Series CD1BA/3

SET~2

प्रश्न-पत्र कोड
Q.P. Code **30/3/2**

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 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 हैं – खण्ड **क, ख, ग, घ** तथा **ङ** ।*

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

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

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

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

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

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

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

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

General Instructions :

Read the following instructions carefully and follow them :

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

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

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

(iv) *In Section–****B****, questions number* ***21*** *to* ***25*** *are Very Short-Answer (VSA) type questions, carrying* ***2*** *marks each.*

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

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

(vii) *In Section–****E****, questions number* ***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.*

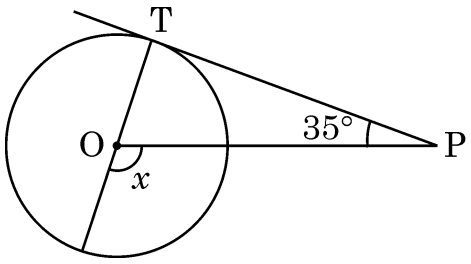
(x) *Use of calculators is* ***not*** *allowed.*

खण्ड – क

20 × 1 = 20

इस खण्ड में **20** प्रश्न हैं तथा प्रत्येक का **1** अंक है ।

1. दी गई आकृति में, केंद्र O वाले वृत्त की एक स्पर्श-रेखा PT यदि इस प्रकार है कि $\angle TPO = 35°$, तो $\angle x$ की माप है : **1**



(A) 110° (B) 115°

(C) 120° (D) 125°

2. किसी परीक्षा के एक प्रश्न के सही उत्तर का अनुमान लगाने की प्रायिकता $\frac{x}{6}$ है । यदि अनुमान द्वारा इसके सही न होने की प्रायिकता $\frac{2}{3}$ है, तो x का मान है : **1**

(A) 2 (B) 3

(C) 4 (D) 6

3. भूमि पर स्थित एक बिंदु, जो एक सीधी खड़ी मीनार के पाद से 30 m की दूरी पर है, से मीनार के शिखर का उन्नयन कोण 60° है, तो मीनार की ऊँचाई (मीटरों में) है : **1**

(A) $10\sqrt{3}$ (B) $30\sqrt{3}$

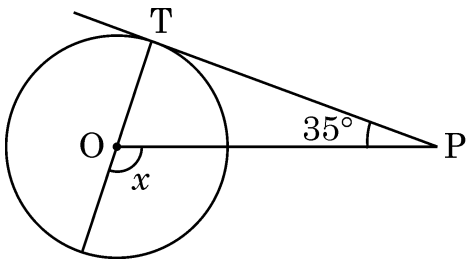
(C) 60 (D) 30

SECTION – A

20 × 1 = 20

This section consists of **20** questions of **1** mark each.

1. In the given figure, if PT is a tangent to a circle with centre O and $\angle TPO = 35°$, then the measure of $\angle x$ is : **1**



(A) 110° (B) 115°

(C) 120° (D) 125°

2. The probability of guessing the correct answer to a certain test question is $\frac{x}{6}$. If the probability of not guessing the correct answer to this question is $\frac{2}{3}$, then the value of x is : **1**

(A) 2 (B) 3

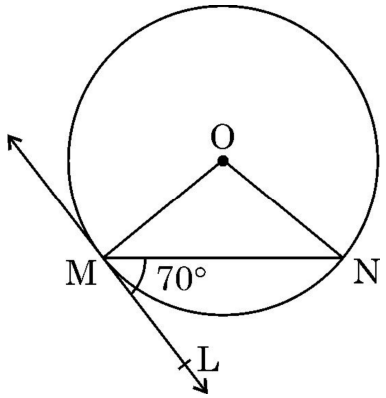
(C) 4 (D) 6

3. From a point on the ground, which is 30 m away from the foot of a vertical tower, the angle of elevation of the top of the tower is found to be 60°. The height (in metres) of the tower is : **1**

(A) $10\sqrt{3}$ (B) $30\sqrt{3}$

(C) 60 (D) 30

4. दी गई आकृति में, O वृत्त का केंद्र है । MN एक जीवा है तथा बिंदु M पर स्पर्श-रेखा ML इस प्रकार है कि यह MN के साथ 70° का कोण बनाती है । ∠MON का माप है : **1**



(A) 120° (B) 140°

(C) 70° (D) 90°

5. यदि दो चरों में रैखिक समीकरणों का एक युग्म संगत है, इसके द्वारा निरूपित समीकरण जिन दो रेखाओं को निरूपित करती हैं, वह हैं : **1**

(A) हमेशा प्रतिच्छेदी (B) समांतर

(C) हमेशा संपाती (D) प्रतिच्छेदी या संपाती

6. यदि एक त्रिज्यखण्ड का क्षेत्रफल वृत्त के क्षेत्रफल का $\frac{7}{20}$ है, तो इसके द्वारा केंद्र पर बना कोण है : **1**

(A) 110° (B) 130°

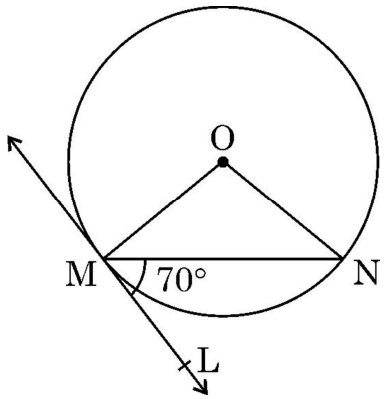
(C) 100° (D) 126°

7. यदि संख्याओं 1, 2, 3, 4, 5, 6, 7, 8, 9 में से यादृच्छया एक संख्या चुनी गई तो एक विषम अभाज्य संख्या के चुने जाने की प्रायिकता है : **1**

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

(C) $\frac{4}{9}$ (D) $\frac{5}{9}$

4. In the given figure, O is the centre of the circle. MN is the chord and the tangent ML at point M makes an angle of 70° with MN. The measure of ∠MON is : **1**



(A) 120° (B) 140°

(C) 70° (D) 90°

5. If a pair of linear equations in two variables is consistent, then the lines represented by the two equations are : **1**

(A) always intersecting (B) parallel

(C) always coincident (D) intersecting or coincident

6. If the area of a sector of a circle is $\frac{7}{20}$ of the area of the circle, then the angle at the centre is equal to **1**

(A) 110° (B) 130°

(C) 100° (D) 126°

7. If a digit is chosen at random from the digits 1, 2, 3, 4, 5, 6, 7, 8, 9; then the probability that this digit is an odd prime number is : **1**

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

(C) $\frac{4}{9}$ (D) $\frac{5}{9}$

8 यदि एक चतुर्भुज के विकर्ण एक दूसरे को समानुपात में विभाजित करते हैं, तो यह चतुर्भुज है : 1

