरता बढ़ाई जा सके। बहुमूल्य धातुओं से निर्मित और रत्नों से सुसज्जित, ब्रोच कई आकार और डिज़ाइन में आते हैं।



एक ऐसे वृत्ताकार ब्रोच को चाँदी के तार से बनाया गया है, जिसका व्यास 35 mm है। तार को वृत्त के 5 व्यासों को बनाने में भी प्रयुक्त किया गया है, जो उसे 10 बराबर त्रिज्यखण्डों में विभाजित करता है, जैसा कि आकृति में दर्शाया गया है।



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

(i) प्रत्येक त्रिज्यखण्ड का केंद्रीय कोण ज्ञात कीजिए। *1*

(ii) चाप ACB की लंबाई ज्ञात कीजिए । *1*

(iii) (क) ब्रोच के प्रत्येक त्रिज्यखण्ड का क्षेत्रफल ज्ञात कीजिए। *2*

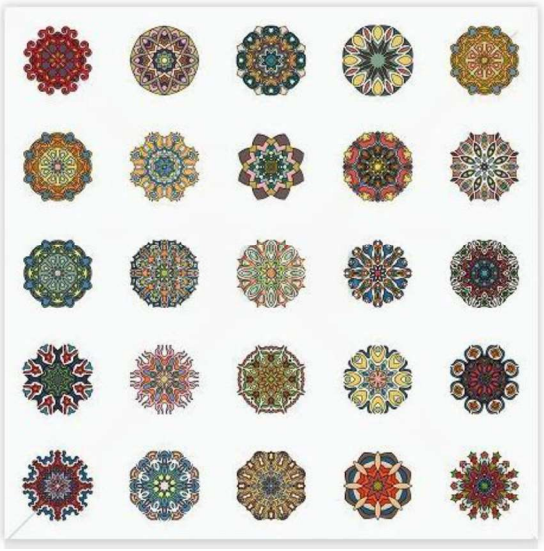
अथवा

(iii) (ख) प्रयोग की गई चाँदी के तार की कुल लंबाई ज्ञात कीजिए। *2*

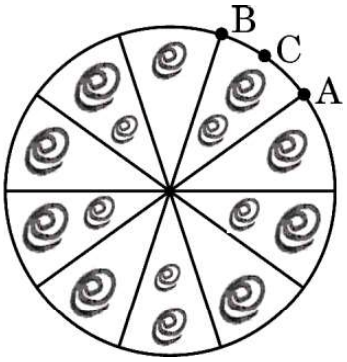
• • •

Case Study – 2

37. A brooch is a decorative piece often worn on clothing like jackets, blouses or dresses to add elegance. Made from precious metals and decorated with gemstones, brooches come in many shapes and designs.



One such brooch is made with silver wire in the form of a circle with diameter 35 mm. The wire is also used in making 5 diameters which divide the circle into 10 equal sectors as shown in the figure.



Based on the above given information, answer the following questions :

(i) Find the central angle of each sector. *1*

(ii) Find the length of the arc ACB. *1*

(iii) (a) Find the area of each sector of the brooch. *2*

OR

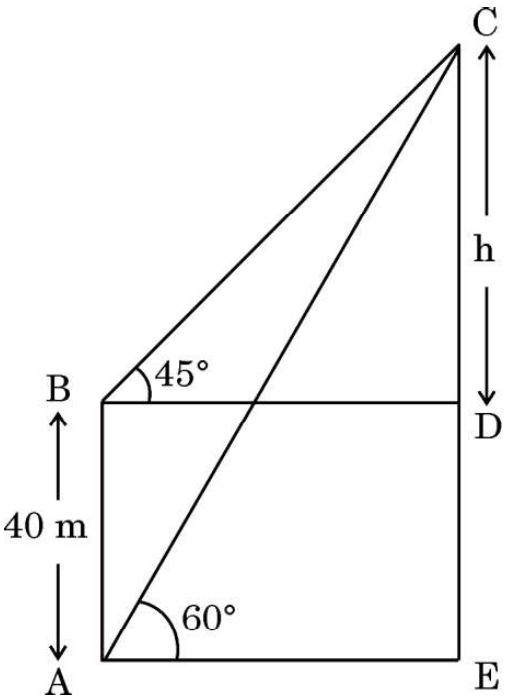
(iii) (b) Find the total length of the silver wire used. *2*

• • •

प्रकरण अध्ययन – 3

38. अमृता एक लाइटहाउस के आधार से कुछ दूरी पर खड़ी है तथा इसके शीर्ष को देख रही है। उसने शीर्ष का उन्नयन कोण 60° पाया। तब, वह अपने प्रारंभिक स्थान से निकट 40 मीटर ऊँचे एक अवलोकन डेक पर चढ़ गई तथा वहाँ से उसने लाइटहाउस के शीर्ष का उन्नयन कोण 45° पाया।





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

(i) यदि CD की लंबाई h मीटर है, तो 'h' के पदों में दूरी BD ज्ञात कीजिए। *1*

(ii) 'h' के पदों में दूरी BC ज्ञात कीजिए। *1*

(iii) (क) लाइटहाउस की ऊँचाई CE ज्ञात कीजिए। [$\sqrt{3}$ = 1·73 प्रयोग कीजिए] *2*

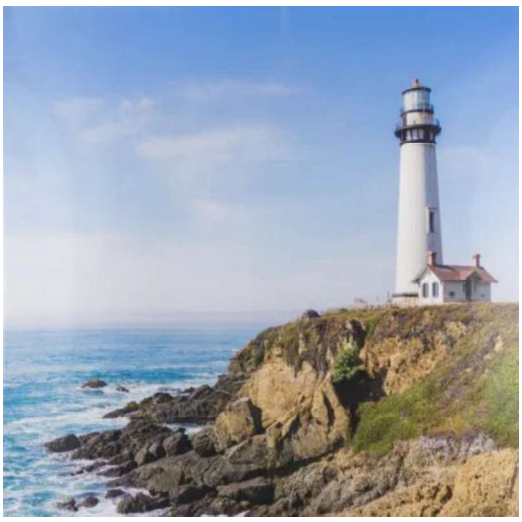
अथवा

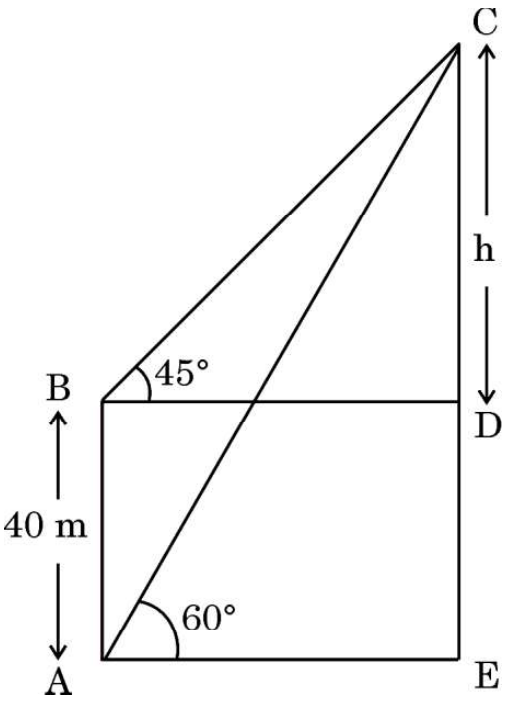
(iii) (ख) यदि AC = 100 m है, तो दूरी AE ज्ञात कीजिए। *2*

• • •

Case Study – 3

38. Amrita stood near the base of a lighthouse, gazing up at its towering height. She measured the angle of elevation to the top and found it to be 60°. Then, she climbed a nearby observation deck, 40 metres higher than her original position and noticed the angle of elevation to the top of lighthouse to be 45°.





Based on the above given information, answer the following questions :

(i) If CD is h metres, find the distance BD in terms of 'h'. *1*

(ii) Find distance BC in terms of 'h'. *1*

(iii) (a) Find the height CE of the lighthouse [Use $\sqrt{3}$ = 1·73] *2*

OR

(iii) (b) Find distance AE, if AC = 100 m. *2*

Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2025
MATHEMATICS (Standard) (Q.P. CODE 30/1/1)

General Instructions: -

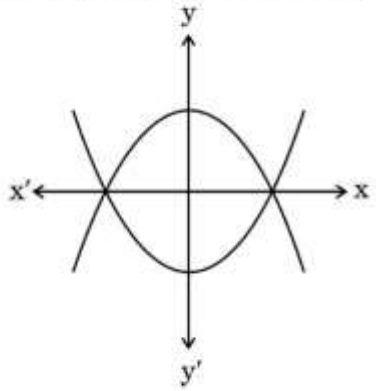
1.	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully.
2.	**"Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, Evaluation done and several other aspects. It's leakage to public in any manner could lead to derailment of the examination system and affect the life and future of millions of candidates. Sharing this policy/document to anyone, publishing in any magazine and printing in News Paper/Website etc. may invite action under various rules of the Board and IPC."**
3.	Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one's own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. **However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and due marks be awarded to them. In class-X, while evaluating two competency-based questions, please try to understand given answer and even if reply is not from Marking Scheme but correct competency is enumerated by the candidate, due marks should be awarded.**
4.	The Marking scheme carries only suggested value points for the answers. These are in the nature of Guidelines only and do not constitute the complete answer. The students can have their own expression and if the expression is correct, the due marks should be awarded accordingly.
5.	The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. If there is any variation, the same should be zero after deliberation and discussion. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.
6.	Evaluators will mark (✓) wherever answer is correct. For wrong answer CROSS 'X" be marked. Evaluators will not put right (✓) while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing.**
7.	If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totalled up and written on the left-hand margin and encircled. This may be followed strictly.
8.	If a question does not have any parts, marks must be awarded on the left-hand margin and encircled. This may also be followed strictly.

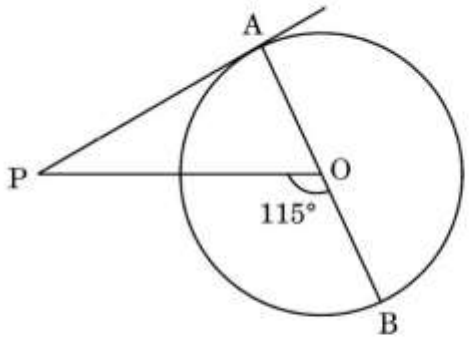
9.	If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note "Extra Question".
10.	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
11.	A full scale of marks ____80____ (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 totalling of marks awarded to an answer. ● Wrong transfer of marks from the inside pages of the answer book to the title page. ● Wrong question wise totalling on the title page. ● Wrong totalling 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 un assessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.
16.	The Examiners should acquaint themselves with the guidelines given in the "**Guidelines for spot Evaluation**" before starting the actual evaluation.
17.	Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totalled and written in figures and words.
18.	The candidates are entitled to obtain photocopy of the Answer Book on request on payment of the prescribed processing fee. All Examiners/Additional Head Examiners/Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme.

MARKING SCHEME
MATHEMATICS (Subject Code–041)
(PAPER CODE: 30/1/1)

Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Marks
	SECTION A This section has **20** Multiple Choice Questions (MCQs) carrying **1** mark each.	
1.	If α and β are the zeroes of polynomial $3x^2 + 6x + k$ such that $\alpha + \beta + \alpha\beta = -\frac{2}{3}$, then the value of k is : (A) -8 (B) 8 (C) -4 (D) 4	
Sol.	(D) 4	**1**
2.	If $x = 1$ and $y = 2$ is a solution of the pair of linear equations $2x - 3y + a = 0$ and $2x + 3y - b = 0$, then : (A) $a = 2b$ (B) $2a = b$ (C) $a + 2b = 0$ (D) $2a + b = 0$	
Sol.	(B) $2a = b$	**1**
3.	The mid-point of the line segment joining the points P(– 4, 5) and Q(4, 6) lies on : (A) x-axis (B) y-axis (C) origin (D) neither x-axis nor y-axis	
Sol.	(B) y – axis	**1**
4.	If θ is an acute angle and $7 + 4 \sin\theta = 9$, then the value of θ is : (A) $90°$ (B) $30°$ (C) $45°$ (D) $60°$	
Sol.	(B) 30^0	**1**

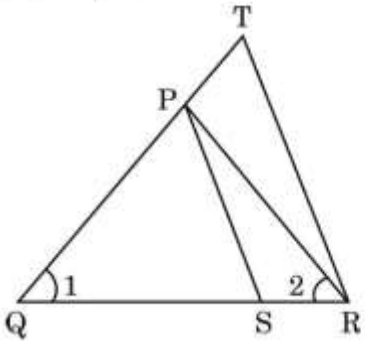
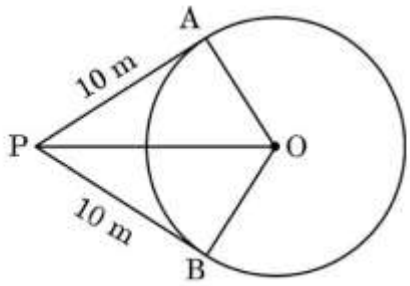
5.	The value of $\tan^2\theta - \left(\frac{1}{\cos\theta} \times \sec\theta\right)$ is : (A) 1 (B) 0 (C) -1 (D) 2	
Sol.	(C) -1	**1**
6.	If HCF(98, 28) = m and LCM(98, 28) = n, then the value of $n - 7m$ is : (A) 0 (B) 28 (C) 98 (D) 198	
Sol.	(C) 98	**1**
7.	The tangents drawn at the extremities of the diameter of a circle are always : (A) parallel (B) perpendicular (C) equal (D) intersecting	
Sol.	(A) parallel	**1**
8.	In triangles ABC and DEF, $\angle B = \angle E$, $\angle F = \angle C$ and AB = 3 DE. Then, the two triangles are : (A) congruent but not similar (B) congruent as well as similar (C) neither congruent nor similar (D) similar but not congruent	
Sol.	(D) similar but not congruent	**1**
9.	If $(-1)^n + (-1)^8 = 0$, then n is : (A) any positive integer (B) any negative integer (C) any odd number (D) any even number	
Sol.	(C) any odd number	**1**

