Series C5ABD/5 **SET~3**

प्रश्न–पत्र कोड **Q.P. Code 30/5/3**

रोल नं.

Roll No.

परीक्षार्थी प्रश्न-पत्र कोड को उत्तर-पुस्तिका के मुख-पृष्ठ पर अवश्य लिखें ।

Candidates must write the Q.P. Code on the title page of the answer-book.

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. छोटी-से-छोटी अभाज्य संख्या तथा छोटी-से-छोटी विषम भाज्य संख्या का ल.स. (LCM) है :

(A) 10 (B) 6

(C) 9 (D) 18

2. यदि प्रथम n प्राकृत संख्याओं का माध्य $\frac{5n}{9}$ है, तो n का मान है :

(A) 5 (B) 4

(C) 9 (D) 10

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

1. The LCM of the smallest prime number and the smallest odd composite number is :

(A) 10 (B) 6

(C) 9 (D) 18

2. If the mean of the first n natural numbers is $\frac{5n}{9}$, then the value of n is :

(A) 5 (B) 4

(C) 9 (D) 10

3. यदि $5 \tan \theta - 12 = 0$ है, तो $\sin \theta$ का मान है :

(A) $\frac{5}{12}$ (B) $\frac{12}{13}$

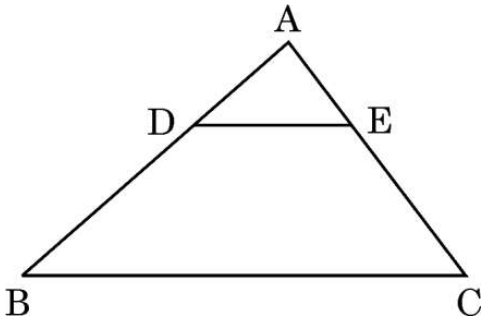
(C) $\frac{5}{13}$ (D) $\frac{12}{5}$

4. समांतर श्रेढ़ी (A.P.) $\sqrt{18}$, $\sqrt{50}$, $\sqrt{98}$, ... का अगला (चौथा) पद है :

(A) $\sqrt{128}$ (B) $\sqrt{140}$

(C) $\sqrt{162}$ (D) $\sqrt{200}$

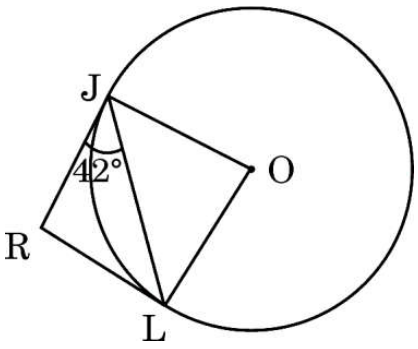
5. दी गई आकृति में, Δ ABC में, DE || BC है । यदि AD = 2·4 cm, DB = 4 cm तथा AE = 2 cm है, तो AC की लंबाई है :



(A) $\frac{10}{3}$ cm (B) $\frac{3}{10}$ cm

(C) $\frac{16}{3}$ cm (D) 1·2 cm

6. दी गई आकृति में, RJ तथा RL, वृत्त पर खींची गई दो स्पर्श-रेखाएँ हैं । यदि $\angle$ RJL = 42° है, तो $\angle$ JOL की माप है :



(A) 42° (B) 84°

(C) 96° (D) 138°

3. If $5 \tan \theta - 12 = 0$, then the value of $\sin \theta$ is :

(A) $\frac{5}{12}$ (B) $\frac{12}{13}$

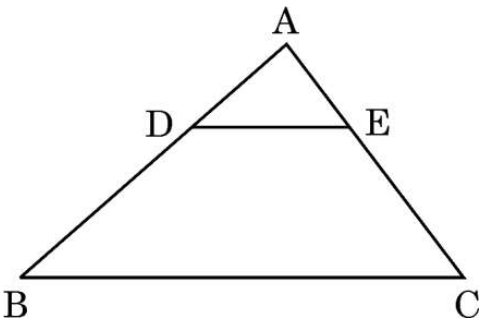
(C) $\frac{5}{13}$ (D) $\frac{12}{5}$

4. The next (4^{th}) term of the A.P. $\sqrt{18}$, $\sqrt{50}$, $\sqrt{98}$, ... is :

(A) $\sqrt{128}$ (B) $\sqrt{140}$

(C) $\sqrt{162}$ (D) $\sqrt{200}$

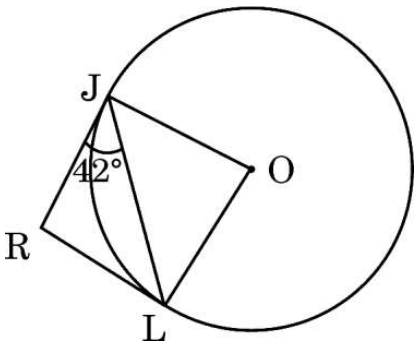
5. In the given figure, in Δ ABC, DE || BC. If AD = 2·4 cm, DB = 4 cm and AE = 2 cm, then the length of AC is :



(A) $\frac{10}{3}$ cm (B) $\frac{3}{10}$ cm

(C) $\frac{16}{3}$ cm (D) 1·2 cm

6. In the given figure, RJ and RL are two tangents to the circle. If $\angle$ RJL = 42°, then the measure of $\angle$ JOL is :



(A) 42° (B) 84°

(C) 96° (D) 138°

7. 21 cm त्रिज्या वाले वृत्त के उस त्रिज्यखण्ड, जो वृत्त के केन्द्र पर $60°$ का कोण अंतरित करता है, का परिमाप है :

(A) 22 cm (B) 43 cm

(C) 64 cm (D) 462 cm

8. द्विघात समीकरण $5x^2 - 6x + 21 = 0$ के मूलों के योगफल तथा गुणनफल में अनुपात है :

(A) 5 : 21 (B) 2 : 7

(C) 21 : 5 (D) 7 : 2

9. समांतर श्रेढ़ी $-11, -8, -5, ..., 49$ का अंत से (प्रथम की ओर) 14वाँ पद है :

(A) 7 (B) 10

(C) 13 (D) 28

10. एक मीनार की समतल भूमि पर पड़ रही छाया की लंबाई मीनार की ऊँचाई की $\sqrt{3}$ गुनी है । सूर्य का उन्नतांश है :

(A) $30°$ (B) $45°$

(C) $60°$ (D) $90°$

11. संख्याओं 1, 2, 3, ..., 15 में से यादृच्छया चुनी गई संख्या की 4 के एक गुणज होने की प्रायिकता क्या है ?

(A) $\frac{4}{15}$ (B) $\frac{6}{15}$

(C) $\frac{3}{15}$ (D) $\frac{5}{15}$

12. यदि $\frac{x}{3} = 2 \sin A$, $\frac{y}{3} = 2 \cos A$ है, तो $x^2 + y^2$ का मान है :

(A) 36 (B) 9

(C) 6 (D) 18

7. The perimeter of the sector of a circle of radius 21 cm which subtends an angle of 60° at the centre of circle, is :

(A) 22 cm (B) 43 cm

(C) 64 cm (D) 462 cm

8. The ratio of the sum and product of the roots of the quadratic equation $5x^2 - 6x + 21 = 0$ is :

(A) 5 : 21 (B) 2 : 7

(C) 21 : 5 (D) 7 : 2

9. The 14^{th} term from the end of the A.P. $-11, -8, -5, ..., 49$ is :

(A) 7 (B) 10

(C) 13 (D) 28

10. The length of the shadow of a tower on the plane ground is $\sqrt{3}$ times the height of the tower. The angle of elevation of the Sun is :

(A) 30° (B) 45°

(C) 60° (D) 90°

11. What is the probability that a number selected randomly from the numbers 1, 2, 3, ..., 15 is a multiple of 4 ?

(A) $\frac{4}{15}$ (B) $\frac{6}{15}$

(C) $\frac{3}{15}$ (D) $\frac{5}{15}$

12. If $\frac{x}{3} = 2 \sin A$, $\frac{y}{3} = 2 \cos A$, then the value of $x^2 + y^2$ is :

(A) 36 (B) 9

(C) 6 (D) 18

13. यदि α तथा β बहुपद $p(x) = kx^2 - 30x + 45k$ के शून्यक हैं तथा $\alpha + \beta = \alpha\beta$ है, तो k का मान है :

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

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

14. 12 cm त्रिज्या वाले वृत्त की एक चाप 10π cm लंबी है । इस चाप द्वारा वृत्त के केंद्र पर अंतरित कोण है :