(A) समांतर चतुर्भुज (B) आयत

(C) वर्ग (D) समलंब

9. यदि $a = 2^2 \times 3^x$, $b = 2^2 \times 3 \times 5$, $c = 2^2 \times 3 \times 7$ तथा LCM (a, b, c) = 3780 है, तो x का मान है : 1

(A) 1 (B) 2

(C) 3 (D) 0

10. दो सिक्कों को एक साथ उछाला गया । अधिक से अधिक एक पट् आने की प्रायिकता है : 1

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

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

11. यदि पाँच प्रेक्षणों x, $x + 2$, $x + 4$, $x + 6$ तथा $x + 8$ का माध्य 11 है, तो x का मान है : 1

(A) 4 (B) 7

(C) 11 (D) 6

12. द्विघात बहुपद $2x^2 - 3x - 9$ के शून्यक हैं : 1

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

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

8. If the diagonals of a quadrilateral divide each other proportionally, then it is a : **1**

(A) parallelogram (B) rectangle

(C) square (D) trapezium

9. If $a = 2^2 \times 3^x$, $b = 2^2 \times 3 \times 5$, $c = 2^2 \times 3 \times 7$ and LCM (a, b, c) = 3780, then x is equal to **1**

(A) 1 (B) 2

(C) 3 (D) 0

10. Two coins are tossed simultaneously. The probability of getting at most one tail is : **1**

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

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

11. If the mean of five observations x, $x + 2$, $x + 4$, $x + 6$ and $x + 8$ is 11, then the value of x is : **1**

(A) 4 (B) 7

(C) 11 (D) 6

12. The zeroes of the quadratic polynomial $2x^2 - 3x - 9$ are : **1**

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

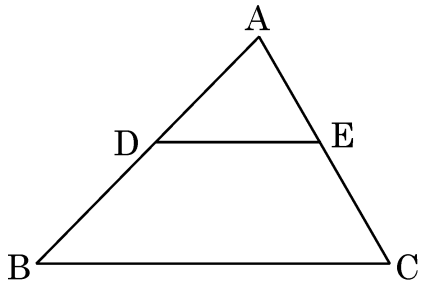
(C) $-3, \frac{3}{2}$ (D) $3, \frac{3}{2}$

13. दो अलग-अलग बिंदुओं पर प्रतिच्छेद करने वाले दो वृत्तों पर खींची जा सकने वाली उभयनिष्ठ स्पर्श-रेखाओं की अधिकतम संख्या है : **1**

(A) 4 (B) 3

(C) 2 (D) 1

14. दी गई आकृति में, ΔABC में $DE \parallel BC$ है । यदि $AD = 2$ cm, $BD = 3$ cm तथा $BC = 7.5$ cm है, तो DE की लंबाई (cm में) है : **1**



(A) 2.5 (B) 3

(C) 5 (D) 6

15. यदि $\cos\theta = \frac{\sqrt{3}}{2}$ तथा $\sin\phi = \frac{1}{2}$ है, तो $\tan(\theta + \phi)$ है : **1**

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

(C) 1 (D) परिभाषित नहीं

16. दिया है कि HCF (2520, 6600) = 40 तथा LCM (2520, 6600) = $252 \times k$ है, तो k का मान है : **1**

(A) 1650 (B) 1600

(C) 165 (D) 1625

17. यदि एक समांतर श्रेढ़ी के प्रथम n पदों का योग $3n^2 + 4n$ है तथा इसका सार्व अंतर 6 है, तो इसका प्रथम पद है : **1**

(A) 7 (B) 4

(C) 6 (D) 3

18. बहुपद $x^2 - 16x + 30$ में से क्या घटाया जाए कि प्राप्त बहुपद का एक शून्यक 15 हो ? **1**

(A) 30 (B) 14

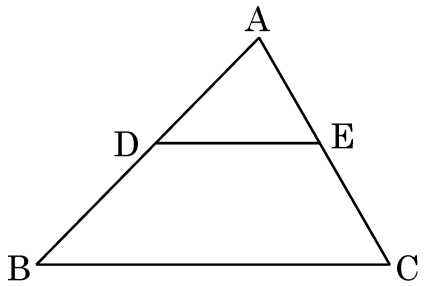
(C) 15 (D) 16

13. Maximum number of common tangents that can be drawn to two circles intersecting at two distinct points is : **1**

(A) 4 (B) 3

(C) 2 (D) 1

14. In Δ ABC, DE $||$ BC (as shown in the figure). If AD = 2 cm, BD = 3 cm, BC = 7.5 cm, then the length of DE (in cm) is : **1**



(A) 2.5 (B) 3

(C) 5 (D) 6

15. If $\cos\theta = \frac{\sqrt{3}}{2}$ and $\sin\phi = \frac{1}{2}$, then $\tan(\theta + \phi)$ is : **1**

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

(C) 1 (D) not defined

16. Given HCF (2520, 6600) = 40, LCM (2520, 6600) = 252 × k, then the value of k is : **1**

(A) 1650 (B) 1600

(C) 165 (D) 1625

17. If the sum of first n terms of an A.P. is $3n^2 + 4n$ and its common difference is 6, then its first term is : **1**

(A) 7 (B) 4

(C) 6 (D) 3

18. What should be subtracted from the polynomial $x^2 - 16x + 30$, so that 15 is the zero of the resulting polynomial ? **1**

(A) 30 (B) 14

(C) 15 (D) 16

निर्देश : प्रश्न **19** तथा **20** अभिकथन तथा तर्क आधारित प्रश्न हैं । प्रत्येक प्रश्न में एक अभिकथन (A) के बाद एक तर्क (R) कथन दिया है । विकल्पों (A), (B), (C) तथा (D) में से सही उत्तर का विकल्प चुनिए ।

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

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

(C) अभिकथन (A) सत्य है, परन्तु तर्क (R) असत्य है ।

(D) अभिकथन (A) असत्य है, जबकि तर्क (R) सत्य है ।

19. **अभिकथन (A)** : एक क्रिकेट मैच में एक बल्लेबाज, खेली गई 45 गेंदों में से 9 गेंदों पर चौका मारता है । एक दिए गए बॉल पर चौका न मारने की प्रायकिता $\frac{4}{5}$ है । **1**

तर्क (R) : P(E) + P(E नहीं) = 1

20. **अभिकथन (A)** : बिंदुओ A (1, 2) तथा B(–1, 1) को मिलाने वाले रेखाखण्ड को आंतरिक रूप से 1 : 2 में विभाजन करने वाला बिंदु $\left(\frac{-1}{3}, \frac{5}{3}\right)$ है । **1**

तर्क (R) : बिंदुओं $A(x_1, y_1)$ तथा $B(x_2, y_2)$ को मिलाने वाले रेखाखण्ड को $m_1 : m_2$ में विभाजित करने वाले बिंदु के निदेशांक $\left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2}\right)$ हैं ।