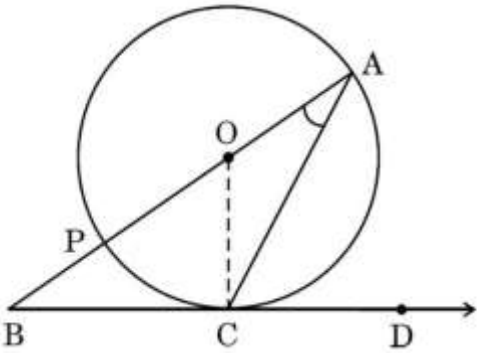
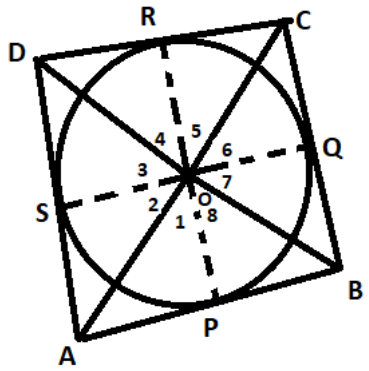
10.	Two polynomials are shown in the graph below. The number of distinct zeroes of both the polynomials is :  (A) 3 (B) 5 (C) 2 (D) 4	
Sol.	(C) 2	**1**
11.	If the sum of first m terms of an AP is $2m^2 + 3m$, then its second term is : (A) 10 (B) 9 (C) 12 (D) 4	
Sol.	(B) 9	**1**
12.	Mode and Mean of a data are 15x and 18x, respectively. Then the median of the data is : (A) x (B) 11x (C) 17x (D) 34x	
Sol.	(C) 17x	**1**
13.	A card is selected at random from a deck of 52 playing cards. The probability of it being a red face card is : (A) $\frac{3}{13}$ (B) $\frac{2}{13}$ (C) $\frac{1}{2}$ (D) $\frac{3}{26}$	
Sol.	(D) $\frac{3}{26}$	**1**

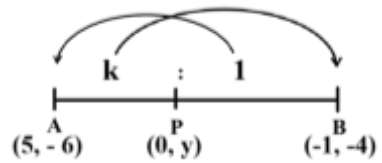
14.	Which of the following is a rational number between $\sqrt{3}$ and $\sqrt{5}$? (A) 1·4142387954012 .... (B) $2{\cdot}32\overline{6}$ (C) π (D) 1·857142	
Sol.	(D) 1.857142	**1**
15.	If a sector of a circle has an area of 40π sq. units and a central angle of 72°, the radius of the circle is : (A) 200 units (B) 100 units (C) 20 units (D) $10\sqrt{2}$ units	
Sol.	(D) $10\sqrt{2}$ units	**1**
16.	In the given figure, PA is a tangent from an external point P to a circle with centre O. If $\angle$ POB = 115°, then $\angle$ APO is equal to :  (A) 25° (B) 65° (C) 90° (D) 35°	
Sol.	(A) 25°	**1**
17.	A kite is flying at a height of 150 m from the ground. It is attached to a string inclined at an angle of 30° to the horizontal. The length of the string is : (A) $100\sqrt{3}$ m (B) 300 m (C) $150\sqrt{2}$ m (D) $150\sqrt{3}$ m	
Sol.	(B) 300 m	**1**

18.	A piece of wire 20 cm long is bent into the form of an arc of a circle of radius $\frac{60}{\pi}$ cm. The angle subtended by the arc at the centre of the circle is : (A) 30° (B) 60° (C) 90° (D) 50°	
Sol.	(B) 60°	**1**
	*Questions number **19** and **20** are Assertion and Reason based questions. Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.* (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A). (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is ***not*** the correct explanation of the Assertion (A). (C) Assertion (A) is true, but Reason (R) is false. (D) Assertion (A) is false, but Reason (R) is true.	
19.	*Assertion (A) :* The probability of selecting a number at random from the numbers 1 to 20 is 1. *Reason (R):* For any event E, if P(E) = 1, then E is called a sure event.	
Sol.	(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).	**1**
20	*Assertion (A) :* If we join two hemispheres of same radius along their bases, then we get a sphere. *Reason (R):* Total Surface Area of a sphere of radius r is $3\pi r^2$.	
Sol.	(C) Assertion (A) is true, but Reason (R) is false.	**1**
	SECTION B This section has **5** Very Short Answer (VSA) type questions carrying **2** marks each.	
21.(a)	If $x \cos 60° + y \cos 0° + \sin 30° - \cot 45° = 5$, then find the value of $x + 2y$.	
Sol.	$x\left(\frac{1}{2}\right) + y\,(1) + \frac{1}{2} - 1 = 5$ $\Rightarrow \quad x + 2y = 11$	**1½** **½**
	OR	

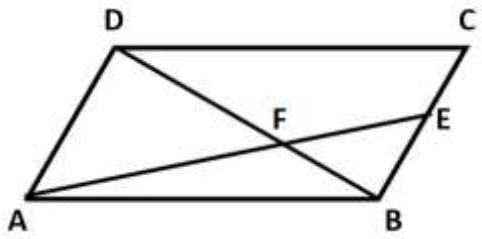
21. (b)	Evaluate : $\dfrac{\tan^2 60°}{\sin^2 60° + \cos^2 30°}$	
Sol.	$\dfrac{(\sqrt{3})^2}{\left(\frac{\sqrt{3}}{2}\right)^2 + \left(\frac{\sqrt{3}}{2}\right)^2}$ $= 2$	**1½** ½
22.	Find the zeroes of the polynomial $p(x) = x^2 + \frac{4}{3}x - \frac{4}{3}$.	
Sol.	$\frac{1}{3}(3x^2 + 4x - 4)$ $= \frac{1}{3}(3x^2 + 6x - 2x - 4)$ $= \frac{1}{3}(3x - 2)(x + 2)$ Zeroes are $\frac{2}{3}, -2$	½ ½ ½ ½
23.	The coordinates of the centre of a circle are (2a, a – 7). Find the value(s) of 'a' if the circle passes through the point (11, – 9) and has diameter $10\sqrt{2}$ units.	
Sol.	radius $= 5\sqrt{2}$ units $(2a - 11)^2 + (a - 7 + 9)^2 = 50$ $\Rightarrow a^2 - 8a + 15 = 0$ $\Rightarrow (a - 5)(a - 3) = 0$ $\Rightarrow a = 5, 3$	½ ½ ½ ½
24.(a)	If $\Delta ABC \sim \Delta PQR$ in which AB = 6 cm, BC = 4 cm, AC = 8 cm and PR = 6 cm, then find the length of (PQ + QR).	
Sol.	$\frac{6}{PQ} = \frac{4}{QR} = \frac{8}{6}$ $\Rightarrow PQ = \frac{9}{2}$ cm or 4.5 cm and QR = 3 cm ∴ PQ + QR = 7.5cm	½ ½ ½ ½
	OR	

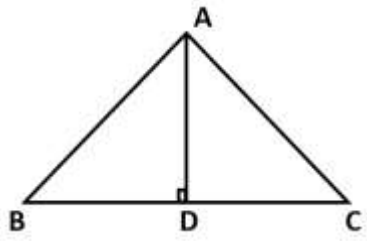
24.(b)	In the given figure, $\frac{QR}{QS} = \frac{QT}{PR}$ and $\angle 1 = \angle 2$, show that $\Delta PQS \sim \Delta TQR$.  	
Sol.	In ΔPQR, $\angle 1 = \angle 2 \therefore PR = PQ$ $\therefore \frac{QR}{QS} = \frac{QT}{PR} \Rightarrow \frac{QR}{QS} = \frac{QT}{PQ}$ Also, $\angle 1 = \angle 1$ $\therefore \Delta PQS \sim \Delta TQR$	½ ½ ½ ½
25.	A person is standing at P outside a circular ground at a distance of 26 m from the centre of the ground. He found that his distances from the points A and B on the ground are 10 m (PA and PB are tangents to the circle). Find the radius of the circular ground.  	
Sol.	$\angle OAP = 90°$ In right ΔOAP, $(26)^2 = OA^2 + (10)^2$ $\Rightarrow OA = \sqrt{576} = 24$ $\therefore$ radius = 24 m	½ **1** ½

	SECTION C This section has **6** Short Answer (SA) type questions carrying **3** marks each.	
26. (a)	In the given figure, O is the centre of the circle and BCD is tangent to it at C. Prove that $\angle BAC + \angle ACD = 90°$.  	
Sol.	In Δ OAC, OA = OC $\Rightarrow \angle OCA = \angle OAC$ Now, $\angle OCD = 90°$ $\Rightarrow \angle OCA + \angle ACD = 90°$ $\Rightarrow \angle OAC + \angle ACD = 90°$ or $\angle BAC + \angle ACD = 90°$	**1** **1** ½ ½
	OR	
26.(b)	Prove that opposite sides of a quadrilateral circumscribing a circle subtend supplementary angles at the centre of the circle.	
Sol.	 Correct Figure Δ OAP $\cong \Delta$ OAS $\therefore \angle 1 = \angle 2$ Similarly, $\angle 3 = \angle 4$, $\angle 5 = \angle 6$, $\angle 7 = \angle 8$ Also, $\angle 1 + \angle 2 + \angle 3 + \angle 4 + \angle 5 + \angle 6 + \angle 7 + \angle 8 = 360°$ $\Rightarrow 2(\angle 1 + \angle 4 + \angle 5 + \angle 8) = 360°$ $\Rightarrow \angle AOB + \angle COD = 180°$ Similarly, $\angle BOC + \angle AOD = 180°$	½ **1** ½ ½ ½

27. (a)	Prove that : $\frac{\tan\theta}{1-\cot\theta}+\frac{\cot\theta}{1-\tan\theta}=1+\sec\theta\,\text{cosec}\,\theta$	
Sol.	LHS $=\frac{\tan\theta}{1-\cot\theta}+\frac{\cot\theta}{1-\tan\theta}$ $=\frac{\frac{\sin\theta}{\cos\theta}}{1-\frac{\cos\theta}{\sin\theta}}+\frac{\frac{\cos\theta}{\sin\theta}}{1-\frac{\sin\theta}{\cos\theta}}$ $=\frac{\sin^2\theta}{\cos\theta(\sin\theta-\cos\theta)}-\frac{\cos^2\theta}{\sin\theta(\sin\theta-\cos\theta)}$ $=\frac{1}{(\sin\theta-\cos\theta)}\left[\frac{\sin^3\theta-\cos^3\theta}{\sin\theta\cos\theta}\right]$ $=\frac{(\sin\theta-\cos\theta)(\sin^2\theta+\sin\theta\cos\theta+\cos^2\theta)}{(\sin\theta-\cos\theta)\sin\theta\cos\theta}$ $=\frac{(1+\sin\theta\cos\theta)}{\sin\theta\cos\theta}$ $=1+\sec\theta\,\text{cosec}\,\theta$ = RHS	½ **1** ½ ½ ½
	OR	
27.(b)	Prove that : $\frac{\sin A+\cos A}{\sin A-\cos A}+\frac{\sin A-\cos A}{\sin A+\cos A}=\frac{2}{2\sin^2 A-1}$	
Sol.	LHS $=\frac{\sin A+\cos A}{\sin A-\cos A}+\frac{\sin A-\cos A}{\sin A+\cos A}$ $=\frac{(\sin A+\cos A)^2+(\sin A-\cos A)^2}{(\sin A-\cos A)(\sin A+\cos A)}$ $=\frac{\sin^2A+\cos^2A+2\sin A\cos A+\sin^2A+\cos^2A-2\sin A\cos A}{\sin^2A-\cos^2A}$ $=\frac{1+1}{\sin^2A-(1-\sin^2A)}$ $=\frac{2}{2\sin^2A-1}$ = RHS	**1** **1** ½ ½
28.	Find the ratio in which the y-axis divides the line segment joining the points (5, – 6) and (– 1, – 4). Also find the point of intersection.	
Sol.	 Let the ratio be k:1 and point on y- axis be P(0, y) $0=\frac{-k+5}{k+1}$ k = 5 Hence, ratio is 5:1 $y=\frac{-4(5)-6}{5+1}=\frac{-26}{6}=\frac{-13}{3}$ Coordinates of point of intersection are $P\left(0,-\frac{13}{3}\right)$	½ **1** ½ ½ ½