(A) $120°$ (B) $6°$

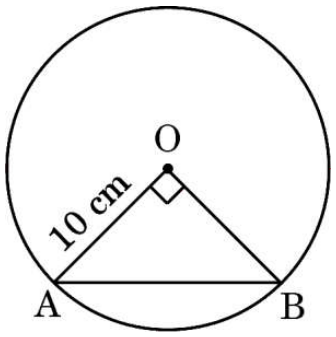
(C) $75°$ (D) $150°$

15. तीन संख्याओं 28, 44, 132 का ल.स. (LCM) है :

(A) 258 (B) 231

(C) 462 (D) 924

16. 10 cm त्रिज्या वाले एक वृत्त की एक जीवा, वृत्त के केंद्र पर समकोण अंतरित करती है । तो जीवा की लंबाई (cm में) है :



(A) $5\sqrt{2}$ (B) $10\sqrt{2}$

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

13. If α and β are the zeroes of the polynomial $p(x) = kx^2 - 30x + 45k$ and $\alpha + \beta = \alpha\beta$, then the value of k is :

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

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

14. The length of an arc of a circle with radius 12 cm is 10π cm. The angle subtended by the arc at the centre of the circle, is :

(A) $120°$ (B) $6°$

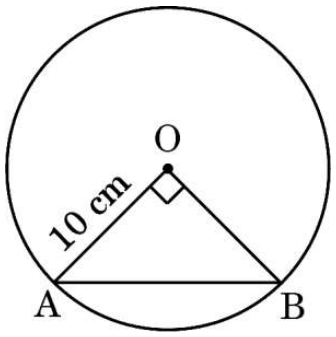
(C) $75°$ (D) $150°$

15. The LCM of three numbers 28, 44, 132 is :

(A) 258 (B) 231

(C) 462 (D) 924

16. A chord of a circle of radius 10 cm subtends a right angle at its centre. The length of the chord (in cm) is :



(A) $5\sqrt{2}$ (B) $10\sqrt{2}$

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

17. समीकरण निकाय $3x + 4y = 5$ तथा $6x + 8y = 7$ द्वारा निम्नलिखित में से किस प्रकार की सरल रेखाएँ निरूपित हो रही हैं ?

(A) समांतर

(B) प्रतिच्छेदी

(C) संपाती

(D) एक-दूसरे के लंबवत्

18. वह बड़ी-से-बड़ी संख्या जो 281 तथा 1249 को भाग करने पर क्रमश: 5 तथा 7 शेषफल देती है, है :

(A) 23 (B) 276

(C) 138 (D) 69

*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) :* शून्य बहुपद की घात परिभाषित नहीं है ।

तर्क (R) : एक शून्येतर अचर बहुपद की घात 0 होती है ।

20. *अभिकथन (A) :* ABCD एक समलंब है जिसमें DC || AB है । E तथा F क्रमशः AD तथा BC पर ऐसे बिंदु हैं कि EF || AB है । तो $\frac{AE}{ED} = \frac{BF}{FC}$ ।

तर्क (R) : किसी समलंब की समांतर भुजाओं के समांतर कोई रेखा असमांतर भुजाओं को समानुपात में बाँटती है ।

17. Which out of the following type of straight lines will be represented by the system of equations $3x + 4y = 5$ and $6x + 8y = 7$?

(A) Parallel

(B) Intersecting

(C) Coincident

(D) Perpendicular to each other

18. The greatest number which divides 281 and 1249, leaving remainder 5 and 7 respectively, is :

(A) 23 (B) 276

(C) 138 (D) 69

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

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

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

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

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

19. *Assertion (A) :* Degree of a zero polynomial is not defined.

Reason (R): Degree of a non-zero constant polynomial is 0.

20. *Assertion (A) :* ABCD is a trapezium with DC || AB. E and F are points on AD and BC respectively, such that EF || AB. Then $\frac{AE}{ED} = \frac{BF}{FC}$.

Reason (R) : Any line parallel to parallel sides of a trapezium divides the non-parallel sides proportionally.

खण्ड ख

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

21. 52 पत्तों की ताश की एक गड्डी में से चिड़ी तथा ईंट के बादशाह, बेगम तथा इक्के निकाल दिए गए । शेष पत्तों को अच्छी तरह फेंटने के बाद उनमें से यादृच्छया एक पत्ता निकाला गया । निम्नलिखित पत्ते के प्राप्त होने की प्रायिकता ज्ञात कीजिए :

(i) चिड़ी का पत्ता

(ii) एक लाल रंग का पत्ता

22. (a) यदि 3 cm त्रिज्या वाले एक वृत्त पर खींची गई दो स्पर्श-रेखाएँ परस्पर $60°$ के कोण पर झुकी हैं, तो प्रत्येक स्पर्श-रेखा की लंबाई ज्ञात कीजिए ।

अथवा

(b) सिद्ध कीजिए कि वृत्त के किसी व्यास के सिरों पर खींची गई स्पर्श-रेखाएँ परस्पर समांतर होती हैं ।

23. (a) वह अनुपात ज्ञात कीजिए जिसमें बिंदु P(– 4, 6), बिंदुओं A(– 6, 10) तथा B(3, – 8) को मिलाने वाले रेखाखण्ड को विभाजित करता है ।

अथवा

(b) सिद्ध कीजिए कि बिंदु (3, 0), (6, 4) तथा (– 1, 3) एक समद्विबाहु त्रिभुज के शीर्ष हैं ।

24. यदि α, β बहुपद $p(x) = 5x^2 - 6x + 1$ के शून्यक हैं, तो $\alpha + \beta + \alpha\beta$ का मान ज्ञात कीजिए ।

25. मान ज्ञात कीजिए :

$$\frac{2 \tan 30° \cdot \sec 60° \cdot \tan 45°}{1 - \sin^2 60°}$$

SECTION B

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

21. The king, queen and ace of clubs and diamonds are removed from a deck of 52 playing cards and the remaining cards are shuffled. A card is randomly drawn from the remaining cards. Find the probability of getting

(i) a card of clubs.

(ii) a red coloured card.

22. (a) If two tangents inclined at an angle of 60° are drawn to a circle of radius 3 cm, then find the length of each tangent.

OR

(b) Prove that the tangents drawn at the ends of a diameter of a circle are parallel.

23. (a) Find the ratio in which the point P(– 4, 6) divides the line segment joining the points A(– 6, 10) and B(3, – 8).

OR

(b) Prove that the points (3, 0), (6, 4) and (– 1, 3) are the vertices of an isosceles triangle.

24. If α, β are zeroes of the polynomial $p(x) = 5x^2 - 6x + 1$, then find the value of $\alpha + \beta + \alpha\beta$.

25. Evaluate :

$$\frac{2 \tan 30^\circ \cdot \sec 60^\circ \cdot \tan 45^\circ}{1 - \sin^2 60^\circ}$$

खण्ड ग

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

26. सिद्ध कीजिए कि :

$$\frac{\tan\theta - \cot\theta}{\sin\theta\ \cos\theta} = \sec^2\theta - \operatorname{cosec}^2\theta$$

27. 21 cm त्रिज्या वाले एक वृत्त से एक त्रिज्यखण्ड काटा गया । त्रिज्यखण्ड का केंद्रीय कोण 150° है । इस त्रिज्यखण्ड के चाप की लंबाई तथा त्रिज्यखण्ड का क्षेत्रफल ज्ञात कीजिए ।

28. (a) सिद्ध कीजिए कि $\sqrt{3}$ एक अपरिमेय संख्या है ।

अथवा

(b) सिद्ध कीजिए कि $\left(\sqrt{2} + \sqrt{3}\right)^2$ एक अपरिमेय संख्या है, दिया गया है कि $\sqrt{6}$ एक अपरिमेय संख्या है ।

29. तीन निष्पक्ष सिक्के एक साथ उछाले गए । निम्नलिखित के प्राप्त करने की प्रायिकता ज्ञात कीजिए :

(i) कम-से-कम एक चित

(ii) मात्र एक पट

(iii) दो चित तथा एक पट

30. सिद्ध कीजिए कि एक वृत्त के परिगत समांतर चतुर्भुज एक समचतुर्भुज होता है ।

31. (a) यदि एक समांतर श्रेढ़ी के पहले 14 पदों का योगफल 1050 है तथा इसका प्रथम पद 10 है, तो इस समांतर श्रेढ़ी का 20वाँ पद तथा nवाँ पद ज्ञात कीजिए ।

अथवा

(b) एक समांतर श्रेढ़ी का प्रथम पद 5, अंतिम पद 45 तथा सभी पदों का योगफल 400 है । इस समांतर श्रेढ़ी के पदों की संख्या तथा सार्व अंतर ज्ञात कीजिए ।

SECTION C

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

26. Prove that :

$$\frac{\tan\theta - \cot\theta}{\sin\theta\ \cos\theta} = \sec^2\theta - \operatorname{cosec}^2\theta$$

27. A sector is cut from a circle of radius 21 cm. The central angle of the sector is 150°. Find the length of the arc of this sector and the area of the sector.