Directions : Questions number **19** and **20** are Assertion and Reason based questions carrying **1** mark each. 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)** : In a cricket match, a batsman hits a boundary 9 times out of 45 balls he plays. The probability that in a given ball, he does not hit the boundary is $\frac{4}{5}$. **1**

Reason (R) : P(E) + P(not E) = 1

20. **Assertion (A)** : The point which divides the line segment joining the points A (1, 2) and B(–1, 1) internally in the ratio 1 : 2 is $\left(\frac{-1}{3}, \frac{5}{3}\right)$ **1**

Reason (R) : The coordinates of the point which divides the line segment joining the points A (x_1, y_1) and B(x_2, y_2) in the ratio $m_1 : m_2$ are $\left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2}\right)$

खण्ड – ख

इस खण्ड में **5** प्रश्न हैं तथा प्रत्येक के **2** अंक हैं ।

21. मान ज्ञात कीजिए : $\frac{\sec^2 45° - \tan^2 45°}{\sin^2 45°}$ **2**

22. (a) यदि बिंदु P(x, y), बिंदुओं A(7, 1) तथा B(3, 5) से समदूरस्थ है, तो x तथा y के बीच का संबंध ज्ञात कीजिए । **2**

अथवा

(b) बिंदु A(–1, y) तथा B(5, 7), केंद्र O(2, –3y) वाले वृत्त पर स्थित दो ऐसे बिंदु हैं कि AB वृत्त का एक व्यास है । y का मान ज्ञात कीजिए । वृत्त की त्रिज्या भी ज्ञात कीजिए । **2**

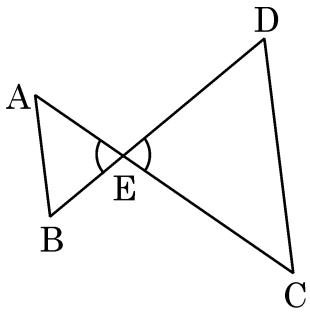
23. 52 पत्तों की अच्छी प्रकार से फेंटी गई ताश की गड्डी में से यादृच्छया एक पत्ता निकाला गया । प्रायिकता ज्ञात कीजिए कि निकाला गया पत्ता (i) पान की बेगम है (ii) गुलाम वाला पत्ता नहीं है । **1 + 1**

24. (a) यदि $2x + y = 13$ तथा $4x - y = 17$ है, तो $(x - y)$ का मान ज्ञात कीजिए । **2**

अथवा

(b) दो संख्याओं का योगफल 105 है तथा उनका अंतर 45 है । संख्याएँ ज्ञात कीजिए । **2**

25. दी गई आकृति में $\frac{EA}{EC} = \frac{EB}{ED}$ है, सिद्ध कीजिए कि $\Delta EAB \sim \Delta ECD$ **2**



SECTION – B

This section consists of **5** questions of **2** marks each.

21. Evaluate : $\frac{\sec^2 45° - \tan^2 45°}{\sin^2 45°}$ **2**

22. (a) Find a relation between x and y such that the point P(x, y) is equidistant from the points A(7, 1) and B(3, 5). **2**

OR

(b) Points A(–1, y) and B(5, 7) lie on a circle with centre O(2, –3y) such that AB is a diameter of the circle. Find the value of y. Also, find the radius of the circle. **2**

23. One card is drawn at random from a well shuffled deck of 52 cards. Find the probability that the card drawn

(i) is queen of hearts;

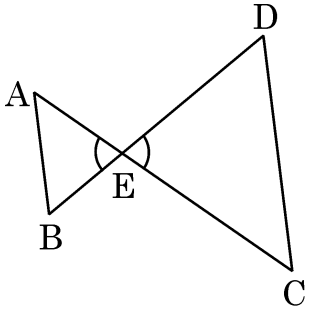
(ii) is not a jack. **1 + 1**

24. (a) If $2x + y = 13$ and $4x - y = 17$, find the value of $(x - y)$. **2**

OR

(b) Sum of two numbers is 105 and their difference is 45. Find the numbers. **2**

25. In the given figure, $\frac{EA}{EC} = \frac{EB}{ED}$, prove that $\Delta EAB \sim \Delta ECD$ **2**



खण्ड – ग

इस खण्ड में **6** प्रश्न हैं जिनमें प्रत्येक के **3** अंक हैं ।

26. निम्न रैखिक समीकरण निकाय का ग्राफ द्वारा हल ज्ञात कीजिए : **3**

$x - y + 1 = 0$

$x + y = 5$

27. सिद्ध कीजिए : $\frac{\sin A + \cos A}{\sin A - \cos A} + \frac{\sin A - \cos A}{\sin A + \cos A} = \frac{2}{2\sin^2 A - 1}$ **3**

28. (a) X-अक्ष बिंदुओं (2, –3) तथा (5, 6) को मिलाने वाले रेखाखण्ड को किस अनुपात में बाँटता है ? प्रतिच्छेदन बिंदु के निर्देशांक भी ज्ञात कीजिए । **3**

अथवा

(b) यदि ΔABC के शीर्षों A,B,C के निर्देशांक A(0, –1), B(2, 1) तथा C(0, 3) हैं, तो माध्यिका AD की लंबाई ज्ञात कीजिए । **3**

29. सिद्ध कीजिए कि वृत्त की किसी जीवा के सिरों पर खींची गईं स्पर्श-रेखाएँ, जीवा के साथ समान कोण बनाती हैं । **3**

30. द्विघात बहुपद $x^2 - 15$ के शून्यक ज्ञात कीजिए । शून्यकों तथा बहुपद के गुणांकों के बीच के संबंध का सत्यापन कीजिए । **3**

31. (a) यदि एक समांतर श्रेढ़ी के प्रथम 7 पदों का योग 49 है तथा इसके प्रथम 17 पदों का योग 289 है, तो इसके प्रथम 20 पदों का योग ज्ञात कीजिए । **3**

अथवा

(b) एक समांतर श्रेढ़ी के 10वें तथा 30वें पदों में 1 : 3 का अनुपात है जबकि इसके प्रथम छः पदों का योग 42 है । इस समांतर श्रेढ़ी का प्रथम पद तथा सार्व अंतर ज्ञात कीजिए । **3**

SECTION – C

This section consists of **6** questions of **3** marks each.