29.	Prove that $\frac{1}{\sqrt{5}}$ is an irrational number.	
Sol.	Let $\frac{1}{\sqrt{5}}$ be a rational number. $\therefore \frac{1}{\sqrt{5}} = \frac{p}{q}$, where $q \neq 0$ and let p & q be the co-primes. $5p^2 = q^2 \Longrightarrow q^2$ is divisible by 5. $\Longrightarrow$ q is divisible by 5. ----- (i) let $q = 5a$, where 'a' is some integer. $25a^2 = 5p^2 \Longrightarrow p^2 = 5a^2 \Longrightarrow p^2$ is divisible by 5. $\Longrightarrow$ p is divisible by 5 ----- (ii) (i) and (ii) leads to contradiction as p and q are coprimes. $\therefore \frac{1}{\sqrt{5}}$ is an irrational number	½ 1 1 ½
30.	A room is in the form of a cylinder surmounted by a hemispherical dome. The base radius of the hemisphere is half of the height of the cylindrical part. If the room contains $\frac{1408}{21}$ m^3 of air, find the height of the cylindrical part. (Use $\pi = \frac{22}{7}$).	
Sol.	Let r is the radius of hemisphere and cylinder and h is the height of cylinder $h = 2r$ Volume of air in room $= \frac{2}{3}\pi r^3 + \pi r^2 h$ $\frac{1408}{21} = \frac{2}{3}\pi r^3 + \pi r^2(2r)$ $\frac{1408}{21} = \frac{8}{3} \times \frac{22}{7} \times r^3$ $r^3 = 8$ $\therefore$ r = 2 m and h = 4 m	½ ½ **1** ½ ½
31.	Two dice are thrown at the same time. Determine the probability that the difference of the numbers on the two dice is 2.	
Sol.	Total outcomes = 36 Number of Outcomes with difference of the numbers on the two dice is 2 = 8 (1,3) (3,1) (4,2) (2,4) (5,3) (3,5) (4,6) (6,4) P (difference of the numbers on the two dice is 2) = $\frac{8}{36}$ or $\frac{2}{9}$	**1** **1** **1**

	SECTION D This section has **4** Long Answer (LA) type questions carrying **5** marks each.	
32.	Vijay invested certain amounts of money in two schemes A and B, which offer interest at the rate of 8% per annum and 9% per annum, respectively. He received ₹ 1,860 as the total annual interest. However, had he interchanged the amounts of investments in the two schemes, he would have received ₹ 20 more as annual interest. How much money did he invest in each scheme ?	
Sol.	Let Vijay invested ₹ x at 8% rate of interest & ₹ y at 9% rate of interest ATQ, $\frac{8x}{100} + \frac{9y}{100} = 1860$ or $8x + 9y = 186000$ ……..(i) $\frac{9x}{100} + \frac{8y}{100} = 1880$ or $9x + 8y = 188000$ ……..(ii) On solving (i) and (ii), we get $x = 12000$ $y = 10000$ Hence, money invested in scheme A is ₹ 12000 and scheme B is ₹ 10000.	**1½** **1½** **1** **1**
33.(a)	The diagonal BD of a parallelogram ABCD intersects the line segment AE at the point F, where E is any point on the side BC. Prove that DF × EF = FB × FA.	
Sol.	 Correct figure In Δ ADF and Δ EBF, ∠ DFA = ∠ EFB ∠ ADF = ∠ FBE ∴ Δ ADF ~ Δ EBF $\therefore \frac{DF}{FB} = \frac{FA}{EF}$ ⇒ DF ×EF = FB ×FA	**1** **2** **1** **1**
	OR	

33.(b)	In ΔABC, if $AD \perp BC$ and $AD^2 = BD \times DC$, then prove that $\angle BAC = 90°$.	
Sol.	 Correct figure	**1**
	$AD^2 = BD \times DC$	
	$\frac{AD}{DC} = \frac{BD}{AD}$	**1**
	Also, $\angle ADB = \angle ADC$	
	$\therefore \Delta DBA \sim \Delta DAC$	**1**
	$\angle DBA = \angle DAC$ $\angle BAD = \angle DCA$	**1**
	Adding both	
	$\angle DBA + \angle DCA = \angle DAC + \angle BAD$	
	$\therefore \quad \angle BAC = 90°$	**1**
34.(a)	The perimeter of a right triangle is 60 cm and its hypotenuse is 25 cm. Find the lengths of other two sides of the triangle.	
Sol.	Let the other two sides be x cm and y cm	
	ATQ	
	$x + y + 25 = 60$	**1**
	$y = 35 - x$	**½**
	Now,	
	$x^2 + y^2 = (25)^2$	
	$x^2 + (35 - x)^2 = 625$	**1**
	$x^2 - 35x + 300 = 0$	**1**
	$(x - 20)(x - 15) = 0$	
	$\Rightarrow x = 20, 15$	**1**
	$x = 20 \Rightarrow y = 15$ $x = 15 \Rightarrow y = 20$	**½**
	Hence sides are 15 cm and 20 cm.	
	OR	
34.(b)	A train travels a distance of 480 km at a uniform speed. If the speed had been 8 km/h less, then it would have taken 3 hours more to cover the same distance. Find the speed of the train.	
Sol.	Let the speed of train be x km/h	
	Reduced speed of train = $(x - 8)$ km/h	**½**
	ATQ	
	$\frac{480}{x - 8} - \frac{480}{x} = 3$	**1½**

	$x^2 - 8x - 1280 = 0$ $(x - 40)(x + 32) = 0$ $\Rightarrow x = 40$ $\therefore$ Speed of train = 40 km/h	**1½** **1** **½**
35.	**Find the missing frequency 'f' in the following table, if the mean of the given data is 18. Hence find the mode.** *Daily Allowance* | *Number of Children* 11 – 13 | 7 13 – 15 | 6 15 – 17 | 9 17 – 19 | 13 19 – 21 | f 21 – 23 | 5 23 – 25 | 4	
Sol.	Daily Allowance | x_i | f_i | $f_i x_i$ 11 – 13 | 12 | 7 | 84 13 – 15 | 14 | 6 | 84 15 – 17 | 16 | 9 | 144 17 – 19 | 18 | 13 | 234 19 – 21 | 20 | f | 20f 21 – 23 | 22 | 5 | 110 23 – 25 | 24 | 4 | 96 Total | | 44 + f | 752 + 20f Correct table Mean = $\frac{752+20f}{44+f}$ $\Rightarrow 18 = \frac{752+20f}{44+f}$ $\therefore$ f = 20 modal class is 19 – 21 mode = $19 + \frac{20-13}{40-13-5} \times 3$ = 19.95 approx.	**1½** **1** **½** **½** **1** **½**

SECTION E

This section has **3** case study based carrying **4** marks each.

36.

Case Study – 1

A school is organizing a charity run to raise funds for a local hospital. The run is planned as a series of rounds around a track, with each round being 300 metres. To make the event more challenging and engaging, the organizers decide to increase the distance of each subsequent round by 50 metres. For example, the second round will be 350 metres, the third round will be 400 metres and so on. The total number of rounds planned is 10.



Based on the information given above, answer the following questions :

(i) Write the fourth, fifth and sixth term of the Arithmetic Progression so formed.

(ii) Determine the distance of the 8th round.

(iii) (a) Find the total distance run after completing all 10 rounds.

OR

(iii) (b) If a runner completes only the first 6 rounds, what is the total distance run by the runner ?

Sol.

A.P formed is 300, 350, 400……

(i) $a_4 = 450$

$a_5 = 500$

$a_6 = 550$ — **1**

(ii) $a_8 = 300 + 7 \times 50$ — ½

$= 650$ m — ½

(iii) (a) $S_{10} = \frac{10}{2} \times (2 \times 300 + 9 \times 50)$ — **1**

$= 5250$ m — **1**

OR

(iii) (b) $S_6 = \frac{6}{2} \times (2 \times 300 + 5 \times 50)$ — **1**

$= 2250$ m — **1**

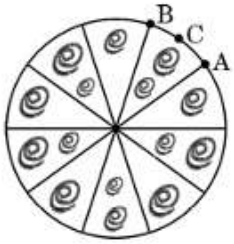
37.

Case Study – 2

A brooch is a decorative piece often worn on clothing like jackets, blouses or dresses to add elegance. Made from precious metals and decorated with gemstones, brooches come in many shapes and designs.



One such brooch is made with silver wire in the form of a circle with diameter 35 mm. The wire is also used in making 5 diameters which divide the circle into 10 equal sectors as shown in the figure.



Based on the above given information, answer the following questions :

(i) Find the central angle of each sector.

(ii) Find the length of the arc ACB.

(iii) (a) Find the area of each sector of the brooch.

OR

(iii) (b) Find the total length of the silver wire used.

Sol.

(i) central angle = $\frac{360^0}{10} = 36°$ **1**

(ii) length of arc ACB = $\frac{1}{10} \times 2 \times \frac{22}{7} \times \frac{35}{2} = 11\text{mm}$ **1**

(iii)(a) Area of each sector of the brooch = $\frac{1}{10} \times \frac{22}{7} \times \frac{35}{2} \times \frac{35}{2}$ **1**

$= \frac{385}{4}$ mm^2 or 96.25 mm^2 **1**

OR

(iii) (b) length of silver wire used = $2 \times \frac{22}{7} \times \frac{35}{2} + 5 \times 35$ **1**

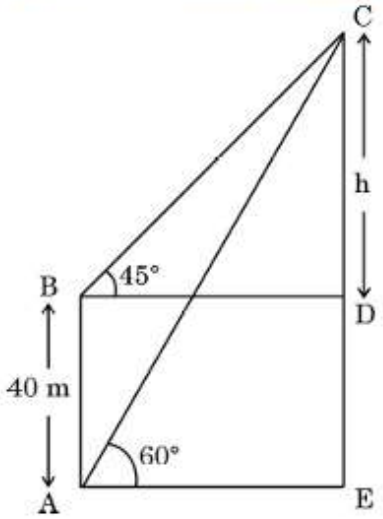
= 285 mm **1**

38.

Case Study – 3

Amrita stood near the base of a lighthouse, gazing up at its towering height. She measured the angle of elevation to the top and found it to be 60°. Then, she climbed a nearby observation deck, 40 metres higher than her original position and noticed the angle of elevation to the top of lighthouse to be 45°.





Based on the above given information, answer the following questions :

(i) **If CD is h metres, find the distance BD in terms of 'h'.**

(ii) **Find distance BC in terms of 'h'.**

(iii) (a) Find the height CE of the lighthouse [Use $\sqrt{3}$ = 1·73]

OR

(iii) (b) Find distance AE, if AC = 100 m.

Sol.

(i) $\frac{h}{BD} = \tan 45° = 1$ ½

$\Rightarrow$ BD = h m ½

(ii) $\frac{h}{BC} = \sin 45° = \frac{1}{\sqrt{2}}$ ½

$\Rightarrow$ BC = $\sqrt{2}$h m ½

(iii)(a) $\tan 60° = \frac{EC}{AE}$

$\Rightarrow \sqrt{3} = \frac{h+40}{h}$ **1**

$\Rightarrow$ h = 20 ($\sqrt{3}$ + 1) = 20 × 2.73 = 54.6 m ½

$\therefore$ CE = 54.6 + 40 = 94.6 m ½

OR

	(iii)(b) $\cos 60° = \frac{AE}{AC}$ $\Rightarrow \quad \frac{1}{2} = \frac{AE}{100}$ $\therefore \quad AE = 50$ m	**1** **1**

Series C4ABD/4 **SET~1**

प्रश्न–पत्र कोड
Q.P. Code **30/4/1**

रोल नं.
Roll No.