28. (a) Prove that $\sqrt{3}$ is an irrational number.

OR

(b) Prove that $\left(\sqrt{2} + \sqrt{3}\right)^2$ is an irrational number, given that $\sqrt{6}$ is an irrational number.

29. Three unbiased coins are tossed simultaneously. Find the probability of getting :

(i) at least one head.

(ii) exactly one tail.

(iii) two heads and one tail.

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

31. (a) If the sum of the first 14 terms of an A.P. is 1050 and the first term is 10, then find the 20^{th} term and the n^{th} term.

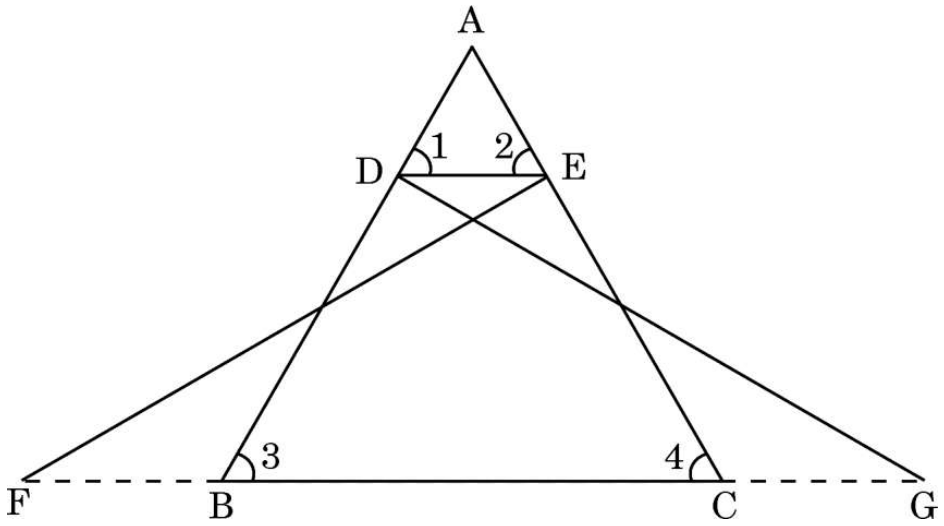
OR

(b) The first term of an A.P. is 5, the last term is 45 and the sum of all the terms is 400. Find the number of terms and the common difference of the A.P.

खण्ड घ

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

32. (a) दी गई आकृति में, Δ FEC $\cong \Delta$ GDB तथा $\angle 1 = \angle 2$ है । सिद्ध कीजिए कि Δ ADE ~ Δ ABC.



अथवा

(b) एक Δ ABC की भुजाएँ AB और AC तथा माध्यिका AD क्रमश: एक अन्य त्रिभुज Δ PQR की भुजाओं PQ और PR तथा माध्यिका PM के समानुपाती हैं । दर्शाइए कि Δ ABC ~ Δ PQR.

33. (a) 'k' का वह मान ज्ञात कीजिए जिसके लिए द्विघात समीकरण $(k + 1)x^2 - 6(k + 1)x + 3(k + 9) = 0, k \neq -1$ के वास्तविक और समान मूल हैं ।

अथवा

(b) एक व्यक्ति की आयु अपने बेटे की आयु के वर्ग की दुगुनी है । आठ वर्ष पश्चात्, इस व्यक्ति की आयु अपने बेटे की आयु के तीन गुने से 4 वर्ष अधिक होगी । उनकी वर्तमान आयु ज्ञात कीजिए ।

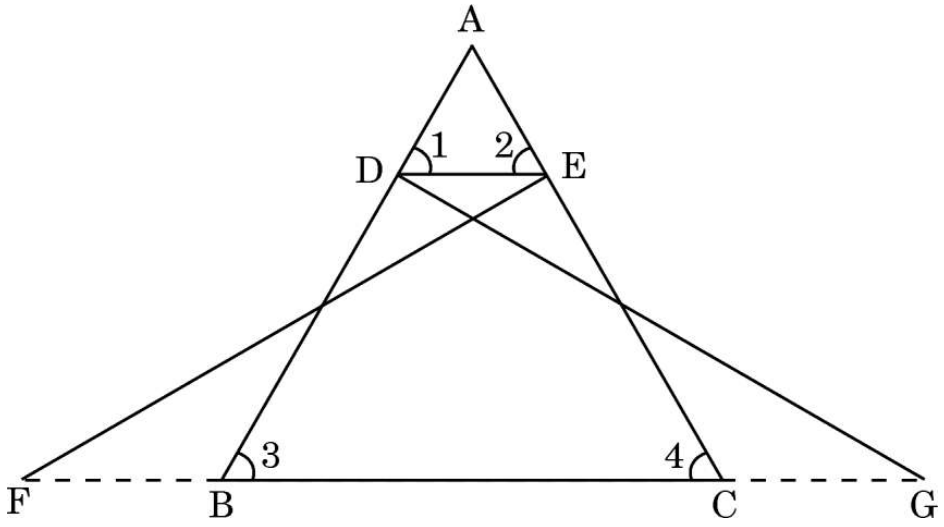
34. एक सड़क में भूमि से 15 मीटर की ऊँचाई पर एक खिड़की से, सड़क के दूसरी ओर के एक अन्य घर के शिखर तथा पाद के उन्नयन तथा अवनमन कोण क्रमश: 30° तथा 45° हैं । इस सामने वाले घर की ऊँचाई ज्ञात कीजिए । ($\sqrt{3}$ = 1·732 का प्रयोग कीजिए)

SECTION D

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

32. (a) In the given figure, Δ FEC $\cong \Delta$ GDB and $\angle 1 = \angle 2$.

Prove that Δ ADE ~ Δ ABC.



OR

(b) Sides AB and AC and median AD of a Δ ABC are respectively proportional to sides PQ and PR and median PM of another Δ PQR. Show that Δ ABC ~ Δ PQR.

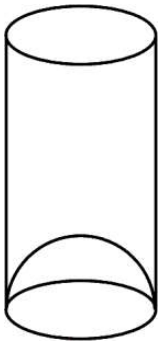
33. (a) Find the value of 'k' for which the quadratic equation $(k + 1)x^2 - 6(k + 1)x + 3(k + 9) = 0$, $k \neq -1$ has real and equal roots.

OR

(b) The age of a man is twice the square of the age of his son. Eight years hence, the age of the man will be 4 years more than three times the age of his son. Find their present ages.

34. From a window 15 metres high above the ground in a street, the angles of elevation and depression of the top and the foot of another house on the opposite side of the street are 30° and 45° respectively. Find the height of the opposite house. (Use $\sqrt{3}$ = 1·732)

35. एक जूस बेचने वाला अपने ग्राहकों को नीचे दी गई आकृति में दिखाए गिलास में जूस देता है । बेलनाकार गिलास का आंतरिक व्यास 5·6 cm है, परन्तु गिलास के निचले आधार में एक उभरा हुआ अर्धगोला है जिससे गिलास की धारिता कम हो जाती है । यदि गिलास की ऊँचाई 10 cm है, तो गिलास की आभासी धारिता तथा वास्तविक धारिता ज्ञात कीजिए ।