26. Solve the following system of linear equations graphically : **3**

$x - y + 1 = 0$

$x + y = 5$

27. Prove that $\frac{\sin A + \cos A}{\sin A - \cos A} + \frac{\sin A - \cos A}{\sin A + \cos A} = \frac{2}{2\sin^2 A - 1}$ **3**

28. (a) In what ratio does the X-axis divides the line segment joining the points(2, –3) and (5, 6) ? Also, find the coordinates of the point of intersection. **3**

OR

(b) Find the length of the median AD of ΔABC having vertices A(0, –1), B(2, 1) and C(0, 3). **3**

29. Prove that the tangents drawn at the end points of a chord of a circle makes equal angles with the chord. **3**

30. Find the zeroes of the quadratic polynomial $x^2 - 15$ and verify the relationship between the zeroes and the coefficients of the polynomial. **3**

31. (a) If the sum of first 7 terms of an A.P. is 49 and that of first 17 terms is 289, find the sum of its first 20 terms. **3**

OR

(b) The ratio of the 10^{th} term to its 30^{th} term of an A.P. is 1 : 3 and the sum of its first six terms is 42. Find the first term and the common difference of A.P. **3**

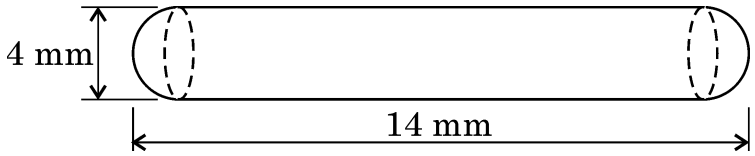
खण्ड – घ

इस खण्ड में **4** प्रश्न हैं तथा प्रत्येक के **5** अंक हैं ।

32. (a) ऊँचाई 200 cm और आधार व्यास 28 cm वाले एक ठोस बेलन, जिस पर ऊँचाई 50 cm और त्रिज्या 7 cm वाला एक अन्य बेलन आरोपित है, से लोहे का एक ठोस स्तंभ बना है । इस स्तम्भ का द्रव्यमान ज्ञात कीजिए, जबकि दिया है कि 1 cm^3 लोहे का द्रव्यमान 8 g होता है । **5**

अथवा

(b) दवा का एक कैप्सूल एक बेलन के आकार का है जिसके दोनों सिरों पर एक अर्धगोला लगा हुआ है । पूरे कैप्सूल की लंबाई 14 mm है और व्यास 4 mm है । इसका पृष्ठीय क्षेत्रफल ज्ञात कीजिए । इसका आयतन भी ज्ञात कीजिए । **5**



33. (a) 2800 km की एक हवाई यात्रा के दौरान, खराब मौसम के कारण वायुयान की औसत चाल को 100 km/h कम कर दिया गया जिससे यात्रा का समय 30 मिनट बढ़ गया । हवाई यात्रा का मूल समय ज्ञात कीजिए । **5**

अथवा

(b) एक भिन्न का हर इसके अंश के दुगुने से एक अधिक है । यदि भिन्न और इसके व्युत्क्रम का योग $2\frac{16}{21}$ है, तो भिन्न ज्ञात कीजिए । **5**

34. एक समांतर चतुर्भुज ABCD की भुजा CD के मध्य बिंदु M से एक रेखा BM इस प्रकार खींची गई कि यह AC को L पर तथा बढ़ाई गई AD को E पर काटती है । सिद्ध कीजिए कि EL = 2BL. **5**

35. भूमि के एक बिंदु A से एक जेट प्लेन का उन्नयन कोण 60° है । 30 से. की उड़ान के बाद यह उन्नयन कोण 30° हो जाता है । यदि जेट प्लेट एक निश्चित (अचर) ऊँचाई $3600\sqrt{3}$ m पर उड़ रहा है, तो इसकी चाल ज्ञात कीजिए । **5**

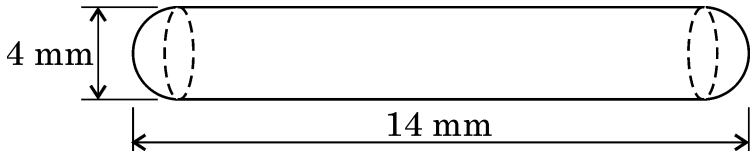
SECTION – D

This section consists of **4** questions of **5** marks each.

32. (a) A solid iron pole consists of a solid cylinder of height 200 cm and base diameter 28 cm, which is surmounted by another cylinder of height 50 cm and radius 7 cm. Find the mass of the pole, given that 1 cm^3 of iron has approximately 8 g mass. **5**

OR

(b) A medicine capsule is in the shape of a cylinder with two hemispheres stuck to each of its ends. The length of the entire capsule is 14 mm and the diameter of the capsule is 4 mm, find its surface area. Also, find its volume. **5**



33. (a) In a flight of 2800 km, an aircraft was slowed down due to bad weather. Its average speed is reduced by 100 km/h and by doing so, the time of flight is increased by 30 minutes. Find the original duration of the flight. **5**

OR

(b) The denominator of a fraction is one more than twice the numerator. If the sum of the fraction and its reciprocal is $2\frac{16}{21}$, find the fraction. **5**

34. Through the mid-point M of the side CD of a parallelogram ABCD, the line BM is drawn intersecting AC in L and AD produced in E. Prove that EL = 2BL. **5**

35. The angle of elevation of a jet plane from a point A on the ground is 60°. After a flight of 30 seconds, the angle of elevation changes to 30°. If the jet plane is flying at a constant height of $3600\sqrt{3}$ m, find the speed of the jet plane. **5**

खण्ड – ङ

इस खण्ड में **तीन** प्रकरण आधारित प्रश्न हैं जिनमें प्रत्येक के 4 अंक हैं :

36. गतिविधियों के माध्यम से गणित पढ़ाना एक शक्तिशाली दृष्टिकोण है जो छात्रों की समझ और जुड़ाव को बढ़ाता है । इसे ध्यान में रखते हुए, सुश्री मुक्ता ने कक्षा 5 के छात्रों के लिए एक अभाज्य संख्या खेल की योजना बनाई । उसने कक्षा के पहले छात्र को संख्या 2 को किसी अभाज्य संख्या से गुणा करके अगले छात्र को दे दें । दूसरा छात्र भी इसे किसी अभाज्य संख्या से गुणा कर इसे तीसरे छात्र को दे दें । इसी प्रकार अभाज्य संख्याओं से गुणा करते करते आखिरी छात्र को गुणा करने के पश्चात् 173250 प्राप्त हुआ ।

अब मुक्ता ने छात्रों से निम्न कुछ प्रश्न पूछे :

(i) छात्रों द्वारा प्रयोग की गई सबसे छोटी अभाज्य संख्या कौन सी है ? **1**

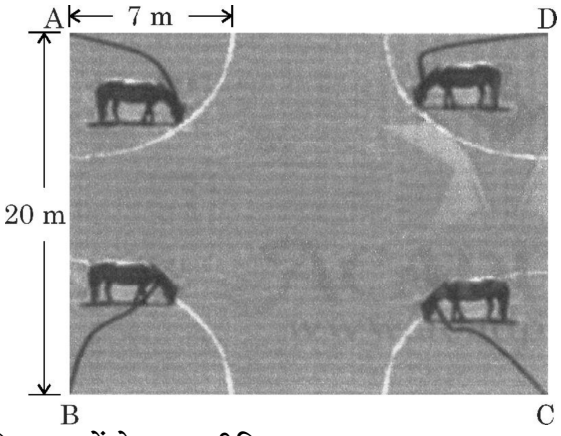
(ii) (a) कक्षा में कितने छात्र हैं ? **2**