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

नोट / NOTE :

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

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

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

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

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

गणित (मानक)
MATHEMATICS (STANDARD)

निर्धारित समय : 3 घण्टे *अधिकतम अंक : 80*

Time allowed : 3 hours *Maximum Marks : 80*

सामान्य निर्देश :

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

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

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

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

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

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

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

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

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

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

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

खण्ड क

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

1. यदि $ax + by = a^2 - b^2$ तथा $bx + ay = 0$ है, तो $x + y$ का मान है :

(A) $a^2 - b^2$ (B) $a + b$

(C) $a - b$ (D) $a^2 + b^2$

2. दो संख्याओं 65 तथा 104 का म.स. (HCF) 13 है । यदि 65 तथा 104 का ल.स. (LCM) $40x$ है, तो x का मान है :

(A) 5 (B) 13

(C) 40 (D) 8

General Instructions :

Read the following instructions very carefully and strictly follow them :

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

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

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

(iv) *In **Section B,** Questions no. **21** to **25** are very short answer (VSA) type questions, carrying **2** marks each.*

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

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

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

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

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

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

SECTION A

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

1. If $ax + by = a^2 - b^2$ and $bx + ay = 0$, then the value of $x + y$ is :

(A) $a^2 - b^2$ (B) $a + b$

(C) $a - b$ (D) $a^2 + b^2$

2. The HCF of two numbers 65 and 104 is 13. If LCM of 65 and 104 is 40x, then the value of x is :

(A) 5 (B) 13

(C) 40 (D) 8

3. यदि एक बहुपद $p(x) = x^2 - 5x + 6$ है, तो $p(1) + p(4)$ का मान है :

(A) 0 (B) 4

(C) 2 (D) – 4

4. यदि द्विघात समीकरण $3x^2 - 2x + c = 0$ का विविक्तकर 16 है, तो c का मान है :

(A) 1 (B) 0

(C) – 1 (D) $\sqrt{2}$

5. यदि वृत्त की एक चाप वृत्त केंद्र पर 90° का कोण अंतरित करती है, तो इस चाप की लंबाई तथा वृत्त की परिधि में अनुपात है :

(A) 2 : 3 (B) 1 : 4

(C) 4 : 1 (D) 1 : 3

6. 12 cm त्रिज्या वाले एक वृत्त के एक त्रिज्यखण्ड का क्षेत्रफल 60π cm^2 है । इस त्रिज्यखण्ड के केंद्रीय कोण की माप है :

(A) 120° (B) 6°

(C) 75° (D) 150°

7. यदि किन्हीं आँकड़ों के बहुलक तथा माध्यक का अंतर 24 है, तो इनके माध्यक और माध्य का अंतर है :

(A) 12 (B) 24

(C) 8 (D) 36

8. दो पासों को एक साथ उछाला गया । दोनों पासों पर विषम संख्याएँ प्राप्त होने की प्रायिकता है :

(A) $\frac{6}{36}$ (B) $\frac{3}{36}$

(C) $\frac{12}{36}$ (D) $\frac{9}{36}$

9. एक ठोस अर्धगोले के संपूर्ण पृष्ठीय क्षेत्रफल तथा इसकी त्रिज्या के वर्ग के बीच का अनुपात है :

(A) $2\pi : 1$ (B) $4\pi : 1$

(C) $3\pi : 1$ (D) $1 : 4\pi$

3. If a polynomial p(x) is given by $p(x) = x^2 - 5x + 6$, then the value of $p(1) + p(4)$ is :

(A) 0 (B) 4

(C) 2 (D) – 4

4. If the discriminant of the quadratic equation $3x^2 - 2x + c = 0$ is 16, then the value of c is :

(A) 1 (B) 0

(C) – 1 (D) $\sqrt{2}$

5. If an arc subtends an angle of 90° at the centre of a circle, then the ratio of its length to the circumference of the circle is :

(A) 2 : 3 (B) 1 : 4

(C) 4 : 1 (D) 1 : 3

6. The area of the sector of a circle of radius 12 cm is 60π cm^2. The central angle of this sector is :

(A) 120° (B) 6°

(C) 75° (D) 150°

7. If the difference of mode and median of a data is 24, then the difference of its median and mean is :

(A) 12 (B) 24

(C) 8 (D) 36

8. Two dice are tossed simultaneously. The probability of getting odd numbers on both the dice is :

(A) $\frac{6}{36}$ (B) $\frac{3}{36}$

(C) $\frac{12}{36}$ (D) $\frac{9}{36}$

9. The ratio of total surface area of a solid hemisphere to the square of its radius is :

(A) $2\pi : 1$ (B) $4\pi : 1$

(C) $3\pi : 1$ (D) $1 : 4\pi$

10. यदि $\sin\theta = 1$ है, तो $\frac{1}{2}\sin\left(\frac{\theta}{2}\right)$ का मान है :

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

(C) $\frac{1}{2}$ (D) 0

11. दी गई दो रेखाएँ परस्पर समांतर हैं । इनमें से एक रेखा का समीकरण $5x - 3y = 2$ है । तो दूसरी रेखा का समीकरण हो सकता है :

(A) $-15x - 9y = 5$ (B) $15x + 9y = 5$

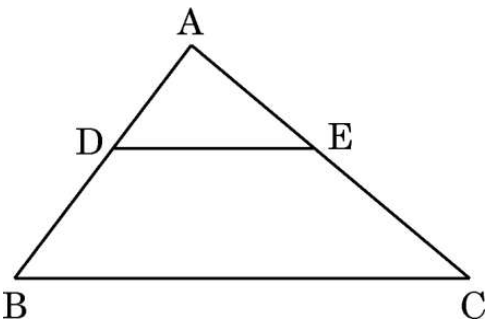
(C) $9x - 15y = 6$ (D) $-15x + 9y = 5$

12. तीन संख्याएँ जो एक समांतर श्रेढ़ी में हैं, का योगफल 30 है । इसका मध्य पद क्या है ?

(A) 4 (B) 10

(C) 16 (D) 8

13. एक Δ ABC में, DE || BC है (जैसा कि आकृति में दर्शाया गया है) । यदि AD = 4 cm, AB = 9 cm तथा AC = 13·5 cm है, तो EC की लंबाई है :



(A) 6 cm (B) 7·5 cm

(C) 9 cm (D) 5·7 cm

14. दिन में किसी समय, एक मीनार की छाया की लंबाई इसकी ऊँचाई के बराबर होती है । तो उस समय सूर्य का उन्नतांश है :

(A) 30° (B) 45°

(C) 60° (D) 90°

10. If $\sin\theta = 1$, then the value of $\frac{1}{2}\sin\left(\frac{\theta}{2}\right)$ is :

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

(C) $\frac{1}{2}$ (D) 0

11. Two lines are given to be parallel. The equation of one of these lines is $5x - 3y = 2$. The equation of the second line can be :

(A) $-15x - 9y = 5$ (B) $15x + 9y = 5$

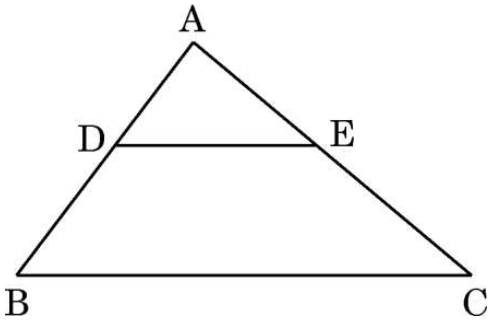
(C) $9x - 15y = 6$ (D) $-15x + 9y = 5$

12. Three numbers in A.P. have the sum 30. What is its middle term ?

(A) 4 (B) 10

(C) 16 (D) 8

13. In Δ ABC, DE || BC (as shown in the figure). If AD = 4 cm, AB = 9 cm and AC = 13·5 cm, then the length of EC is :



(A) 6 cm (B) 7·5 cm

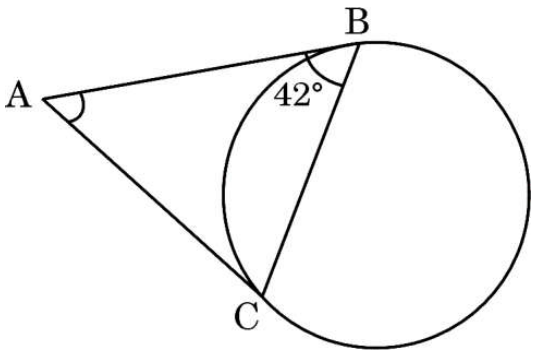
(C) 9 cm (D) 5·7 cm

14. At some time of the day, the length of the shadow of a tower is equal to its height. Then, the Sun's altitude at that time is :

(A) 30° (B) 45°

(C) 60° (D) 90°

15. दी गई आकृति में, AB तथा AC एक वृत्त पर खींची गई स्पर्श-रेखाएँ हैं । यदि $\angle ABC = 42°$ है, तो $\angle BAC$ की माप है :



(A) $96°$ (B) $42°$

(C) $106°$ (D) $86°$

16. एक समांतर चतुर्भुज ABCD के तीन शीर्ष A(– 2, 3), B(6, 7) तथा C(8, 3) हैं, तो इसका चौथा शीर्ष D है :

(A) $(0, 1)$ (B) $(0, -1)$

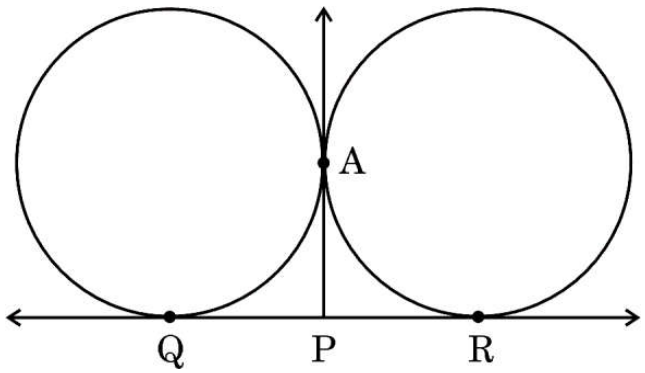
(C) $(-1, 0)$ (D) $(1, 0)$

17. किसी घटना E के लिए, यदि $P(E) + P(\overline{E}) = q$ है, तो $q^2 - 4$ का मान है :

(A) -3 (B) 3

(C) 5 (D) -5

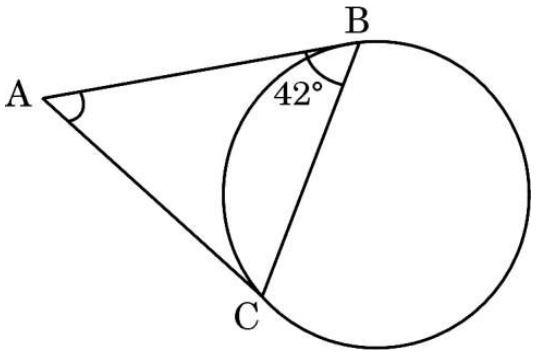
18. दी गई आकृति में, बिंदु A पर बाह्य स्पर्श करने वाले दो वृत्तों की एक उभयनिष्ठ स्पर्श-रेखा QR है । बिंदु A पर खींची गई स्पर्श-रेखा QR को P पर मिलती है । यदि AP = 4·2 cm है, तो QR की लंबाई है :



(A) 4·2 cm (B) 2·1 cm

(C) 8·4 cm (D) 6·3 cm

15. In the given figure, AB and AC are tangents to the circle. If $\angle$ ABC = 42°, then the measure of $\angle$ BAC is :



(A) 96° (B) 42°

(C) 106° (D) 86°

16. The fourth vertex D of a parallelogram ABCD whose three vertices are A(– 2, 3), B(6, 7) and C(8, 3) is :

(A) (0, 1) (B) (0, – 1)

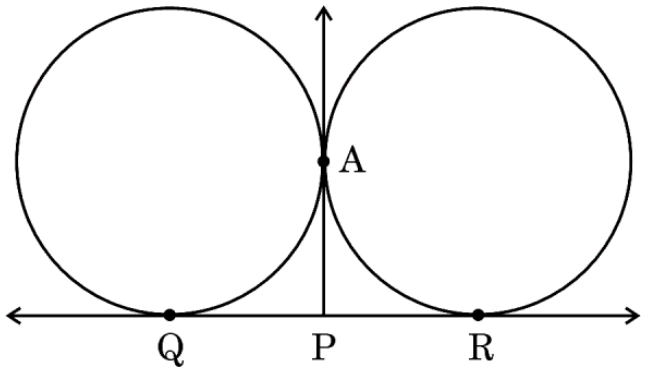
(C) (– 1, 0) (D) (1, 0)

17. For an event E, if P(E) + $P(\overline{E})$ = q, then the value of $q^2 - 4$ is :

(A) – 3 (B) 3

(C) 5 (D) – 5

18. In the given figure, QR is a common tangent to the two given circles touching externally at A. The tangent at A meets QR at P. If AP = 4·2 cm, then the length of QR is :



(A) 4·2 cm (B) 2·1 cm

(C) 8·4 cm (D) 6·3 cm

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

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

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

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

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

19. *अभिकथन (A) :* एक रेखाखण्ड का मध्य-बिंदु इसे 1 : 1 के अनुपात में विभाजित करता है ।

तर्क (R) : बिंदु $(-3, k)$, बिंदुओं $(-5, 4)$ तथा $(-2, 3)$ को मिलाने वाले रेखाखण्ड को 1 : 2 के अनुपात में विभाजित करता है ।

20. *अभिकथन (A) :* यदि एक वृत्त की परिधि 176 cm है, तो इसकी त्रिज्या 28 cm है ।

तर्क (R) : वृत्त की परिधि = $2\pi \times$ त्रिज्या

खण्ड ख

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

21. तीन घंटियाँ क्रमशः 9, 12 तथा 15 मिनट के अंतराल पर बजती हैं । यदि वह एक साथ बजना शुरू करती हैं, तो कितने समय के बाद वह दोबारा एक साथ बजेंगी ?

22. (a) एक घड़ी की मिनट वाली सुई की लंबाई 14 cm है । 5 मिनट में इसके द्वारा घड़ी के तल पर रचित क्षेत्रफल ज्ञात कीजिए ।

अथवा

(b) 42 cm त्रिज्या वाले वृत्त की उस चाप की लंबाई ज्ञात कीजिए जो वृत्त के केंद्र पर $60°$ का कोण अंतरित करती है ।

23. (a) मान ज्ञात कीजिए : $\dfrac{5\cos^2 60° + 4\sec^2 30° - \tan^2 45°}{\sin^2 30° + \sin^2 60°}$

अथवा

(b) यदि $\sin(A - B) = \dfrac{1}{2}$, $\cos(A + B) = \dfrac{1}{2}$; $0 < A + B \leq 90°$, $A > B$ है; तो $\angle A$ तथा $\angle B$ 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 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) :* Mid-point of a line segment divides the line segment in the ratio 1 : 1.

Reason (R) : The ratio in which the point $(-3, k)$ divides the line segment joining the points $(-5, 4)$ and $(-2, 3)$ is 1 : 2.

20. *Assertion (A) :* If the circumference of a circle is 176 cm, then its radius is 28 cm.