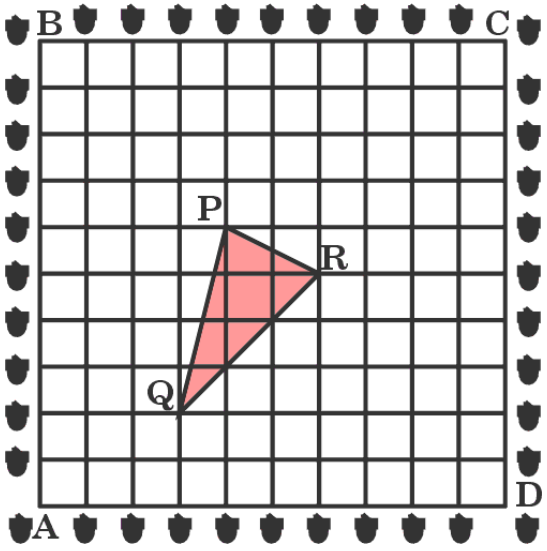


खण्ड ङ

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

प्रकरण अध्ययन – 1

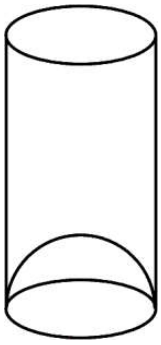
36. एक बगीचा एक वर्ग के आकार का है । माली ने बगीचे की सीमा पर एक-दूसरे से 1 m की दूरी पर अशोक के पेड़ के पौधे उगाए । वह बगीचे को गुलाब के पौधों से सजाना चाहता है । उसने गुलाब के पौधे उगाने के लिए बगीचे के अन्दर एक त्रिभुजाकार क्षेत्र चुना । उपर्युक्त स्थिति में, माली ने कक्षा 10 के छात्रों की मदद ली जिन्होंने निम्न प्रकार का चार्ट बनाया ।



उपर्युक्त के आधार पर, निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) A को मूल-बिंदु लेकर, Δ PQR के शीर्षों के निर्देशांक क्या हैं ? *1*

35. A juice seller was serving his customers using glasses as shown in the figure. The inner diameter of the cylindrical glass was 5·6 cm, but the bottom of the glass had a hemispherical raised portion which reduced the capacity of the glass. If the height of the glass was 10 cm, find the apparent capacity and the actual capacity of the glass.

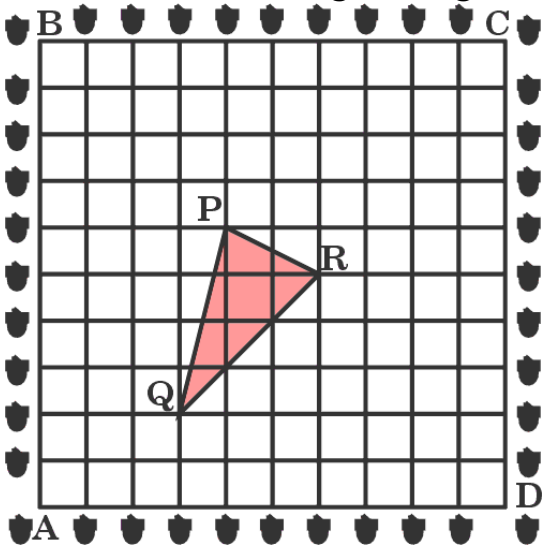


SECTION E

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

Case Study – 1

36. A garden is in the shape of a square. The gardener grew saplings of Ashoka tree on the boundary of the garden at the distance of 1 m from each other. He wants to decorate the garden with rose plants. He chose a triangular region inside the garden to grow rose plants. In the above situation, the gardener took help from the students of class 10. They made a chart for it which looks like the given figure.



Based on the above, answer the following questions :

(i) If A is taken as origin, what are the coordinates of the vertices of Δ PQR ? *1*

(ii) (a) दूरियाँ PQ तथा QR ज्ञात कीजिए । *2*

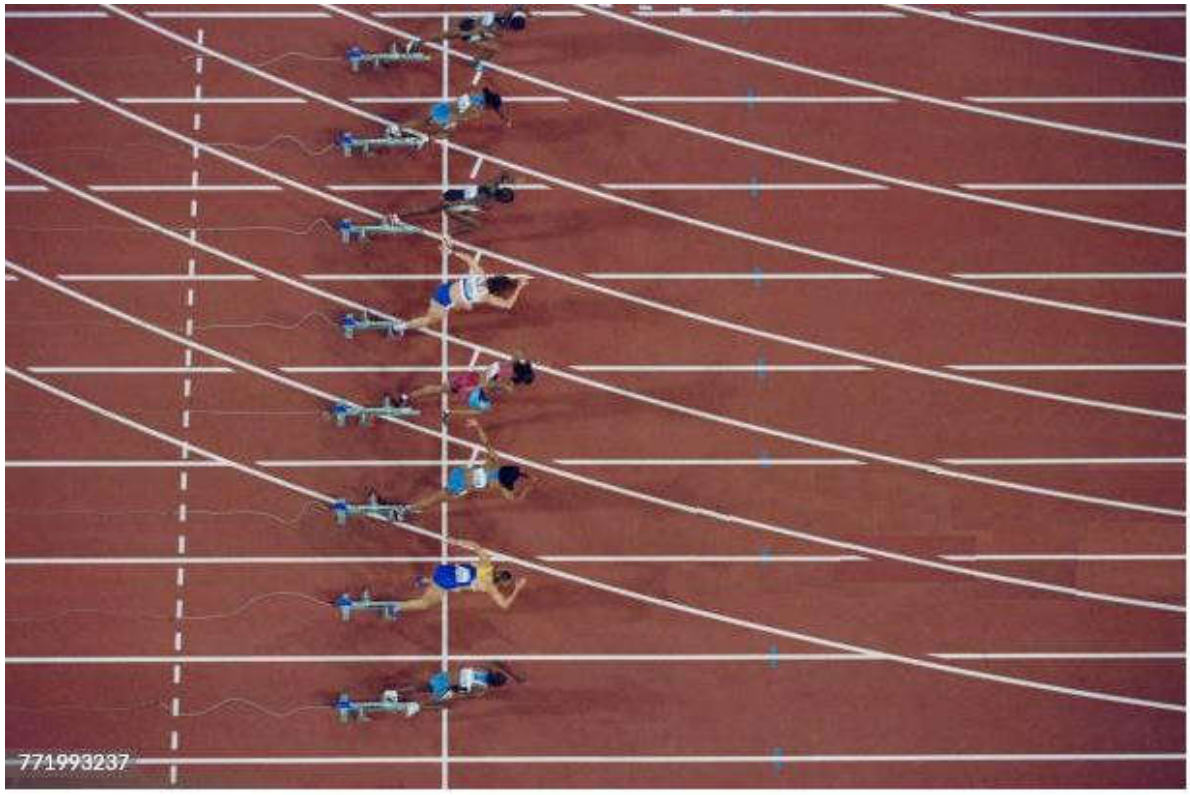
अथवा

(b) बिंदुओं P तथा R को मिलाने वाले रेखाखण्ड को 2 : 1 के अन्त: विभाजन करने वाले बिंदु के निर्देशांक ज्ञात कीजिए । *2*

(iii) ज्ञात कीजिए कि क्या Δ PQR एक समद्विबाहु त्रिभुज है । *1*

प्रकरण अध्ययन – 2

37. दौड़ने या साइकिल चलाने जैसी गतिविधियाँ तनाव और अवसाद जैसे मानसिक विकार के जोखिम को कम करती हैं । दौड़ने से सहनशक्ति बढ़ाने में मदद मिलती है । बच्चों की हड्डियाँ और मांसपेशियाँ मजबूत होती हैं और उनका वजन बढ़ने की संभावना कम होती है । एक स्कूल के शारीरिक शिक्षा शिक्षक ने अपने स्कूल परिसर में एक इंटर-स्कूल रनिंग प्रतियोगिता आयोजित करने का निर्णय लिया । छात्रों के समूह द्वारा 100 m की दौड़ में लिया गया समय नोट किया गया, जो निम्न प्रकार है :



समय (सेकण्ड में)	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100
छात्रों की संख्या	8	10	13	6	3

उपर्युक्त के आधार पर, निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) ऊपर दिए गए आँकड़ों का माध्यक वर्ग क्या है ? *1*