अथवा

(b) छात्रों द्वारा बड़ी से बड़ी अभाज्य संख्या कौन सी प्रयोग की गई है ? **2**

(iii) कौन सी अभाज्य संख्या अधिकतम बार प्रयोग की गई है ? **1**

37. एक अस्तबल के मालिक के पास 4 घोड़े हैं । वह आमतौर पर इन घोड़ों को अपने खेत में चराने के लिए 20 मीटर लंबे वर्गाकार घास के मैदान के प्रत्येक कोने पर 7 m. लंबी रस्सी के खूँटों से बाँधता है । लेकिन कई बार रस्सी से बाँधने से उसके घोड़ों को चोट भी लग जाती है । इसलिए उसने उस क्षेत्र के चारों ओर बाढ़ बनाने का निर्णय लिया जहाँ घोड़ा चर सकता है ।



उपरोक्त के आधार पर निम्न प्रश्नों के उत्तर दीजिए :

(i) वर्गाकार घास के मैदान का क्षेत्रफल ज्ञात कीजिए । **1**

(ii) (a) उस कुल क्षेत्र का क्षेत्रफल ज्ञात कीजिए जिसमें यह घोड़े चर सकते हैं । **2**

अथवा

(b) यदि प्रत्येक घोड़े की रस्सी को 7 m से बढ़ाकर 10 m कर दिया जाए, तो एक घोड़े द्वारा चर सकने वाले क्षेत्र का क्षेत्रफल ज्ञात कीजिए । ($\pi = 3.14$ लीजिए) **2**

(iii) यदि प्रत्येक घोड़े की रस्सी 7 cm लंबी है, तो खेत का कितना क्षेत्रफल चरे बिना रह जाएगा ? **1**

SECTION – E

This section consists of **3** case study based questions of **4** marks each.

36. Teaching Mathematics through activities is a powerful approach that enhances students' understanding and engagement. Keeping this in mind, Ms. Mukta planned a prime number game for class 5 students. She announces the number 2 in her class and asked the first student to multiply it by a prime number and then pass it to second student. Second student also multiplied it by a prime number and passed it to third student. In this way by multiplying to a prime number, the last student got 173250.

Now, Mukta asked some questions as given below to the students :

(i) What is the least prime number used by students ? **1**

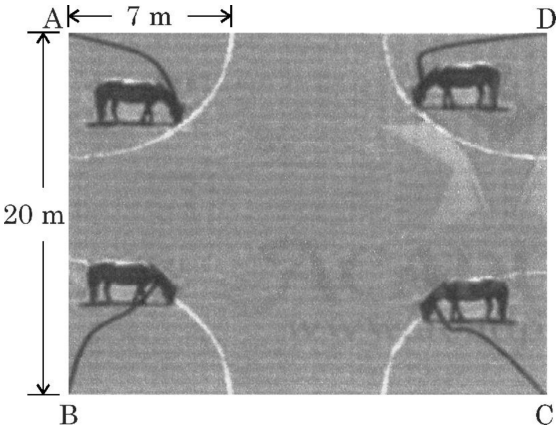
(ii) (a) How many students are in the class ? **2**

OR

(b) What is the highest prime number used by students ? **2**

(iii) Which prime number has been used maximum times ? **1**

37. A stable owner has four horses. He usually tie these horses with 7 m long rope to pegs at each corner of a square shaped grass field of 20 m length, to graze in his farm. But tying with rope sometimes results in injuries to his horses, so he decided to build fence around the area so that each horse can graze.



Based on the above, answer the following questions :

(i) Find the area of the square shaped grass field. **1**

(ii) (a) Find the area of the total field in which these horses can graze. **2**

OR

(b) If the length of the rope of each horse is increased from 7 m to 10 m, find the area grazed by one horse. (Use $\pi = 3.14$) **2**

(iii) What is area of the field that is left ungrazed, if the length of the rope of each horse is 7 cm ? **1**

38. व्यावसायिक प्रशिक्षण व्यावहारिक कौशल और अनुभव प्रदान करते हुए पारंपरिक शिक्षा का पूरक है । शिक्षा जहाँ व्यक्तियों के व्यापक ज्ञान आधार से सुसज्जित करती है, व्यावसायिक प्रशिक्षण नौकरी विशिष्ट कौशल पर ध्यान केंद्रित करता है तथा रोज़गार क्षमता को बढ़ाता है, जिससे छात्र आत्मनिर्भर बनता है ।

उपरोक्त के आधार पर एक अध्यापक ने, उन विद्यार्थियों/वयस्कों का आवृत्ति वितरण दे कर निम्न सारिणी बनाई जो प्रशिक्षण संस्था से व्यावसायिक प्रशिक्षण ले रहे हैं :

आयु (वर्षों में)	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54
भाग लेने वालों की संख्या	62	132	96	37	13	11	10	4

उपरोक्त से निम्न प्रश्नों के उत्तर दीजिए :

(i) ऊपर दिए गए आँकड़ों में बहुलक वर्ग की निचली सीमा क्या है ? **1**

(ii) (a) उपरोक्त आँकड़ों से माध्यक वर्ग ज्ञात कीजिए । **2**

अथवा

(b) 50 वर्ष से छोटे उन भाग लेने वालों की संख्या ज्ञात कीजिए जो व्यावसायिक प्रशिक्षण ले रहे हैं । **2**

(iii) माध्य, माध्यक तथा बहुलक में आनुभविक संबंध लिखिए । **1**

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38. Vocational training complements traditional education by providing practical skills and hands-on experience. While education equips individuals with a broad knowledge base, vocational training focuses on job-specific skills, enhancing employability thus making the student self-reliant. Keeping this in view, a teacher made the following table giving the frequency distribution of students/adults undergoing vocational training from the training institute.

Age (in years)	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54
Number of participants	62	132	96	37	13	11	10	4

From the above answer the following questions :

(i) What is the lower limit of the modal class of the above data ? **1**

(ii) (a) Find the median class of the above data. **2**

OR

(b) Find the number of participants of age less than 50 years who undergo vocational training. **2**

(iii) Give the empirical relationship between mean, median and mode. **1**

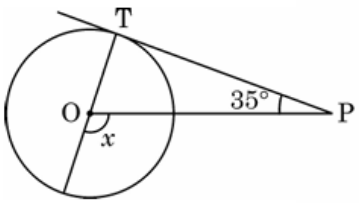
Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2024
MATHEMATICS PAPER CODE 30/3/2

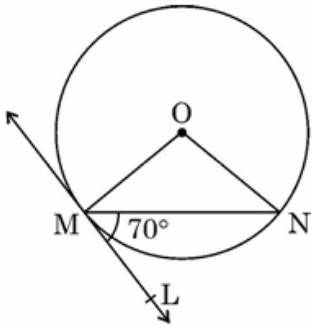
General Instructions: -

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 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.