Reason (R): Circumference = $2\pi \times$ radius of a circle.

SECTION B

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

21. Three bells toll at intervals of 9, 12 and 15 minutes respectively. If they start tolling together, after what time will they next toll together ?

22. (a) The minute hand of a clock is 14 cm long. Find the area on the face of the clock described by the minute hand in 5 minutes.

OR

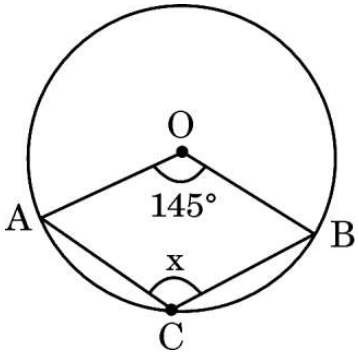
(b) Find the length of the arc of a circle which subtends an angle of 60° at the centre of the circle of radius 42 cm.

23. (a) Evaluate : $\dfrac{5\cos^2 60° + 4\sec^2 30° - \tan^2 45°}{\sin^2 30° + \sin^2 60°}$

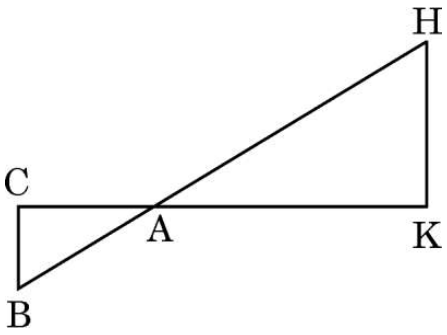
OR

(b) If $\sin(A - B) = \dfrac{1}{2}$, $\cos(A + B) = \dfrac{1}{2}$; $0 < A + B \leq 90°$, $A > B$; find $\angle A$ and $\angle B$.

24. दी गई आकृति में, O वृत्त का केंद्र है । यदि $\angle AOB = 145°$ है, तो x का मान ज्ञात कीजिए ।



25. दी गई आकृति में, $\Delta AHK \sim \Delta ABC$ है । यदि AK = 8 cm, BC = 3·2 cm तथा HK = 6·4 cm है, तो AC की लंबाई ज्ञात कीजिए ।



खण्ड ग

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

26. सिद्ध कीजिए : $\frac{\sin\theta - \cos\theta + 1}{\sin\theta + \cos\theta - 1} = \frac{1}{\sec\theta - \tan\theta}$

27. (a) तीन सिक्कों को एक साथ उछाला गया । निम्न के प्राप्त होने की प्रायिकता क्या है ?

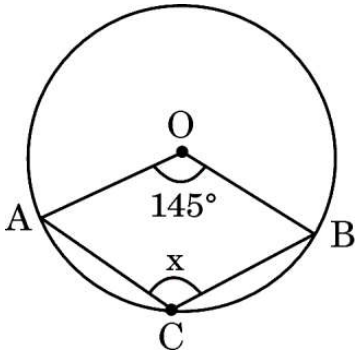
(i) कम-से-कम एक चित

(ii) मात्र दो पट

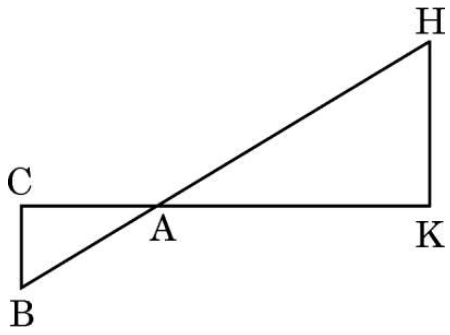
(iii) अधिक-से-अधिक एक पट

अथवा

24. In the given figure, O is the centre of the circle. If $\angle$ AOB = 145°, then find the value of x.



25. In the given figure, Δ AHK ~ Δ ABC. If AK = 8 cm, BC = 3·2 cm and HK = 6·4 cm, then find the length of AC.



SECTION C

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

26. Prove that $\frac{\sin\theta - \cos\theta + 1}{\sin\theta + \cos\theta - 1} = \frac{1}{\sec\theta - \tan\theta}$

27. (a) Three coins are tossed simultaneously. What is the probability of getting

(i) at least one head ?

(ii) exactly two tails ?

(iii) at most one tail ?

OR

(b) एक पेटी में 90 डिस्क (discs) हैं, जिन पर 1 से 90 तक संख्याएँ अंकित हैं । यदि इस पेटी में से एक डिस्क यादृच्छया निकाला जाता है, तो इसकी प्रायिकता ज्ञात कीजिए कि इस डिस्क पर अंकित होगी :

(i) दो अंकों की संख्या जो 40 से कम है ।

(ii) 5 से भाज्य वह संख्या जो 50 से बड़ी है ।

(iii) एक पूर्ण वर्ग संख्या ।

28. रेहाना ₹ 2,000 निकालने के लिए एक बैंक गई तथा उसने खजांची (कैशियर) को केवल ₹ 50 और ₹ 100 के नोट देने के लिए कहा । रेहाना को कुल 25 नोट प्राप्त हुए । ज्ञात कीजिए कि उसे ₹ 50 तथा ₹ 100 के कितने-कितने नोट मिले ।

29. (a) बहुपद $4x^2 + 4x - 3$ के शून्यक ज्ञात कीजिए तथा शून्यकों तथा बहुपद के गुणांकों के बीच के संबंध की जाँच कीजिए ।

अथवा

(b) यदि α तथा β बहुपद $x^2 + x - 2$ के शून्यक हैं, तो $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$ का मान ज्ञात कीजिए ।

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

31. सिद्ध कीजिए कि किसी वृत्त के परिगत समांतर चतुर्भुज समचतुर्भुज होता है ।

(b) A box contains 90 discs which are numbered 1 to 90. If one disc is drawn at random from the box, find the probability that it bears a :

(i) 2-digit number less than 40.

(ii) number divisible by 5 and greater than 50.

(iii) a perfect square number.

28. Rehana went to a bank to withdraw ₹ 2,000. She asked the cashier to give her ₹ 50 and ₹ 100 notes only. Rehana got 25 notes in all. Find how many notes of ₹ 50 and ₹ 100 did she receive.

29. (a) Find the zeroes of the polynomial $4x^2 + 4x - 3$ and verify the relationship between zeroes and coefficients of the polynomial.

OR

(b) If α and β are the zeroes of the polynomial $x^2 + x - 2$, then find the value of $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$.

30. Prove that $\frac{2 - \sqrt{3}}{5}$ is an irrational number, given that $\sqrt{3}$ is an irrational number.

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

खण्ड घ

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

32. एक 100 m चौड़ी सड़क के दोनों ओर आमने-सामने, समान लंबाई वाले दो खंभे लगे हुए हैं । इन दोनों खंभों के बीच सड़क के एक बिंदु से खंभों के शिखर के उन्नयन कोण क्रमशः 60° और 30° हैं । प्रत्येक खंभे की लंबाई और खंभों से सड़क के बिंदु की दूरी ज्ञात कीजिए । ($\sqrt{3}$ = 1·732 प्रयोग कीजिए)

33. (a) एक समांतर चतुर्भुज ABCD की बढ़ाई गई भुजा AD पर बिंदु E इस प्रकार है कि BE, भुजा CD को F पर काटती है । दर्शाइए कि Δ ABE ~ Δ CFB.

अथवा

(b) Δ ABC की भुजाएँ AB, BC तथा माध्यिका AD क्रमशः Δ PQR की भुजाओं PQ, QR तथा माध्यिका PM के समानुपाती हैं । सिद्ध कीजिए कि Δ ABC ~ Δ PQR.

34. (a) एक रेलगाड़ी 90 km की दूरी एक स्थिर चाल से चलती है । यदि इसकी चाल 15 km/h अधिक होती, तो इसे यह यात्रा पूरी करने में 30 मिनट कम लगते । रेलगाड़ी की मूल चाल ज्ञात कीजिए ।

अथवा

(b) 'c' का वह मान ज्ञात कीजिए, जिसके लिए द्विघात समीकरण

$$(c + 1)\,x^2 - 6\,(c + 1)\,x + 3\,(c + 9) = 0;\ c \neq -1$$

के मूल वास्तविक तथा समान हों ।

35. निम्नलिखित सारणी, एक अस्पताल में पूरे वर्ष में आए रोगियों की आयु दर्शाती है :

आयु (वर्षों में)	5 – 15	15 – 25	25 – 35	35 – 45	45 – 55	55 – 65
रोगियों की संख्या	6	11	21	23	14	5

उपर्युक्त प्रदत्त आँकड़ों का बहुलक तथा माध्य ज्ञात कीजिए ।

SECTION D

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

32. Two pillars of equal lengths stand on either side of a road which is 100 m wide, exactly opposite to each other. At a point on the road between the pillars, the angles of elevation of the tops of the pillars are 60° and 30°. Find the length of each pillar and distance of the point on the road from the pillars. (Use $\sqrt{3}$ = 1·732)

33. (a) E is a point on the side AD produced of a parallelogram ABCD and BE intersects CD at F. Show that Δ ABE ~ Δ CFB.

OR

(b) Sides AB, BC and the median AD of Δ ABC are respectively proportional to sides PQ, QR and the median PM of another Δ PQR. Prove that Δ ABC ~ Δ PQR.

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

OR

(b) Find the value of 'c' for which the quadratic equation

$$(c + 1)\,x^2 - 6\,(c + 1)\,x + 3\,(c + 9) = 0;\ c \neq -1$$

has real and equal roots.

35. The following table shows the ages of the patients admitted in a hospital during a year :

Age (in years)	5 – 15	15 – 25	25 – 35	35 – 45	45 – 55	55 – 65
Number of patients	6	11	21	23	14	5

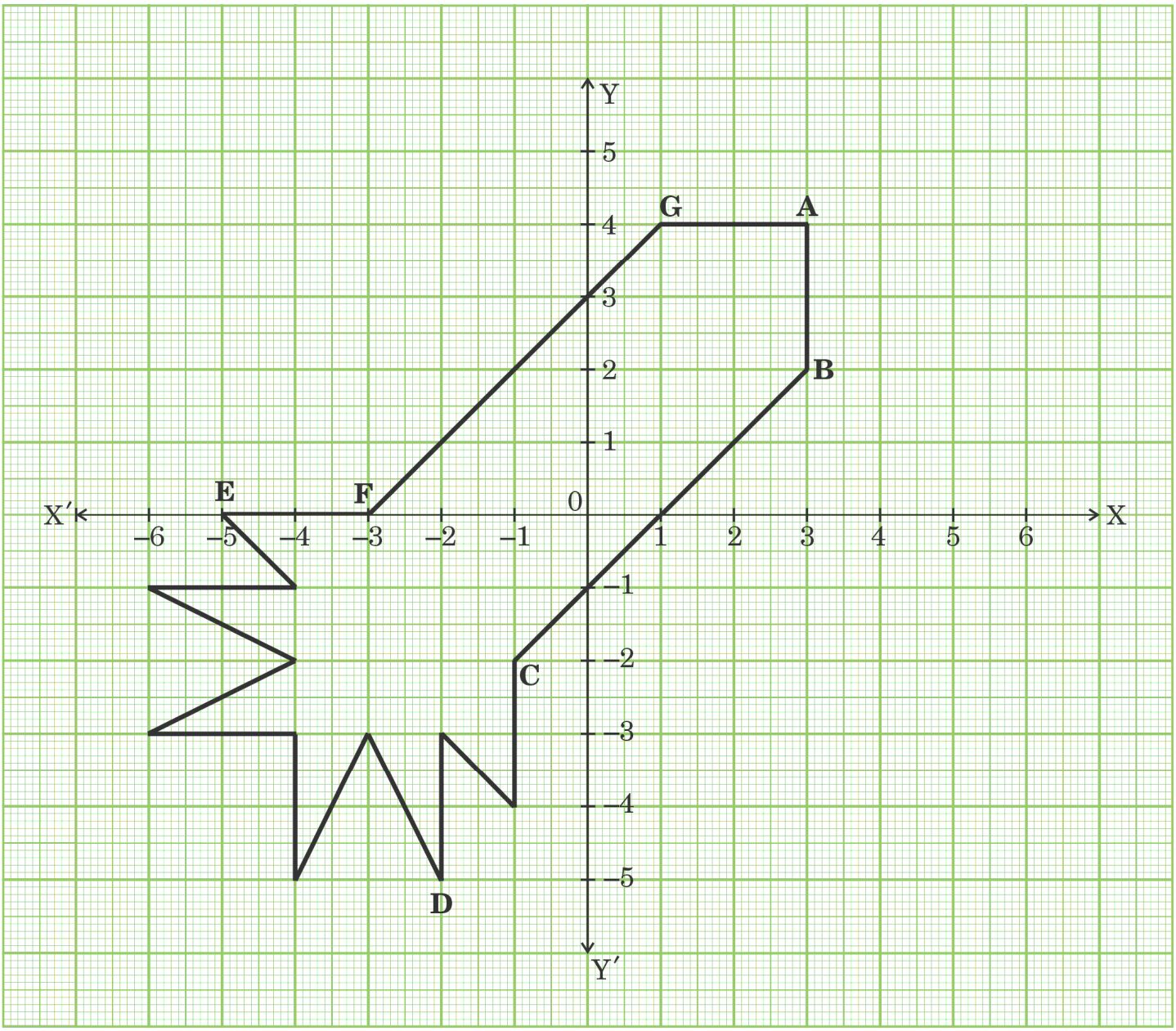
Find the mode and mean of the data given above.