(ii) (a) Find distances PQ and QR. *2*

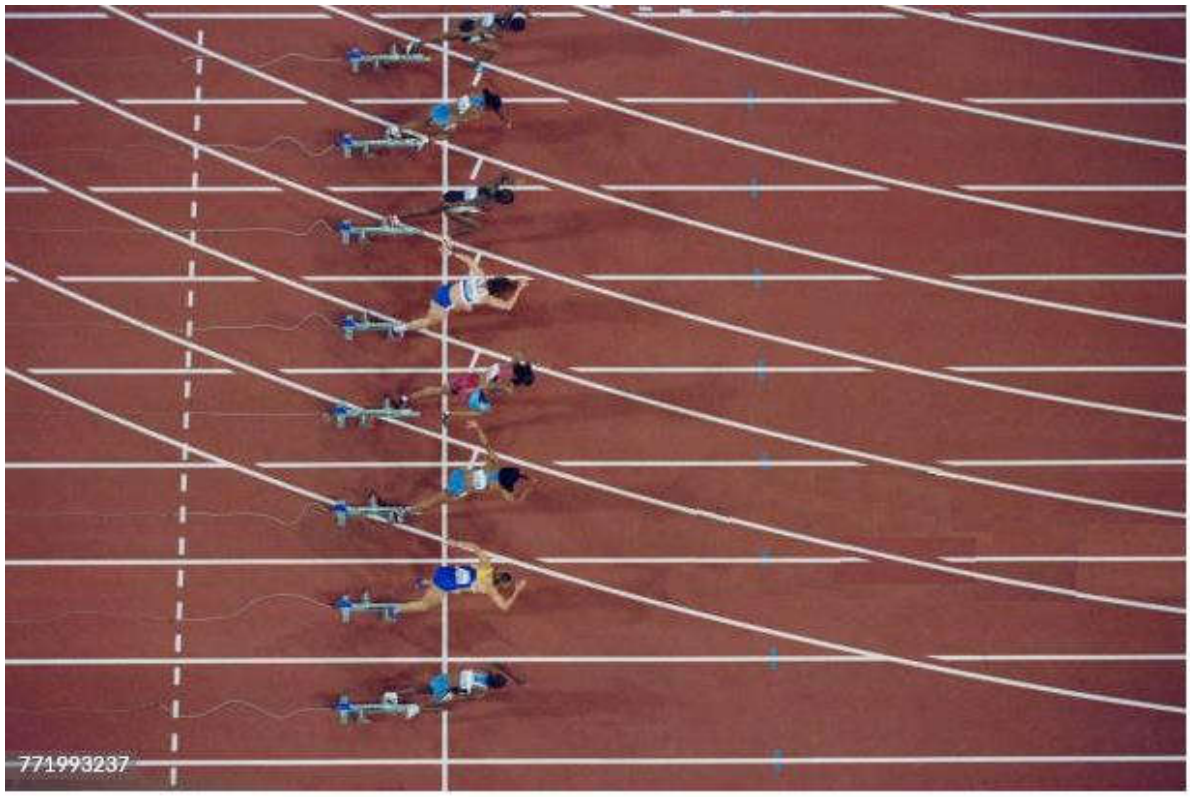
OR

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

(iii) Find out if Δ PQR is an isosceles triangle. *1*

Case Study – 2

37. Activities like running or cycling reduce stress and the risk of mental disorder like depression. Running helps build endurance. Children develop stronger bones and muscles and are less prone to gain weight. The physical education teacher of a school has decided to conduct an inter school running tournament in his school premises. The time taken by a group of students to run 100 m, was noted as follows :



Time (in seconds)	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100
Number of students	8	10	13	6	3

Based on the above, answer the following questions :

(i) What is the median class of the above given data ? *1*

(ii) (a) दौड़ पूरी करने में छात्रों द्वारा लिया गया माध्य समय ज्ञात कीजिए । *2*

अथवा

(b) ऊपर दिए गए आँकड़ों का बहुलक ज्ञात कीजिए । *2*

(iii) कितने छात्रों ने 60 सेकण्ड से कम समय लिया ? *1*

प्रकरण अध्ययन – 3

38. एस्सेल वर्ल्ड भारत के सबसे बड़े मनोरंजन पार्कों में से एक है जो सभी उम्र के आगंतुकों के लिए रोमांचक सवारी, जल आकर्षण और मनोरंजन विकल्पों की एक विविध शृंखला प्रदान करता है । यह पार्क अपने प्रतिष्ठित "वॉटर किंगडम" के लिए जाना जाता है, जो इसे पारिवारिक सैर और मनोरंजन के लिए एक लोकप्रिय गंतव्य बनाता है । पार्क का टिकट शुल्क ₹ 150 प्रति बच्चा तथा ₹ 250 प्रति वयस्क है ।

एक दिन, पार्क के खजांची ने यह पाया कि 300 टिकट बिकी हैं तथा ₹ 55,000 एकत्र हुए हैं ।

उपर्युक्त के आधार पर, निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) यदि उस दिन आए बच्चों की संख्या x तथा वयस्कों की संख्या y है, तो दी गई स्थिति को बीजगणितीय रूप में लिखिए । *1*

(ii) (a) इस मनोरंजन पार्क में उस दिन कितने बच्चे आए ? *2*

अथवा

(b) इस मनोरंजन पार्क में उस दिन कितने वयस्क आए ? *2*

(iii) मनोरंजन पार्क में यदि 250 बच्चे तथा 100 वयस्क आए, तो कितनी राशि एकत्र होगी ? *1*

(ii) (a) Find the mean time taken by the students to finish the race. *2*

OR

(b) Find the mode of the above given data. *2*

(iii) How many students took time less than 60 seconds ? *1*

Case Study – 3

38. Essel World is one of India's largest amusement parks that offers a diverse range of thrilling rides, water attractions and entertainment options for visitors of all ages. The park is known for its iconic "Water Kingdom" section, making it a popular destination for family outings and fun-filled adventure. The ticket charges for the park are ₹ 150 per child and ₹ 250 per adult.

On a day, the cashier of the park found that 300 tickets were sold and an amount of ₹ 55,000 was collected.

Based on the above, answer the following questions :

(i) If the number of children visited be x and the number of adults visited be y, then write the given situation algebraically. *1*

(ii) (a) How many children visited the amusement park that day ? *2*

OR

(b) How many adults visited the amusement park that day ? *2*

(iii) How much amount will be collected if 250 children and 100 adults visit the amusement park ? *1*

Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2024
MATHEMATICS PAPER CODE 30/5/3

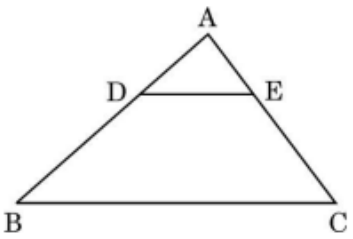
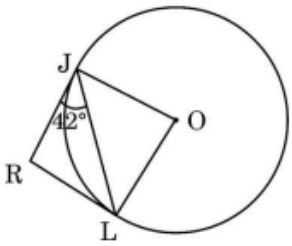
General Instructions: -

1	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully.
2	**"Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, Evaluation done and several other aspects. 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.

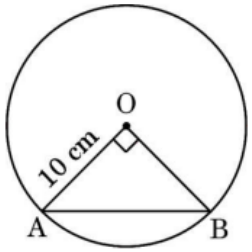
9	**<u>In Q1-Q20, if a candidate attempts the question more than once (without cancelling the previous attempt), marks shall be awarded for the first attempt only and the other answer scored out with a note "Extra Question".</u>**
10	**<u>In Q21-Q38, if a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note "Extra Question".</u>**
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: 30/5/3

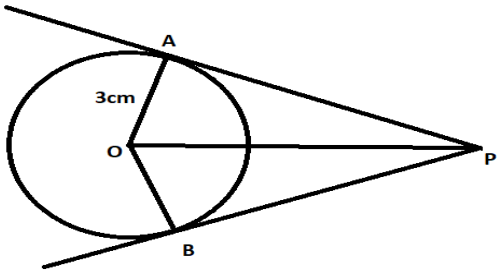
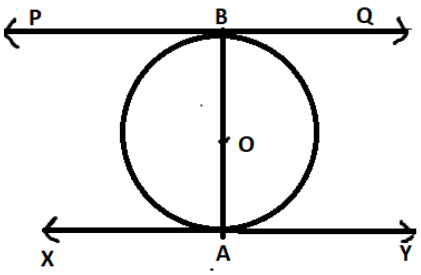
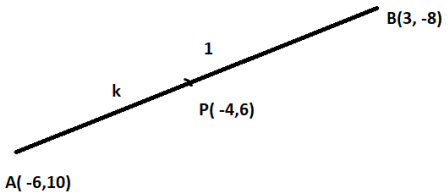
Q. No.	EXPECTED ANSWER / VALUE POINTS	Marks
	SECTION-A **This section comprises Multiple Choice Questions (MCQs) of 1 mark each**	
1.	The LCM of the smallest prime number and the smallest odd composite number is : (A) 10 (B) 6 (C) 9 (D) 18	
Sol.	(D) 18	1
2.	If the mean of the first n natural numbers is $\frac{5n}{9}$, then the value of n is : (A) 5 (B) 4 (C) 9 (D) 10	
Sol.	(C) 9	1
3.	If $5 \tan \theta - 12 = 0$, then the value of $\sin \theta$ is : (A) $\frac{5}{12}$ (B) $\frac{12}{13}$ (C) $\frac{5}{13}$ (D) $\frac{12}{5}$	
Sol.	(B) $\frac{12}{13}$	1
4.	The next (4^{th}) term of the A.P. $\sqrt{18}$, $\sqrt{50}$, $\sqrt{98}$, ... is : (A) $\sqrt{128}$ (B) $\sqrt{140}$ (C) $\sqrt{162}$ (D) $\sqrt{200}$	
Sol.	(C) $\sqrt{162}$	1