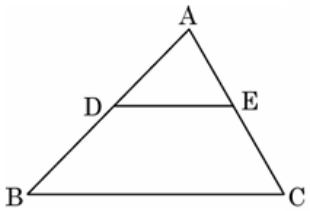
9	**In Q1-Q20, if a candidate attempts the question more than once (without cancelling the previous attempt), marks shall be awarded for the first attempt only and the other answer scored out with a note "Extra Question".**
10	**In Q21-Q38, if a student has attempted an extra question, answer of the 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: 30/3/2)

Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Marks
	SECTION A This section consists of 20 questions of 1 marks each.	
1.	In the given figure, if PT is a tangent to a circle with centre O and $\angle TPO = 35°$, then the measure of $\angle x$ is :  (A) 110° (B) 115° (C) 120° (D) 125°	
Sol.	(D) 125°	1
2.	The probability of guessing the correct answer to a certain test question is $\frac{x}{6}$. If the probability of not guessing the correct answer to this question is $\frac{2}{3}$, then the value of x is : (A) 2 (B) 3 (C) 4 (D) 6	
Sol.	(A) 2	1

3.	From a point on the ground, which is 30 m away from the foot of a vertical tower, the angle of elevation of the top of the tower is found to be 60°. The height (in metres) of the tower is : (A) $10\sqrt{3}$ (B) $30\sqrt{3}$ (C) 60 (D) 30	
Sol.	(B) $30\sqrt{3}$	1
4.	In the given figure, O is the centre of the circle. MN is the chord and the tangent ML at point M makes an angle of 70° with MN. The measure of ∠MON is :  (A) 120° (B) 140° (C) 70° (D) 90°	
Sol.	(B)140°	1
5.	If a pair of linear equations in two variables is consistent, then the lines represented by the two equations are : (A) always intersecting (B) parallel (C) always coincident (D) intersecting or coincident	
Sol.	(D) intersecting or coincident	1
6.	If the area of a sector of a circle is $\frac{7}{20}$ of the area of the circle, then the angle at the centre is equal to (A) 110° (B) 130° (C) 100° (D) 126°	

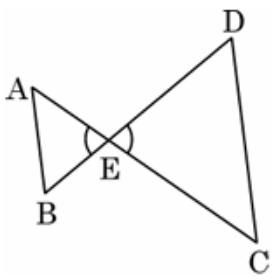
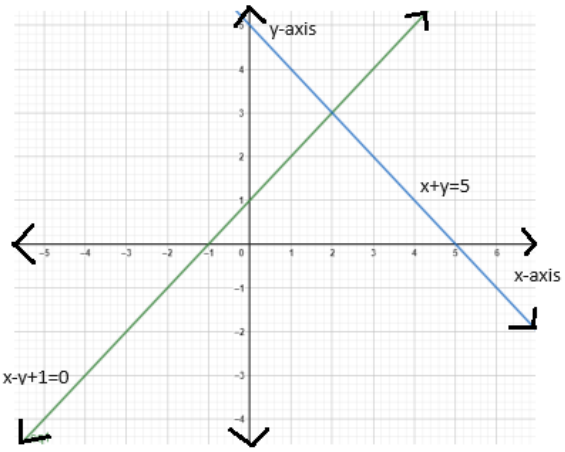
Sol.	(D) 126°	1
7.	If a digit is chosen at random from the digits 1, 2, 3, 4, 5, 6, 7, 8, 9; then the probability that this digit is an odd prime number is : (A) $\frac{1}{3}$ (B) $\frac{2}{3}$ (C) $\frac{4}{9}$ (D) $\frac{5}{9}$	
Sol.	(A) $\frac{1}{3}$	1
8.	If the diagonals of a quadrilateral divide each other proportionally, then it is a : (A) parallelogram (B) rectangle (C) square (D) trapezium	
Sol.	(D) trapezium	1
9.	If $a = 2^2 \times 3^x$, $b = 2^2 \times 3 \times 5$, $c = 2^2 \times 3 \times 7$ and LCM (a, b, c) = 3780, then x is equal to (A) 1 (B) 2 (C) 3 (D) 0	
Sol.	(C) 3	1
10.	Two coins are tossed simultaneously. The probability of getting at most one tail is : (A) $\frac{1}{2}$ (B) $\frac{1}{4}$ (C) $\frac{3}{4}$ (D) 1	
Sol.	(C) $\frac{3}{4}$	1
11.	If the mean of five observations x, $x + 2$, $x + 4$, $x + 6$ and $x + 8$ is 11, then the value of x is : (A) 4 (B) 7 (C) 11 (D) 6	
Sol.	(B) 7	1

12.	The zeroes of the quadratic polynomial $2x^2 - 3x - 9$ are : (A) $3, \frac{-3}{2}$ (B) $-3, \frac{-3}{2}$ (C) $-3, \frac{3}{2}$ (D) $3, \frac{3}{2}$	
Sol.	(A) $3, \frac{-3}{2}$	1
13.	Maximum number of common tangents that can be drawn to two circles intersecting at two distinct points is : (A) 4 (B) 3 (C) 2 (D) 1	
Sol.	(C) 2	1
14.	In Δ ABC, DE $\|\|$ BC (as shown in the figure). If AD = 2 cm, BD = 3 cm, BC = 7.5 cm, then the length of DE (in cm) is :  (A) 2.5 (B) 3 (C) 5 (D) 6	
Sol.	(B) 3	1
15.	If $\cos\theta = \frac{\sqrt{3}}{2}$ and $\sin\phi = \frac{1}{2}$, then $\tan(\theta + \phi)$ is : (A) $\sqrt{3}$ (B) $\frac{1}{\sqrt{3}}$ (C) 1 (D) not defined	
Sol.	(A) $\sqrt{3}$	1
16.	Given HCF (2520, 6600) = 40, LCM (2520, 6600) = 252 × k, then the value of k is : (A) 1650 (B) 1600 (C) 165 (D) 1625	