खण्ड ङ

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

प्रकरण अध्ययन – 1

36. रेयान को छोटी उम्र से ही तारों की जगमगाहट और अंतरिक्ष की विशालता बहुत आकर्षित करती थी । वह हमेशा एक दिन अंतरिक्ष-यात्री बनने का सपना देखता था । इसलिए उसने ग्राफ पेपर पर अपने राकेट डिज़ाइन को स्केच करना शुरू कर दिया । ऐसा एक डिज़ाइन नीचे दिया गया है :



उपर्युक्त पर आधारित, निम्नलिखित प्रश्नों के उत्तर दीजिए :

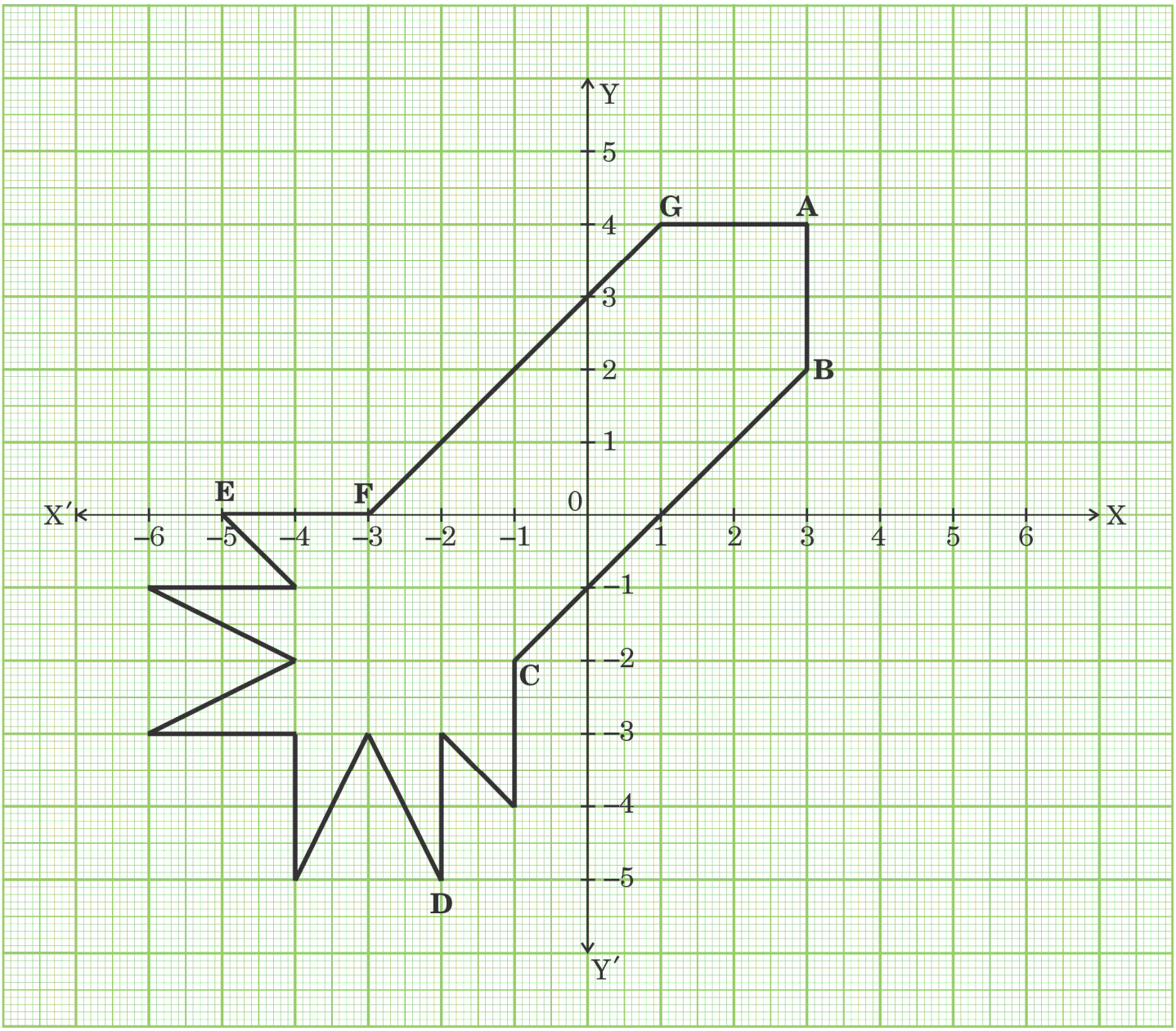
(i) F तथा G को मिलाने वाले रेखाखण्ड का मध्य-बिंदु ज्ञात कीजिए । *1*

SECTION E

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

Case Study – 1

36. Ryan, from a very young age, was fascinated by the twinkling of stars and the vastness of space. He always dreamt of becoming an astronaut one day. So he started to sketch his own rocket designs on the graph sheet. One such design is given below :



Based on the above, answer the following questions :

(i) Find the mid-point of the segment joining F and G. *1*

(ii) (a) बिंदुओं A तथा C के बीच की दूरी कितनी है ? *2*

अथवा

(b) बिंदुओं A तथा B को मिलाने वाले रेखाखण्ड को 1 : 3 के अनुपात में अंतः विभाजन करने वाले बिंदु के निर्देशांक ज्ञात कीजिए । *2*

(iii) बिंदु D के निर्देशांक क्या हैं ? *1*

प्रकरण अध्ययन – 2

37. ट्रेजर हंट एक रोमांचक और साहसिक खेल है, जहाँ प्रतिभागी छिपे हुए खजाने को खोजने के लिए सुरागों/संख्याओं/मानचित्रों की एक शृंखला का अनुसरण करते हैं । खिलाड़ी प्रतिष्ठित पुरस्कार का स्थान जानने के लिए एक रोमांचक खोज में लगे रहते हैं, समस्याओं और पहेलियों को सुलझाते हैं ।

एक ट्रेजर हंट खेल खेलते समय कुछ सुराग (संख्याएँ) विभिन्न स्थानों में छिपे होते हैं जो सामूहिक रूप में एक A.P. बनाते हैं । यदि nवें स्थान पर संख्या $20 + 4n$ है, तो खिलाड़ियों की मदद के लिए निम्नलिखित प्रश्नों के उत्तर दीजिए :



(i) पहले स्थान पर कौन-सी संख्या है ? *1*

(ii) (a) कौन-सा स्थान 112 क्रमांकित है ? *2*

अथवा

(b) पहले 10 स्थानों की सभी संख्याओं का योगफल क्या है ? *2*

(iii) कौन-सी संख्या $(n - 2)$वें स्थान पर है ? *1*

(ii) (a) What is the distance between the points A and C ? *2*

OR

(b) Find the coordinates of the point which divides the line segment joining the points A and B in the ratio 1 : 3 internally. *2*

(iii) What are the coordinates of the point D ? *1*

Case Study – 2

37. Treasure Hunt is an exciting and adventurous game where participants follow a series of clues/numbers/maps to discover hidden treasures. Players engage in a thrilling quest, solving puzzles and riddles to unveil the location of the coveted prize.

While playing a treasure hunt game, some clues (numbers) are hidden in various spots collectively forming an A.P. If the number on the nth spot is $20 + 4n$, then answer the following questions to help the players in spotting the clues :



(i) Which number is on first spot ? *1*

(ii) (a) Which spot is numbered as 112 ? *2*

OR

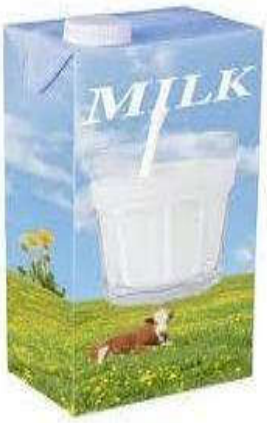
(b) What is the sum of all the numbers on the first 10 spots ? *2*

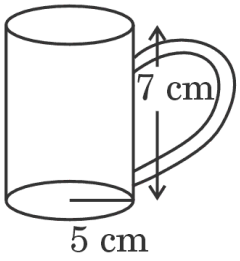
(iii) Which number is on the $(n - 2)^{th}$ spot ? *1*

प्रकरण अध्ययन – 3

38. टैम्पर-प्रूफ टेट्रा-पैक दूध ताज़गी और सुरक्षा दोनों की गारंटी देता है । यह दूध बेजोड़ गुणवत्ता सुनिश्चित करता है, इसमें निहित पोषण मूल्यों को संरक्षित करता है और इसे स्वास्थ्य के प्रति जागरूक व्यक्तियों के लिए एक विश्वसनीय विकल्प बनाता है ।







500 mL दूध 15 cm × 8 cm × 5 cm आयाम के घनाभाकार पैकेट में पैक हैं तथा यह दूध के पैकेट 30 cm × 32 cm × 15 cm के घनाभाकार कार्टन (डिब्बे) में रखे हैं ।

उपर्युक्त दी गई जानकारी के आधार पर निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) घनाभाकार कार्टन (डिब्बे) का आयतन ज्ञात कीजिए । *1*

(ii) (a) दूध के एक पैकेट का संपूर्ण पृष्ठीय क्षेत्रफल ज्ञात कीजिए । *2*

अथवा

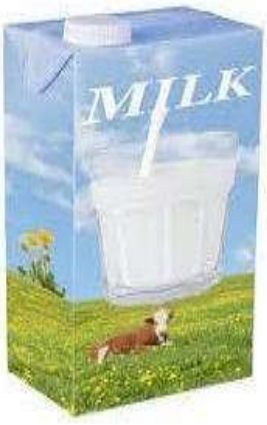
(b) एक कार्टन (डिब्बे) में कितने दूध के पैकेट आ सकते हैं ? *2*

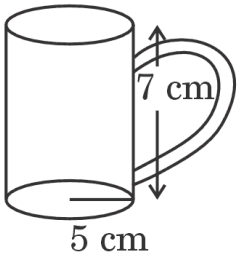
(iii) आकृति में दिखाए गए कप में कितना दूध आ सकता है ? *1*

Case Study – 3

38. Tamper-proof tetra-packed milk guarantees both freshness and security. This milk ensures uncompromised quality, preserving the nutritional values within and making it a reliable choice for health-conscious individuals.







500 mL milk is packed in a cuboidal container of dimensions 15 cm × 8 cm × 5 cm. These milk packets are then packed in cuboidal cartons of dimensions 30 cm × 32 cm × 15 cm.

Based on the above given information, answer the following questions :

(i) Find the volume of the cuboidal carton. *1*

(ii) (a) Find the total surface area of a milk packet. *2*

OR

(b) How many milk packets can be filled in a carton ? *2*

(iii) How much milk can the cup (as shown in the figure) hold ? *1*

Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2024
MATHEMATICS PAPER CODE 30/4/1

General Instructions: -

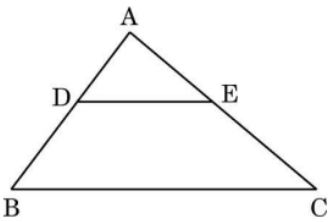
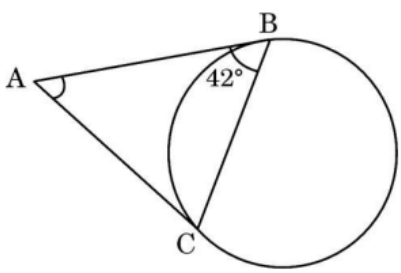
1	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully.
2	**"Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, Evaluation done and several other aspects. It's leakage to public in any manner could lead to derailment of the examination system and affect the life and future of millions of candidates. Sharing this policy/document to anyone, publishing in any magazine and printing in News Paper/Website etc. may invite action under various rules of the Board and IPC."**
3	Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one's own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. **However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and due marks be awarded to them. In class - X, while evaluating two competency-based questions, please try to understand given answer and even if reply is not from marking scheme but correct competency is enumerated by the candidate, due marks should be awarded.**
4	The Marking scheme carries only suggested value points for the answers. These are in the nature of Guidelines only and do not constitute the complete answer. The students can have their own expression and if the expression is correct, the due marks should be awarded accordingly.
5	The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. If there is any variation, the same should be zero after deliberation and discussion. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.
6	Evaluators will mark (✓) wherever answer is correct. For wrong answer CROSS 'X" be marked. Evaluators will not put right (✓) while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing.**
7	If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totalled up and written on the left-hand margin and encircled. This may be followed strictly.
8	If a question does not have any parts, marks must be awarded on the left-hand margin and encircled. This may also be followed strictly.