5.	In the given figure, in Δ ABC, DE $\|\|$ BC. If AD = 2·4 cm, DB = 4 cm and AE = 2 cm, then the length of AC is :  (A) $\frac{10}{3}$ cm (B) $\frac{3}{10}$ cm (C) $\frac{16}{3}$ cm (D) 1·2 cm	
Sol.	(C) $\frac{16}{3}$ cm	1
6.	In the given figure, RJ and RL are two tangents to the circle. If $\angle$ RJL = 42°, then the measure of $\angle$ JOL is :  (A) 42° (B) 84° (C) 96° (D) 138°	
Sol.	(B) 84^0	1
7.	The perimeter of the sector of a circle of radius 21 cm which subtends an angle of 60° at the centre of circle, is : (A) 22 cm (B) 43 cm (C) 64 cm (D) 462 cm	
Sol.	(C) 64 cm	1
8.	The ratio of the sum and product of the roots of the quadratic equation $5x^2 - 6x + 21 = 0$ is : (A) 5 : 21 (B) 2 : 7 (C) 21 : 5 (D) 7 : 2	
Sol.	(B) 2:7	1

9.	The 14^{th} term from the end of the A.P. $-11, -8, -5, \ldots, 49$ is : (A) 7 (B) 10 (C) 13 (D) 28	
Sol.	(B) 10	1
10.	The length of the shadow of a tower on the plane ground is $\sqrt{3}$ times the height of the tower. The angle of elevation of the Sun is : (A) $30°$ (B) $45°$ (C) $60°$ (D) $90°$	
Sol.	(A) 30^0	1
11.	What is the probability that a number selected randomly from the numbers 1, 2, 3, ..., 15 is a multiple of 4 ? (A) $\frac{4}{15}$ (B) $\frac{6}{15}$ (C) $\frac{3}{15}$ (D) $\frac{5}{15}$	
Sol.	(C) $\frac{3}{15}$	1
12.	If $\frac{x}{3} = 2 \sin A$, $\frac{y}{3} = 2 \cos A$, then the value of $x^2 + y^2$ is : (A) 36 (B) 9 (C) 6 (D) 18	
Sol.	(A) 36	1
13.	If α and β are the zeroes of the polynomial $p(x) = kx^2 - 30x + 45k$ and $\alpha + \beta = \alpha\beta$, then the value of k is : (A) $-\frac{2}{3}$ (B) $-\frac{3}{2}$ (C) $\frac{3}{2}$ (D) $\frac{2}{3}$	
Sol.	(D) $\frac{2}{3}$	1
14.	The length of an arc of a circle with radius 12 cm is 10π cm. The angle subtended by the arc at the centre of the circle, is : (A) $120°$ (B) $6°$ (C) $75°$ (D) $150°$	
Sol.	(D) 150^0	1

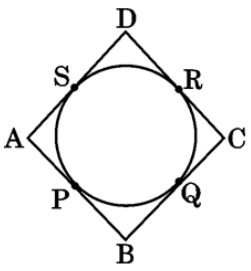
15.	The LCM of three numbers 28, 44, 132 is : (A) 258 (B) 231 (C) 462 (D) 924	
Sol.	(D) 924	1
16.	A chord of a circle of radius 10 cm subtends a right angle at its centre. The length of the chord (in cm) is :  (A) $5\sqrt{2}$ (B) $10\sqrt{2}$ (C) $\frac{5}{\sqrt{2}}$ (D) 5	
Sol.	(B) $10\sqrt{2}$	1
17.	Which out of the following type of straight lines will be represented by the system of equations $3x + 4y = 5$ and $6x + 8y = 7$? (A) Parallel (B) Intersecting (C) Coincident (D) Perpendicular to each other	
Sol.	(A) Parallel	1
18.	The greatest number which divides 281 and 1249, leaving remainder 5 and 7 respectively, is : (A) 23 (B) 276 (C) 138 (D) 69	
Sol.	(C) 138	1

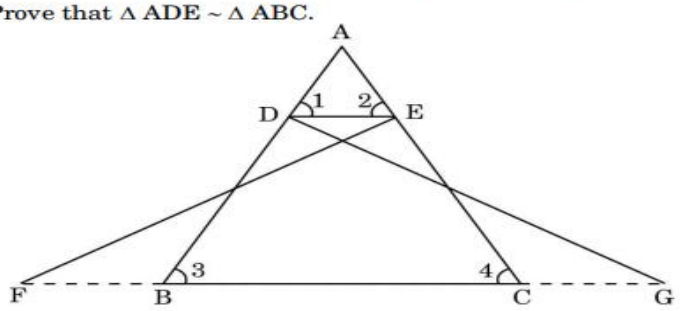
	*Questions number **19** and **20** are Assertion and Reason based questions. Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.* (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A). (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is ***not*** the correct explanation of Assertion (A). (C) Assertion (A) is true, but Reason (R) is false. (D) Assertion (A) is false, but Reason (R) is true.	
19.	*Assertion (A) :* Degree of a zero polynomial is not defined. *Reason (R):* Degree of a non-zero constant polynomial is 0.	
Sol.	(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A).	1
20.	*Assertion (A) :* ABCD is a trapezium with DC || AB. E and F are points on AD and BC respectively, such that EF || AB. Then $\frac{AE}{ED} = \frac{BF}{FC}$. *Reason (R) :* Any line parallel to parallel sides of a trapezium divides the non-parallel sides proportionally.	
Sol.	(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).	1
	SECTION- B **This section comprises Very Short Answer (VSA) type questions of 2 marks each**	
21.	The king, queen and ace of clubs and diamonds are removed from a deck of 52 playing cards and the remaining cards are shuffled. A card is randomly drawn from the remaining cards. Find the probability of getting (i) a card of clubs. (ii) a red coloured card.	
Sol.	Total cards left = 52 − 3 − 3 = 46 (i) P (card of clubs) = $\frac{10}{46}$ or $\frac{5}{23}$ (ii) P (red coloured card) = $\frac{23}{46}$ or $\frac{1}{2}$	1 1

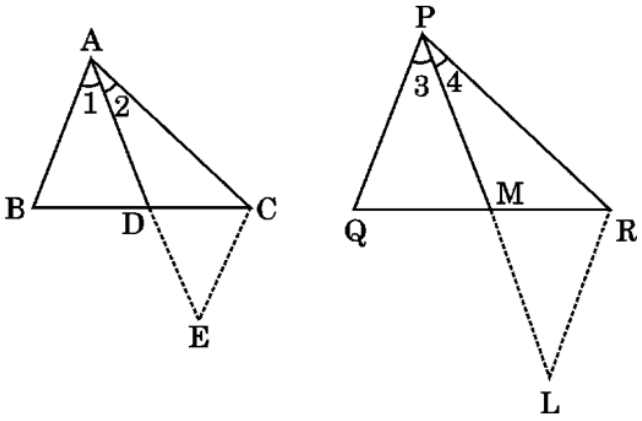
22.(a)	**If two tangents inclined at an angle of 60° are drawn to a circle of radius 3 cm, then find the length of each tangent.**	
Sol.	Correct Figure  $\angle$ APO = 30^0 tan $30^0 = \frac{1}{\sqrt{3}} = \frac{3}{AP}$ AP = $3\sqrt{3}$ cm	½ ½ ½ ½
	OR	
22.(b)	**Prove that the tangents drawn at the ends of a diameter of a circle are parallel.**	
Sol.	Correct Figure  $\angle$ OAY = $\angle$ OBP = 90^0 But they are forming alternate interior angles Therefore, PQ || XY	½ ½ 1
23.(a)	**Find the ratio in which the point P(– 4, 6) divides the line segment joining the points A(– 6, 10) and B(3, – 8).**	
Sol.	Let the ratio be k:1 $-4 = \frac{3k-6}{k+1}$ $\Rightarrow$ k = $\frac{2}{7}$ $\therefore$ required ratio is 2 : 7  	1 ½ ½
	OR	