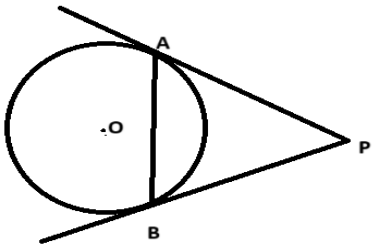
Sol.	(A) 1650	1
17.	If the sum of first n terms of an A.P. is $3n^2 + 4n$ and its common difference is 6, then its first term is : (A) 7 (B) 4 (C) 6 (D) 3	
Sol.	(A) 7	1
18.	What should be subtracted from the polynomial $x^2 - 16x + 30$, so that 15 is the zero of the resulting polynomial ? (A) 30 (B) 14 (C) 15 (D) 16	
Sol.	(C) 15	1
	Directions : Questions number **19** and **20** are Assertion and Reason based questions carrying **1** mark each. 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)** : In a cricket match, a batsman hits a boundary 9 times out of 45 balls he plays. The probability that in a given ball, he does not hit the boundary is $\frac{4}{5}$. **Reason (R)** : P(E) + P(not E) = 1	
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)** : The point which divides the line segment joining the points A (1, 2) and B(–1, 1) internally in the ratio 1 : 2 is $\left(\frac{-1}{3}, \frac{5}{3}\right)$ **Reason (R)** : The coordinates of the point which divides the line segment joining the points A (x_1, y_1) and B(x_2, y_2) in the ratio $m_1 : m_2$ are $\left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2}\right)$	
Sol.	(D) Assertion (A) is false , but Reason(R) is true.	1
	SECTION B This section consists of 5 questions of 2 marks each..	
21.	Evaluate : $\frac{\sec^2 45° - \tan^2 45°}{\sin^2 45°}$	
Sol.	$\frac{\sec^2 45^\circ - \tan^2 45^\circ}{\sin^2 45^\circ} = \frac{\left(\sqrt{2}\right)^2 - (1)^2}{\left(\frac{1}{\sqrt{2}}\right)^2}$ $= 2$	1½ ½
22(a).	Find a relation between x and y such that the point P(x, y) is equidistant from the points A(7, 1) and B(3, 5).	
Sol.	PA= PB $\Rightarrow PA^2 = PB^2$ $(x - 7)^2 + (y - 1)^2 = (x - 3)^2 + (y - 5)^2$ $\Rightarrow -8x + 8y + 16 = 0$ or $x - y - 2 = 0$	1 1
	OR	
22(b).	Points A(–1, y) and B(5, 7) lie on a circle with centre O(2, –3y) such that AB is a diameter of the circle. Find the value of y. Also, find the radius of the circle.	
Sol.	Centre O (2, – 3y) is the mid point of AB $\therefore \frac{y+7}{2} = -3y$ $\Rightarrow y = -1$	½ ½

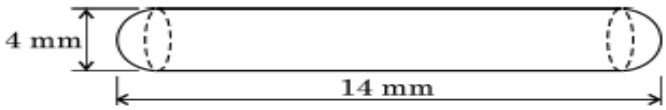
	Radius = OB = $\sqrt{(5-2)^2+(7-3)^2}$ = 5	1
23.	One card is drawn at random from a well shuffled deck of 52 cards. Find the probability that the card drawn (i) is queen of hearts; (ii) is not a jack.	
Sol.	Total outcomes = 52 (i) P (card is queen of hearts) = $\frac{1}{52}$ (ii) P (not a jack) = $\frac{48}{52}$ *or* $\frac{12}{13}$	1 1
24(a).	If $2x + y = 13$ and $4x - y = 17$, find the value of $(x - y)$.	
Sol.	$2x + y = 13$……..(i) $4x - y = 17$ ……(ii) Solving (i) and (ii) x=5 & y = 3 x-y=2	1½ ½
	OR	
24(b).	Sum of two numbers is 105 and their difference is 45. Find the numbers.	
Sol.	Let the numbers be x, y (x > y) x + y = 105 ……. (i) x – y = 45 ……. (ii) on solving (i) and (ii) $\Rightarrow$ x = 75 & y = 30 $\therefore$ Numbers are 75, 30	½ ½ 1

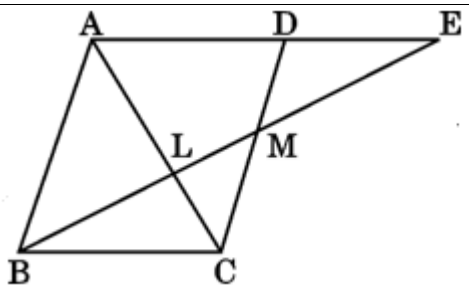
25.	In the given figure, $\frac{EA}{EC} = \frac{EB}{ED}$, prove that $\Delta EAB \sim \Delta ECD$  	
Sol.	In ΔEAB and ΔECD $\frac{EA}{EC} = \frac{EB}{ED}$ $\angle AEB = \angle CED$ $\Delta EAB \sim \Delta ECD$	1 1
	SECTION C This section consists of 6 questions of 3 marks each.	
26.	Solve the following system of linear equations graphically : $x - y + 1 = 0$ $x + y = 5$	
Sol.	 Correct graph Solution is x= 2 , y=3	2 1

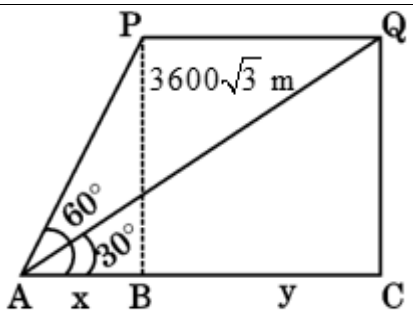
27.	Prove that $\frac{\sin A+\cos A}{\sin A-\cos A}+\frac{\sin A-\cos A}{\sin A+\cos A}=\frac{2}{2\sin^2 A-1}$	
Sol.	L.H.S$=\frac{(sinA+cosA)^2+(sinA-cosA)^2}{(sinA-cosA)(sinA+cosA)}$ $=\frac{sin^2A+cos^2A+2sinAcosA+sin^2A+cos^2A-2sinAcosA}{sin^2A-cos^2A}$ $=\frac{1+1}{sin^2A-(1-sin^2A)}$ $=\frac{2}{2sin^2A-1}$ = R.H.S.	½ 1 1 ½
28(a).	In what ratio does the X-axis divides the line segment joining the points(2, –3) and (5, 6) ? Also, find the coordinates of the point of intersection.	
Sol.	Let the co ordinate of the point of intersection be (x, 0). Let ratio be k:1 $\therefore \frac{6k-3}{k+1}=0$ $\Rightarrow k=\frac{1}{2}$ ∴ required ratio is 1: 2 $\therefore x=\frac{5\times1+2\times2}{1+2}=\frac{9}{3}=3$ ∴ the co ordinate of the point of intersection is (3,0)	½ 1 ½ ½ ½
	OR	
28(b).	Find the length of the median AD of ΔABC having vertices A(0, –1), B(2, 1) and C(0, 3).	
Sol.	Coordinate of D(1,2). AD= $\sqrt{(1-0)^2-(1+2)^2}$ $=\sqrt{10}$	1 1 1