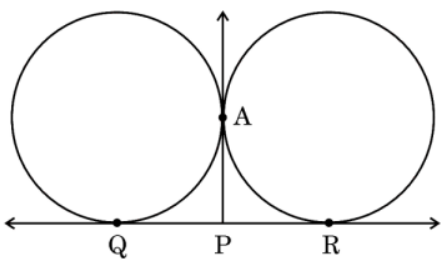
9	**In Q1-Q20, if a candidate attempts the question more than once (without cancelling the previous attempt), marks shall be awarded for the first attempt only and the other answer scored out with a note "Extra Question".**
10	**In Q21-Q38, if a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note "Extra Question".**
11	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
12	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.
13	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.
14	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 totalling of marks awarded to an answer. ● Wrong transfer of marks from the inside pages of the answer book to the title page. ● Wrong question wise totalling on the title page. ● Wrong totalling 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.
15	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.
16	Any un assessed 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.
17	The Examiners should acquaint themselves with the guidelines given in the "**Guidelines for spot Evaluation**" before starting the actual evaluation.
18	Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totalled and written in figures and words.
19	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 (Subject Code–041)
(PAPER CODE: 30/4/1)

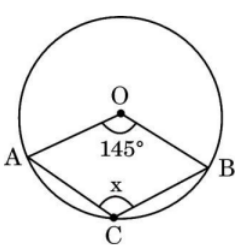
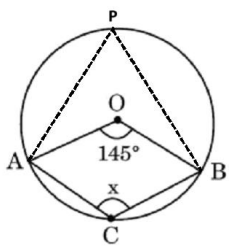
Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Marks
	SECTION A This section comprises Multiple Choice Questions (MCQs) of 1 mark each	
1.	If $ax + by = a^2 - b^2$ and $bx + ay = 0$, then the value of $x + y$ is : (A) $a^2 - b^2$ (B) $a + b$ (C) $a - b$ (D) $a^2 + b^2$	
Sol.	(C) a – b	1
2.	The HCF of two numbers 65 and 104 is 13. If LCM of 65 and 104 is 40x, then the value of x is : (A) 5 (B) 13 (C) 40 (D) 8	
Sol.	(B) 13	1
3.	If a polynomial p(x) is given by $p(x) = x^2 - 5x + 6$, then the value of $p(1) + p(4)$ is : (A) 0 (B) 4 (C) 2 (D) – 4	
Sol.	(B) 4	1
4.	If the discriminant of the quadratic equation $3x^2 - 2x + c = 0$ is 16, then the value of c is : (A) 1 (B) 0 (C) – 1 (D) $\sqrt{2}$	
Sol.	(C) -1	1
5.	If an arc subtends an angle of 90° at the centre of a circle, then the ratio of its length to the circumference of the circle is : (A) 2 : 3 (B) 1 : 4 (C) 4 : 1 (D) 1 : 3	
Sol.	(B) 1:4	1

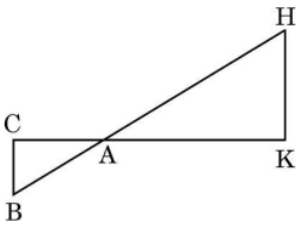
6.	The area of the sector of a circle of radius 12 cm is 60π cm^2. The central angle of this sector is : (A) 120° (B) 6° (C) 75° (D) 150°	
Sol.	(D) 150°	1
7.	If the difference of mode and median of a data is 24, then the difference of its median and mean is : (A) 12 (B) 24 (C) 8 (D) 36	
Sol.	(A) 12	1
8.	Two dice are tossed simultaneously. The probability of getting odd numbers on both the dice is : (A) $\frac{6}{36}$ (B) $\frac{3}{36}$ (C) $\frac{12}{36}$ (D) $\frac{9}{36}$	
Sol.	(D) $\frac{9}{36}$	1
9.	The ratio of total surface area of a solid hemisphere to the square of its radius is : (A) $2\pi : 1$ (B) $4\pi : 1$ (C) $3\pi : 1$ (D) $1 : 4\pi$	
Sol.	(C) $3\pi:1$	1
10.	If $\sin\theta = 1$, then the value of $\frac{1}{2}\sin\left(\frac{\theta}{2}\right)$ is : (A) $\frac{1}{2\sqrt{2}}$ (B) $\frac{1}{\sqrt{2}}$ (C) $\frac{1}{2}$ (D) 0	
Sol.	(A) $\frac{1}{2\sqrt{2}}$	1
11.	Two lines are given to be parallel. The equation of one of these lines is $5x - 3y = 2$. The equation of the second line can be : (A) $-15x - 9y = 5$ (B) $15x + 9y = 5$ (C) $9x - 15y = 6$ (D) $-15x + 9y = 5$	
Sol.	(D) $-15x + 9y = 5$	1

12.	Three numbers in A.P. have the sum 30. What is its middle term ? (A) 4 (B) 10 (C) 16 (D) 8	
Sol.	(B) 10	1
13.	In Δ ABC, DE $\|\|$ BC (as shown in the figure). If AD = 4 cm, AB = 9 cm and AC = 13·5 cm, then the length of EC is :  (A) 6 cm (B) 7·5 cm (C) 9 cm (D) 5·7 cm	
Sol.	(B) 7.5 cm	1
14.	At some time of the day, the length of the shadow of a tower is equal to its height. Then, the Sun's altitude at that time is : (A) 30° (B) 45° (C) 60° (D) 90°	
Sol.	(B) 45°	1
15.	In the given figure, AB and AC are tangents to the circle. If $\angle$ ABC = 42°, then the measure of $\angle$ BAC is :  (A) 96° (B) 42° (C) 106° (D) 86°	
Sol.	(A) 96°	1

16.	The fourth vertex D of a parallelogram ABCD whose three vertices are A(– 2, 3), B(6, 7) and C(8, 3) is : (A) (0, 1) (B) (0, –1) (C) (–1, 0) (D) (1, 0)	
Sol.	(B) (0,-1)	1
17.	For an event E, if P(E) + P($\overline{E}$) = q, then the value of $q^2 - 4$ is : (A) – 3 (B) 3 (C) 5 (D) – 5	
Sol.	(A) -3	1
18.	In the given figure, QR is a common tangent to the two given circles touching externally at A. The tangent at A meets QR at P. If AP = 4·2 cm, then the length of QR is :  (A) 4·2 cm (B) 2·1 cm (C) 8·4 cm (D) 6·3 cm	
Sol.	(C) 8.4 cm	1
	*Questions number **19** and **20** are Assertion and Reason based questions. Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.* (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of 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) :* Mid-point of a line segment divides the line segment in the ratio 1 : 1. *Reason (R) :* The ratio in which the point (– 3, k) divides the line segment joining the points (– 5, 4) and (– 2, 3) is 1 : 2.	
Sol.	(C) Assertion (A) is true but Reason (R) is false	1

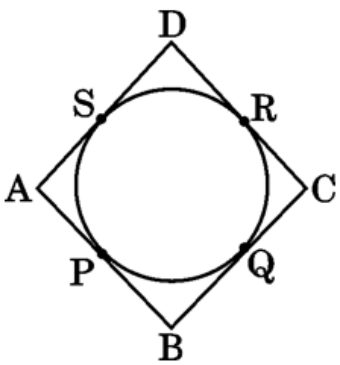
20.	*Assertion (A) :* If the circumference of a circle is 176 cm, then its radius is 28 cm. *Reason (R):* Circumference = $2\pi \times$ radius of a circle.	
Sol.	(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).	1
	SECTION B This section comprises Very Short Answer (VSA) type questions of 2 marks each.	
21.	Three bells toll at intervals of 9, 12 and 15 minutes respectively. If they start tolling together, after what time will they next toll together ?	
Sol.	$9 = 3^2$ $12 = 2^2 \times 3$ $15 = 3 \times 5$ L.C.M = $2^2 \times 3^2 \times 5 = 180$ Three bells will toll together after 180 min.	1 1
22. (a)	The minute hand of a clock is 14 cm long. Find the area on the face of the clock described by the minute hand in 5 minutes.	
Sol.	Angle subtended in 5 min. = 30° Area described by minute hand = $\frac{30}{360} \times \frac{22}{7} \times 14 \times 14$ $= \frac{154}{3}$ cm^2 or 51.33 cm^2 approx.	½ 1 ½
	OR	
22. (b)	Find the length of the arc of a circle which subtends an angle of 60° at the centre of the circle of radius 42 cm.	
Sol.	Length of arc = $2 \times \frac{22}{7} \times 42 \times \frac{60}{360}$ = 44 cm	1½ ½

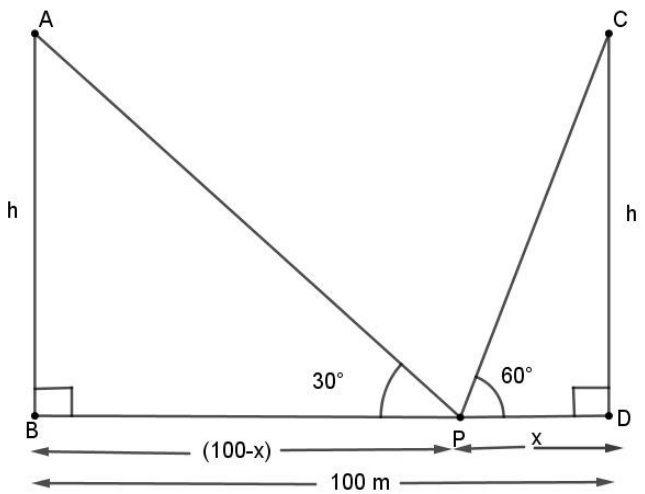
23. (a)	Evaluate : $\frac{5\cos^2 60° + 4\sec^2 30° - \tan^2 45°}{\sin^2 30° + \sin^2 60°}$	
Sol.	$\frac{5\left(\frac{1}{2}\right)^2+4\left(\frac{2}{\sqrt{3}}\right)^2-(1)^2}{\left(\frac{1}{2}\right)^2+\left(\frac{\sqrt{3}}{2}\right)^2}$ $= \frac{67}{12}$	1½ ½
	OR	
23.(b)	If $\sin(A - B) = \frac{1}{2}$, $\cos(A + B) = \frac{1}{2}$; $0 < A + B \leq 90°$, $A > B$; find $\angle A$ and $\angle B$.	
Sol.	$\sin(A - B) = \sin 30°$ $A - B = 30°$ --------(i) $\cos(A+B) = \cos 60°$ $A + B = 60°$ ---------(ii) Solving (i) and (ii) $A = 45°$, $B = 15°$	½ ½ 1
24.	In the given figure, O is the centre of the circle. If $\angle AOB = 145°$, then find the value of x. 	
Sol.	 Take a point P on circumference and join AP & BP.	½

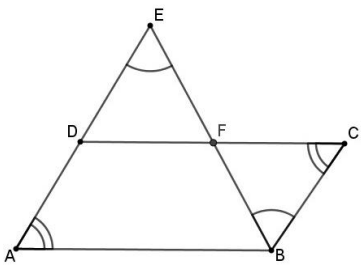
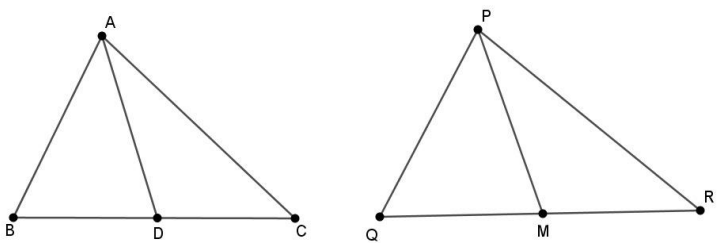
	$\angle APB = \frac{1}{2} \times 145° = 72.5°$ $\angle APB + \angle ACB = 180°$ $\Rightarrow \angle ACB = 107.5°$ or $x = 107.5°$	½ ½ ½
25.	In the given figure, Δ AHK ~ Δ ABC. If AK = 8 cm, BC = 3·2 cm and HK = 6·4 cm, then find the length of AC.  	
Sol.	$\because \Delta AHK \sim \Delta ABC$ (given) $\therefore \frac{HK}{BC} = \frac{AK}{AC}$ $\Rightarrow \frac{6.4}{3.2} = \frac{8.0}{AC}$ $\Rightarrow$ AC = 4 cm	 1 1
	SECTION C This section comprises Short Answer (SA) type questions of 3 marks each.	
26.	Prove that $\frac{\sin\theta - \cos\theta + 1}{\sin\theta + \cos\theta - 1} = \frac{1}{\sec\theta - \tan\theta}$	
Sol.	L.H.S = $\frac{\sin\theta - \cos\theta + 1}{\sin\theta + \cos\theta - 1}$ Divide Numerator and Denominator by cos θ. $= \frac{\tan\theta - 1 + \sec\theta}{\tan\theta + 1 - \sec\theta}$ $= \frac{\tan\theta - 1 + \sec\theta}{(\tan\theta - \sec\theta) + (\sec^2\theta - \tan^2\theta)}$ $= \frac{\tan\theta - 1 + \sec\theta}{(\sec\theta - \tan\theta)(\tan\theta + \sec\theta - 1)}$ $= \frac{1}{\sec\theta - \tan\theta}$ = R.H.S	 1 1 ½ ½