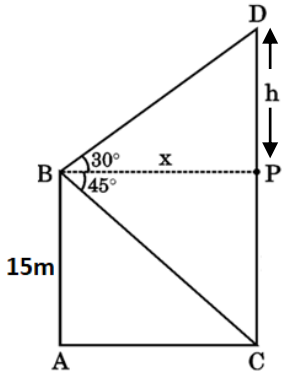
23.(b)	**Prove that the points (3, 0), (6, 4) and (– 1, 3) are the vertices of an isosceles triangle.**	
Sol.	Let A(3,0) , B(6,4) , C(-1, 3) AB = $\sqrt{(3-6)^2 + (0-4)^2} = 5$ BC = $\sqrt{(6+1)^2 + (4-3)^2} = \sqrt{50}$ CA = $\sqrt{(3+1)^2 + (0-3)^2} = 5$ As, AB = AC $\Rightarrow$ ABC is an isosceles triangle	½ ½ ½ ½
24.	If α, β are zeroes of the polynomial $p(x) = 5x^2 - 6x + 1$, then find the value of $\alpha + \beta + \alpha\beta$.	
Sol.	$\alpha + \beta = \frac{6}{5}$ $\alpha\beta = \frac{1}{5}$ $\alpha + \beta + \alpha\beta = \frac{6}{5} + \frac{1}{5} = \frac{7}{5}$	½ ½ 1
25.	Evaluate : $\frac{2\tan 30^\circ \cdot \sec 60^\circ \cdot \tan 45^\circ}{1 - \sin^2 60^\circ}$	
Sol.	$\frac{2\times\frac{1}{\sqrt{3}}\times 2\times 1}{1-\frac{3}{4}}$ $= \frac{16}{\sqrt{3}}$ or $\frac{16\sqrt{3}}{3}$	1½ ½
	SECTION- C **This section comprises Short Answer (SA) type questions of 3 marks each.**	
26.	Prove that : $\frac{\tan\theta - \cot\theta}{\sin\theta\cos\theta} = \sec^2\theta - \text{cosec}^2\theta$	
Sol.	LHS = $\frac{\tan\theta - \cot\theta}{\sin\theta\cos\theta}$ = $\frac{\frac{\sin\theta}{\cos\theta} - \frac{\cos\theta}{\sin\theta}}{\sin\theta\cos\theta}$ = $\frac{\sin^2\theta - \cos^2\theta}{\sin^2\theta\cos^2\theta}$ = $\frac{1}{\cos^2\theta} - \frac{1}{\sin^2\theta}$ = $sec^2\theta - cosec^2\theta$ = RHS	1 ½ 1 ½

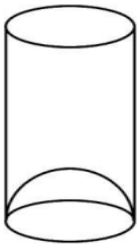
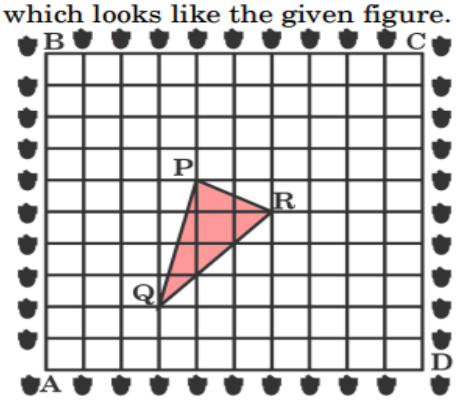
27.	**A sector is cut from a circle of radius 21 cm. The central angle of the sector is 150°. Find the length of the arc of this sector and the area of the sector.**	
Sol.	Length of the arc = $2 \times \frac{22}{7} \times 21 \times \frac{150}{360}$ $= 55cm^2$ Area of sector = $\frac{22}{7} \times 21 \times 21 \times \frac{150}{360}$ $= 577{\cdot}5\ cm^2$	1 ½ 1 ½
28.(a)	**Prove that $\sqrt{3}$ is an irrational number.**	
Sol.	Let $\sqrt{3}$ be a rational number. $\therefore \sqrt{3} = \frac{p}{q}$, where $q \neq 0$ and p & q are coprime. $3q^2 = p^2 \Longrightarrow p^2$ is divisible by 3 $\Longrightarrow$ p is divisible by 3----- (i) $\Longrightarrow p = 3a$, where 'a' is a postive integer $9a^2 = 3q^2 \Longrightarrow q^2 = 3a^2 \Longrightarrow q^2$ is divisible by 3 $\Longrightarrow$ q is divisible by 3 ----- (ii) (i) and (ii) leads to contradiction as 'p' and 'q' are coprime. $\therefore \sqrt{3}$ is an irrational number.	½ 1 1 ½
	OR	
28.(b)	**Prove that $\left(\sqrt{2} + \sqrt{3}\right)^2$ is an irrational number, given that $\sqrt{6}$ is an irrational number.**	
Sol.	$(\sqrt{2} + \sqrt{3})^2 = 2 + 3 + 2\sqrt{6} = 5 + 2\sqrt{6}$ Let us assume, to the contrary, that $5 + 2\sqrt{6}$ is rational $\therefore 5 + 2\sqrt{6} = \frac{a}{b}$; a, b are integers, $b \neq 0$ $\therefore \sqrt{6} = \frac{a-5b}{2b}$ RHS is a rational number, whereas LHS is an irrational number. $\therefore$ Our assumption is wrong. $\Rightarrow 5 + 2\sqrt{6} = (\sqrt{2} + \sqrt{3})^2$ is an irrational number	1 ½ ½ ½ ½

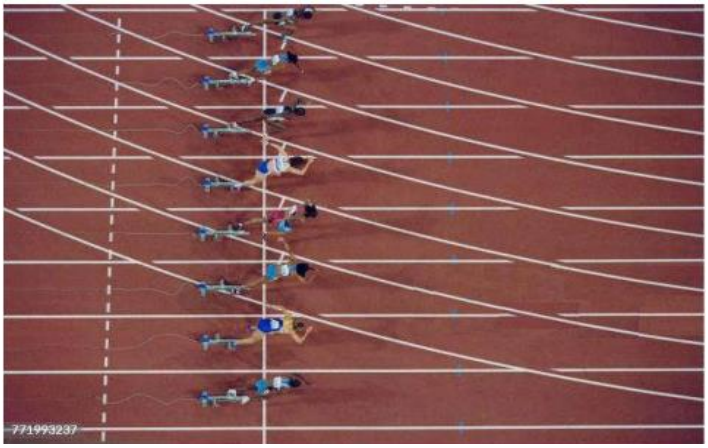
29.	**Three unbiased coins are tossed simultaneously. Find the probability of getting :** **(i) at least one head.** **(ii) exactly one tail.** **(iii) two heads and one tail.**	
Sol.	Total number of possible outcomes = 8 (i) P(at least one head) = $\frac{7}{8}$ (ii) P (exactly one tail) = $\frac{3}{8}$ (iii) P (2 heads and one tail) = $\frac{3}{8}$	 1 1 1
30.	**Prove that the parallelogram circumscribing a circle is a rhombus.**	
Sol.	Correct figure  $\therefore$ AP = AS BP = BQ CR = CQ DR = DS Adding, (AP + BP) + (CR + DR) = (AS + DS) + (BQ + CQ) $\Rightarrow$ AB + CD = AD + BC Now AB = CD and AD = BC $\Rightarrow$ 2 AB = 2 BC $\Rightarrow$ AB = BC $\Rightarrow$ ABCD is a rhombus	½ 1 1 ½
31.(a)	**If the sum of the first 14 terms of an A.P. is 1050 and the first term is 10, then find the 20^{th} term and the n^{th} term.**	
Sol.	$\frac{14}{2}(20 + 13d) = 1050$ $\Rightarrow$ d = 10 $\therefore$ a_{20} = 10 + 19 × 10 = 200	1 1 ½

	$a_n = 10 + (n - 1)\ 10 = 10n$	½
	OR	
31. (b)	**The first term of an A.P. is 5, the last term is 45 and the sum of all the terms is 400. Find the number of terms and the common difference of the A.P.**	
Sol.	$a = 5,\ a_n = 45,\ S_n = 400$ $\frac{n}{2}(5 + 45) = 400$ $\Rightarrow n = 16$ $5 + 15d = 45$ $\Rightarrow d = \frac{40}{15}$ or $\frac{8}{3}$	1 1 ½ ½
	SECTION- D **This section comprises Long Answer (LA) type questions of 5 marks each.**	
32.(a)	**In the given figure, Δ FEC $\cong \Delta$ GDB and $\angle 1 = \angle 2$.** **Prove that Δ ADE ~ Δ ABC.**  	
Sol.	Δ FEC $\cong \Delta$ GDB Therefore, $\angle 3 = \angle 4$ In Δ ABC, $\angle 3 = \angle 4$ $\therefore$ AB = AC ……(i) In Δ ADE, $\angle 1 = \angle 2$ AD = AE ……(ii) Dividing (ii) by (i) $\frac{AD}{AB} = \frac{AE}{AC}$ $\Rightarrow$ DE $\|$ BC $\angle 1 = \angle 3$ and $\angle 2 = \angle 4$ $\therefore \Delta$ ADE ~ Δ ABC	1 1 1 1 1
	OR	