27.(a)	Three coins are tossed simultaneously. What is the probability of getting (i) at least one head ? (ii) exactly two tails ? (iii) at most one tail ?	
Sol.	Total number of outcomes = 8 (i) P (at least one head) = $\frac{7}{8}$ (ii) P (exactly 2 tails) = $\frac{3}{8}$ (iii) P (at most one tail) = $\frac{4}{8}$ or $\frac{1}{2}$	 1 1 1
	OR	
27.(b)	A box contains 90 discs which are numbered 1 to 90. If one disc is drawn at random from the box, find the probability that it bears a : (i) 2-digit number less than 40. (ii) number divisible by 5 and greater than 50. (iii) a perfect square number.	
Sol.	Total outcomes = 90 (i) P (2 digit number less than 40) = $\frac{30}{90}$ or $\frac{1}{3}$ (ii) P (a number divisible by 5 and greater than 50) = $\frac{8}{90}$ or $\frac{4}{45}$ (iii) P (a perfect square number) = $\frac{9}{90}$ or $\frac{1}{10}$	 1 1 1
28	Rehana went to a bank to withdraw ₹ 2,000. She asked the cashier to give her ₹ 50 and ₹ 100 notes only. Rehana got 25 notes in all. Find how many notes of ₹ 50 and ₹ 100 did she receive.	
Sol.	Let number of ₹50 notes = x and number of ₹100 notes = y Here x + y = 25 ------(i) 50x + 100y = 2000 or x + 2y = 40 -------(ii)	 1 1

	Solving eq.(i) and eq.(ii), we get x = 10 and y = 15 Therefore 10 notes of ₹50 and 15 notes of ₹100 are received.	½ + ½
29.(a)	Find the zeroes of the polynomial $4x^2 + 4x - 3$ and verify the relationship between zeroes and coefficients of the polynomial.	
Sol.	$P(x) = 4x^2 + 4x - 3$ $= (2x + 3)(2x - 1)$ $\therefore$ Zeroes of the polynomial are $\frac{-3}{2}$, $\frac{1}{2}$ Sum of Zeroes $= \frac{-3}{2} + \frac{1}{2} = \frac{-3+1}{2} = -1 = \frac{-4}{4} = \frac{-(\text{coefficient of } x)}{(\text{coefficient of } x^2)}$ Product of Zeroes $= \frac{-3}{2} \times \frac{1}{2} = \frac{-3}{4} = \frac{\text{constant term}}{\text{coefficient of } x^2}$	1 1 ½ ½
	OR	
29(b).	If α and β are the zeroes of the polynomial $x^2 + x - 2$, then find the value of $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$.	
Sol.	Here $\alpha + \beta = -1$ and $\alpha\beta = -2$ $\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = \frac{\alpha^2 + \beta^2}{\alpha\beta} = \frac{(\alpha+\beta)^2 - 2\alpha\beta}{\alpha\beta}$ $= \frac{(-1)^2 - 2(-2)}{-2} = -\frac{5}{2}$	1 1 1
30.	Prove that $\frac{2-\sqrt{3}}{5}$ is an irrational number, given that $\sqrt{3}$ is an irrational number.	
Sol.	Assuming $\frac{2-\sqrt{3}}{5}$ to be a rational number. $\Rightarrow \frac{2-\sqrt{3}}{5} = \frac{p}{q}$,where p and q are integers & $q \neq 0$ $\Rightarrow \sqrt{3} = \frac{2q-5p}{q}$ Here RHS is rational but LHS is irrational. Therefore our assumption is wrong.	½ 1 ½ ½

	Hence $\frac{2-\sqrt{3}}{5}$ is an irrational number.	½
31.	**Prove that the parallelogram circumscribing a circle is a rhombus.**	
Sol.	Correct figure 	½
	AP = AS -----(i) BP = BQ -----(ii) CR = CQ -----(iii) DR = DS -----(iv)	1
	Adding (i), (ii), (iii) & (iv) AP + BP + CR + DR = AS + BQ + CQ + DS $\Rightarrow$ AB + CD = AD + BC	1
	But ABCD is a parallelogram $\Rightarrow$AB = CD and AD = BC $\therefore$ 2AB = 2AD or AB = AD	½
	Hence, ABCD is a rhombus.	

	SECTION D This section comprises Long Answer (LA) type questions of 5 marks each.	
32.	Two pillars of equal lengths stand on either side of a road which is 100 m wide, exactly opposite to each other. At a point on the road between the pillars, the angles of elevation of the tops of the pillars are 60° and 30°. Find the length of each pillar and distance of the point on the road from the pillars. (Use $\sqrt{3}$ = 1·732)	
Sol.	Correct figure  Let AB and CD are two pillars of equal length h m and let P be the point on road x m away from pillar CD. In ΔCDP $\tan 60° = \sqrt{3} = \frac{h}{x}$ $\Rightarrow h = \sqrt{3}\, x$ ------(i) In ΔABP, $\tan 30° = \frac{1}{\sqrt{3}} = \frac{h}{100-x}$ $\Rightarrow h = \frac{100-x}{\sqrt{3}}$ -------(ii) Solving eq.(i) and eq.(ii) x = 25	1 1 ½ 1 ½ ½

	and h = $25\sqrt{3}$ = 25 × 1.732 = 43.3 The length of each pillar is 43.3 m and the distance of the point on the road from pillars is 75 m and 25 m respectively.	½
33.(a)	**E is a point on the side AD produced of a parallelogram ABCD and BE intersects CD at F. Show that Δ ABE ~ Δ CFB.**	
Sol.	Correct figure  In ΔABE and ΔCFB ∠EAB = ∠BCF ∠AEB = ∠CBF ⇒ ΔABE ~ ΔCFB	2 1 1 1
	OR	
33.(b)	**Sides AB, BC and the median AD of Δ ABC are respectively proportional to sides PQ, QR and the median PM of another Δ PQR. Prove that Δ ABC ~ Δ PQR.**	
Sol.	Correct figure  $\because \frac{AB}{PQ} = \frac{BC}{QR} = \frac{AD}{PM}$ $\therefore \frac{AB}{PQ} = \frac{2BD}{2QM} = \frac{AD}{PM}$	1 1

	$\Rightarrow \frac{AB}{PQ} = \frac{BD}{QM} = \frac{AD}{PM}$ -------(i)	
	$\Rightarrow \Delta ABD \sim \Delta PQM$	1
	$\Rightarrow \angle B = \angle Q$ -----(ii)	1
	In ΔABC and ΔPQR	
	$\frac{AB}{PQ} = \frac{BC}{QR}$	
	$\angle B = \angle Q$	
	$\therefore \Delta ABC \sim \Delta PQR$	1
34(a).	A train travels a distance of 90 km at a constant speed. Had the speed been 15 km/h more, it would have taken 30 minutes less for the journey. Find the original speed of the train.	
Sol.	Let the original speed be x km/h	
	New speed = (x + 15) km/h	½
	A.T.Q.	
	$\frac{90}{x} - \frac{90}{x+15} = \frac{1}{2}$	1½
	$\Rightarrow x^2 + 15x - 2700 = 0$	1
	$\Rightarrow$(x + 60) (x - 45) = 0	1
	$x \neq -60$, x = 45	1
	The original speed of the train = 45km/h	
	OR	
34(b).	Find the value of 'c' for which the quadratic equation $(c + 1)x^2 - 6(c + 1)x + 3(c + 9) = 0;\ c \neq -1$ has real and equal roots.	
Sol.	For real and equal roots,	
	$\{-6(c+1)\}^2 - 4(c+1) \times 3(c+9) = 0$	2
	$\Rightarrow$ 12(c + 1) (2c – 6) = 0	2
	$c \neq -1$ So, c = 3	1

35.

The following table shows the ages of the patients admitted in a hospital during a year :

Age (in years)	5 – 15	15 – 25	25 – 35	35 – 45	45 – 55	55 – 65
Number of patients	6	11	21	23	14	5

Find the mode and mean of the data given above.

Sol.

Age (in years)	No. of patients (f_i)	Mid point (x_i)	$x_i f_i$
5 – 15	6	10	60
15 - 25	11	20	220
25 - 35	21	30	630
35 - 45	23	40	920
45 - 55	14	50	700
55 - 65	5	60	300
Total	80		2830

Correct table 1½

$\Rightarrow$ Mean = $\frac{2830}{80}$ ½

= 35.375 ½

Modal class = (35 - 45) ½

$\Rightarrow Mode = 35 + (\frac{23-21}{2\times23-21-14}) \times h$ 1

= 36.81 1

Therefore, mode and mean of given data are 36.81 years and 35.375 years respectively.

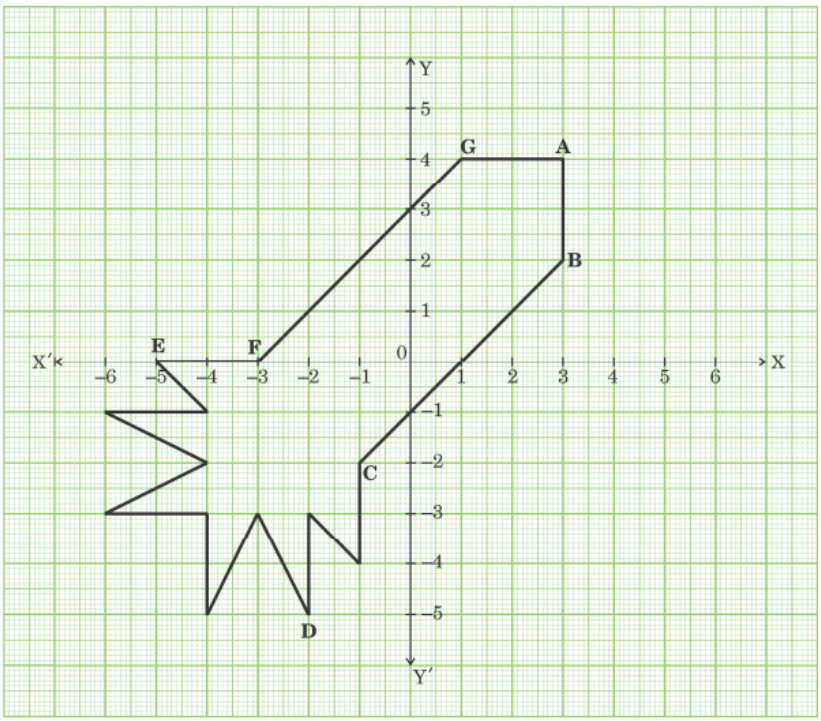
SECTION E

This section comprises 3 case-study based questions of 4 marks each.

36.

Case Study - 1

Ryan, from a very young age, was fascinated by the twinkling of stars and the vastness of space. He always dreamt of becoming an astronaut one day. So he started to sketch his own rocket designs on the graph sheet. One such design is given below :



Based on the above, answer the following questions :

(i) Find the mid-point of the segment joining F and G.

(ii) (a) What is the distance between the points A and C ?

OR

(b) Find the coordinates of the point which divides the line segment joining the points A and B in the ratio 1 : 3 internally.

(iii) What are the coordinates of the point D ?

Sol.

(i) Mid point of FG is $\left(\frac{-3+1}{2}, \frac{0+4}{2}\right) = (-1,2)$ 1

(ii) (a) AC = $\sqrt{(-1-3)^2 + (-2-4)^2}$ 1

= $\sqrt{52}$ or $2\sqrt{13}$ 1

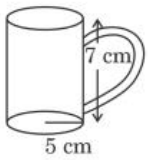
OR

(ii) (b) The coordinates of required point are $\left(\frac{1\times3+3\times3}{1+3}, \frac{1\times2+3\times4}{1+3}\right)$ 1

i.e. $\left(3, \frac{7}{2}\right)$ 1

(iii) D(-2, -5) 1

37.	**Case Study – 2** Treasure Hunt is an exciting and adventurous game where participants follow a series of clues/numbers/maps to discover hidden treasures. Players engage in a thrilling quest, solving puzzles and riddles to unveil the location of the coveted prize. While playing a treasure hunt game, some clues (numbers) are hidden in various spots collectively forming an A.P. If the number on the nth spot is $20 + 4n$, then answer the following questions to help the players in spotting the clues :  (i) Which number is on first spot ? (ii) (a) Which spot is numbered as 112 ? **OR** (b) What is the sum of all the numbers on the first 10 spots ? (iii) Which number is on the $(n - 2)^{th}$ spot ?	
Sol.	(i) Number on the first spot = $20 + 4 \times 1 = 24$ (ii) (a) $20 + 4n = 112$ $\Rightarrow n = 23$ OR (ii) (b) $d = 4$ $S_{10} = \frac{10}{2}[2 \times 24 + 9 \times 4]$ $= 420$ (iii) Number on the $(n - 2)^{th}$ spot $= 20 + 4(n - 2)$ $= 12 + 4n$	1 1 1 ½ 1 ½ 1

38.	**Case Study – 3** Tamper-proof tetra-packed milk guarantees both freshness and security. This milk ensures uncompromised quality, preserving the nutritional values within and making it a reliable choice for health-conscious individuals.    500 mL milk is packed in a cuboidal container of dimensions 15 cm × 8 cm × 5 cm. These milk packets are then packed in cuboidal cartons of dimensions 30 cm × 32 cm × 15 cm. Based on the above given information, answer the following questions : (i) Find the volume of the cuboidal carton. (ii) (a) Find the total surface area of a milk packet. **OR** (b) How many milk packets can be filled in a carton ? (iii) How much milk can the cup (as shown in the figure) hold ?	
Sol.	(i) Volume of cuboidal carton = 30×32×15 = 14400 cm^3 (ii)(a) Total surface area of milk packet = 2(15×8+8×5+5×15) = 470 cm^2 OR (ii) (b) Number of milk packets in carton = $\frac{30\times32\times15}{15\times8\times5}$ = 24 (iii) Capacity of the cup = $\frac{22}{7}$ × 5 × 5 × 7 = 550 cm^3 or 550 ml	½ ½ 1 1 1 1 ½ ½