32.(b)	**Sides AB and AC and median AD of a Δ ABC are respectively proportional to sides PQ and PR and median PM of another Δ PQR. Show that Δ ABC ~ Δ PQR.**	
Sol.	Correct figure  Produce AD to E such that AD = DE and join EC. Produce PM to L such that PM = ML and join LR. $\therefore$ Δ ABD $\cong$ Δ ECD $\therefore$ AB = EC Similarly, PQ = LR $\frac{AB}{PQ} = \frac{AC}{PR} = \frac{AD}{PM}$ $\frac{EC}{LR} = \frac{AC}{PR} = \frac{2AD}{2PM} = \frac{AE}{PL}$ $\therefore$ Δ AEC ~ Δ PLR $\Rightarrow \angle 2 = \angle 4$ Similarly, $\angle 1 = \angle 3$ Adding both, $\angle$BAC = $\angle$QPR $\therefore$ Δ ABC ~ Δ PQR	1 ½ 1 1 ½ ½ ½
33.(a)	**Find the value of 'k' for which the quadratic equation $(k + 1)x^2 - 6(k + 1)x + 3(k + 9) = 0$, $k \neq -1$ has real and equal roots.**	
Sol.	For real and equal roots, $D = b^2 - 4ac = 0$ $36 (k + 1)^2 - 4 (k + 1) \times 3 (k + 9) = 0$ $\Rightarrow k^2 - 2k - 3 = 0$ $\Rightarrow (k - 3) (k + 1) = 0$ $k \neq -1$ So, $k = 3$	2 1½ 1 ½
	OR	

33.(b)	**The age of a man is twice the square of the age of his son. Eight years hence, the age of the man will be 4 years more than three times the age of his son. Find their present ages.**	
Sol.	Let present age of son = x years and present age of man = $2x^2$ years A.T.Q. $3(x + 8) + 4 = 2x^2 + 8$ $\Rightarrow 2x^2 - 3x - 20 = 0$ $\Rightarrow (2x + 5)(x - 4) = 0$ $x \neq -\frac{5}{2}$ So, $x = 4$ Present age of son = 4 years Present age of man = 32 years	1 1 1 1 ½ ½
34.	**From a window 15 metres high above the ground in a street, the angles of elevation and depression of the top and the foot of another house on the opposite side of the street are 30° and 45° respectively. Find the height of the opposite house. (Use $\sqrt{3} = 1{\cdot}732$)**	
Sol.	For correct figure  In right Δ BPC, $\tan 45° = 1 = \frac{15}{x}$ $\Rightarrow x = 15$ In right Δ BPD, $\tan 30° = \frac{1}{\sqrt{3}} = \frac{h}{x}$ $\Rightarrow \quad h = \frac{15\sqrt{3}}{3}$ or $5\sqrt{3}$ $\therefore$ Height of opposite house (CD) = $5\sqrt{3} + 15$ $= 5\ (1{\cdot}732) + 15 = 23{\cdot}66$ m	1 1 ½ 1 ½ ½ ½

35.	A juice seller was serving his customers using glasses as shown in the figure. The inner diameter of the cylindrical glass was 5·6 cm, but the bottom of the glass had a hemispherical raised portion which reduced the capacity of the glass. If the height of the glass was 10 cm, find the apparent capacity and the actual capacity of the glass. 	
Sol.	Radius(r) = 2.8cm Apparent capacity of glass == $\frac{22}{7} \times 2.8 \times 2.8 \times 10$ $= 246.4\ cm^3$ Volume of hemispherical part = = $\frac{2}{3} \times \frac{22}{7} \times 2.8 \times 2.8 \times 2.8$ $= 45.9\ cm^3$ ∴ Actual capacity of glass = 246.4- 45.9 $= 200.5\ cm^3$ or 200.5 ml	½ 1 ½ 1 ½ 1 ½
	SECTION-E **This section comprises 3 case study based questions of 4 marks each.**	
36.	**Case Study – 1** A garden is in the shape of a square. The gardener grew saplings of Ashoka tree on the boundary of the garden at the distance of 1 m from each other. He wants to decorate the garden with rose plants. He chose a triangular region inside the garden to grow rose plants. In the above situation, the gardener took help from the students of class 10. They made a chart for it which looks like the given figure. 	

	Based on the above, answer the following questions : (i) If A is taken as origin, what are the coordinates of the vertices of Δ PQR ? (ii) (a) Find distances PQ and QR. **OR** (b) Find the coordinates of the point which divides the line segment joining points P and R in the ratio 2 : 1 internally. (iii) Find out if Δ PQR is an isosceles triangle.	
Sol.	(i) P (4, 6) , Q (3, 2), R (6, 5) (ii) (a) PQ = $\sqrt{(4-3)^2+(6-2)^2} = \sqrt{17}$ QR = $\sqrt{(3-6)^2+(2-5)^2} = \sqrt{18}$ OR (b) The coordinate of required point are $\left(\frac{6\times2+1\times4}{3}, \frac{5\times2+1\times6}{3}\right)$ i.e. $\left(\frac{16}{3}, \frac{16}{3}\right)$ (iii) PQ = $\sqrt{(4-3)^2+(6-2)^2} = \sqrt{17}$ QR = $\sqrt{(3-6)^2+(2-5)^2} = \sqrt{18}$ PR = $\sqrt{(4-6)^2+(6-5)^2} = \sqrt{5}$ PQ ≠ QR ≠ PR Δ PQR is not isosceles	1 1 1 1 1 ½ ½
37.	**Case Study – 2** Activities like running or cycling reduce stress and the risk of mental disorder like depression. Running helps build endurance. Children develop stronger bones and muscles and are less prone to gain weight. The physical education teacher of a school has decided to conduct an inter school running tournament in his school premises. The time taken by a group of students to run 100 m, was noted as follows : 	

Time (in seconds)	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100
Number of students	8	10	13	6	3

Based on the above, answer the following questions :

(i) What is the median class of the above given data ?

(ii) (a) Find the mean time taken by the students to finish the race.

OR

(b) Find the mode of the above given data.

(iii) How many students took time less than 60 seconds ?

Time (in sec)	Number of students (f)	x_i	cf	$f_i x_i$
0 – 20	8	10	8	80
20 – 40	10	30	18	300
40 – 60	13	50	31	650
60 – 80	6	70	37	420
80 – 100	3	90	40	270
Total	40			1720

Sol.

(i) Correct Cummulative Frequency ½

Median class = 40 – 60 ½

(ii) (a) Correct table for x_i and $f_i x_i$ 1½

Mean = $\frac{1720}{40} = 43$ ½

OR

(b) Modal class = 40-60 ½

Mode = $40 + \frac{(13-10)}{(26-10-6)} \times 20$ 1

= 46 ½

(iii) 31 students took time less than 60 seconds 1

38.

Case Study – 3

Essel World is one of India's largest amusement parks that offers a diverse range of thrilling rides, water attractions and entertainment options for visitors of all ages. The park is known for its iconic "Water Kingdom" section, making it a popular destination for family outings and fun-filled adventure. The ticket charges for the park are ₹ 150 per child and ₹ 250 per adult.

On a day, the cashier of the park found that 300 tickets were sold and an amount of ₹ 55,000 was collected.

Based on the above, answer the following questions :

(i) If the number of children visited be x and the number of adults visited be y, then write the given situation algebraically.

(ii) (a) How many children visited the amusement park that day ?

OR

(b) How many adults visited the amusement park that day ?

(iii) How much amount will be collected if 250 children and 100 adults visit the amusement park ?

Sol.

i) $x + y = 300$ ……(i) ½

$150x + 250y = 55000$……..(ii) ½

(ii) (a) Solving equation (i) and (ii)

Number of children visited park (x) = 200 2

OR

(b) Solving equation (i) and (ii)

Number of adults visited park (y) = 100 2

(iii) Amount collected = $250 \times 150 + 100 \times 250 =$ ₹ 62500 1

* * *