29.	Prove that the tangents drawn at the end points of a chord of a circle makes equal angles with the chord.	
Sol.	 Correct Figure Let AB be the chord of the circle. In ΔPAB PA=PB $\angle PAB = \angle PBA$	1 1 1
30.	Find the zeroes of the quadratic polynomial $x^2 - 15$ and verify the relationship between the zeroes and the coefficients of the polynomial.	
Sol.	Let P(x) = $x^2 - 15$ $= (x - \sqrt{15})(x + \sqrt{15})$ $\therefore$ Zeroes of P(x) are $-\sqrt{15}$ and $\sqrt{15}$ Verification- Sum of zeroes = $-\sqrt{15} + \sqrt{15} = \frac{0}{1} = \frac{-\text{ coefficient of x}}{\text{coefficient of x}^2}$ Product of zeroes = $-\sqrt{15} \times \sqrt{15} = -15 = \frac{-15}{1} = \frac{\text{costant term}}{\text{coefficient of x}^2}$	 1 1 ½ ½
31(a).	If the sum of first 7 terms of an A.P. is 49 and that of first 17 terms is 289, find the sum of its first 20 terms.	
Sol.	Let a be the first term and d be the common difference. $\frac{7}{2}(2a + 6d) = 49$ a + 3d = 7.....(i) $S_{17} = 289$	 ½

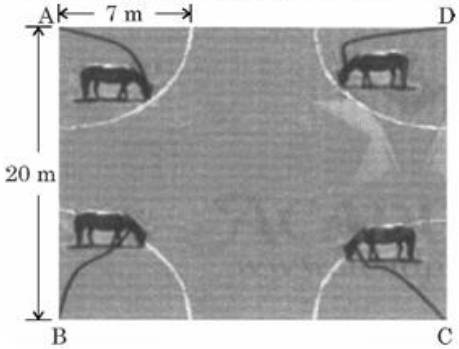
	$\frac{17}{2}(2a + 16d) = 289$ $a + 8d = 17$.....(ii) solving (i) and (ii) $d = 2$ & $a = 1$ $S_{20} = \frac{20}{2}[2(1)+19(2)]$ $= 400$	 ½ 1 ½ ½
	OR	
31(b).	The ratio of the 10th term to its 30th term of an A.P. is 1 : 3 and the sum of its first six terms is 42. Find the first term and the common difference of A.P.	
Sol.	Let a be the first term and d be the common difference. $\frac{a + 9d}{a + 29d} = \frac{1}{3}$ $\Longrightarrow a = d$ .....(i) $\frac{6}{2}(2a + 5d) = 42$ $\Rightarrow 2a + 5d = 14$ ……..(ii) Solving (i) and (ii) $a = 2$ and $d = 2$	 ½ ½ ½ ½ ½ + ½
	SECTION D This section consists of 4 questions of 5 marks each.	
32(a).	A solid iron pole consists of a solid cylinder of height 200 cm and base diameter 28 cm, which is surmounted by another cylinder of height 50 cm and radius 7 cm. Find the mass of the pole, given that 1 cm^3 of iron has approximately 8 g mass.	
Sol.	Radius of lower cylinder = 14 cm Volume of pole = $\frac{22}{7} \times 14 \times 14 \times 200 + \frac{22}{7} \times 7 \times 7 \times 50$ $= 130900\ cm^3$	½ 1+1 1

	Mass of the pole= 8 ×130900 =1047200 gm or 1047.2 kg	1 ½
	OR	
32(b).	A medicine capsule is in the shape of a cylinder with two hemispheres stuck to each of its ends. The length of the entire capsule is 14 mm and the diameter of the capsule is 4 mm, find its surface area. Also, find its volume.  	
Sol.	Radius of hemisphere= radius of cylinder = 2 mm Length of cylindrical part = 14 – 4 = 10 mm. Surface area of the capsule = CSA of cylinder + 2(CSA of hemisphere) $= 2\times \frac{22}{7} \times 2 \times 10 + 2\times 2 \times \frac{22}{7} \times 2 \times 2$ $= 176 \text{ mm}^2$ Volume of the capsule = volume of cylinder + 2(volume of hemisphere) $= \frac{22}{7} \times 2 \times 2 \times 10 + 2 \times \frac{2}{3} \times \frac{22}{7} \times 2 \times 2 \times 2$ $= \frac{3344}{21} \text{ mm}^3$ or 159.24 mm^3	½ ½ 1 1 1 1
33(a).	In a flight of 2800 km, an aircraft was slowed down due to bad weather. Its average speed is reduced by 100 km/h and by doing so, the time of flight is increased by 30 minutes. Find the original duration of the flight.	
Sol.	Let original speed of aircraft be x km/hr. A.T.Q. $\frac{2800}{x-100} - \frac{2800}{x} = \frac{1}{2}$ $\Rightarrow x^2 - 100x - 560000 = 0$ $\Rightarrow (x - 800)(x + 700) = 0$ $x \neq -700$ So, $x = 800$	2 ½ 1 ½

	Original Duration $=\frac{2800}{800}=\frac{7}{2}$ hrs or 3 hrs 30 min.	1
	OR	
33(b).	The denominator of a fraction is one more than twice the numerator. If the sum of the fraction and its reciprocal is $2\frac{16}{21}$, find the fraction.	
Sol.	Let numerator be x , then denominator be (2x + 1) Fraction = $\frac{x}{2x+1}$ A.T.Q. $\frac{x}{2x+1}+\frac{2x+1}{x}=\frac{58}{21}$ $\Rightarrow \quad 11x^2-26x-21=0$ $\Rightarrow (x-3)(11x+7)=0$ $x \neq -\frac{7}{11}$ So, $x=3$ $\therefore$ Fraction = $\frac{3}{7}$	½ ½ 1½ ½ 1 ½ ½
34.	Through the mid-point M of the side CD of a parallelogram ABCD, the line BM is drawn intersecting AC in L and AD produced in E. Prove that EL = 2BL.	
Sol.	 Correct fig. $\Delta BLC \sim \Delta ELA$ $\frac{BL}{EL}=\frac{BC}{EA}$……(i)	1 1 ½

	In ΔEAB M is mid point of BE DM$\parallel AB$ $\therefore AD = DE$ $\Longrightarrow AE = 2AD$ $\Longrightarrow AE = 2BC$……(ii) From (i) and (ii) EL=2BL	1 1 ½
35.	The angle of elevation of a jet plane from a point A on the ground is 60°. After a flight of 30 seconds, the angle of elevation changes to 30°. If the jet plane is flying at a constant height of $3600\sqrt{3}$ m, find the speed of the jet plane.	
Sol.	 Correct fig. In ΔAPB $\tan 60^\circ = \sqrt{3} = \frac{3600\sqrt{3}}{x}$ x =3600 m In ΔAQC $\tan 30^\circ = \frac{1}{\sqrt{3}} = \frac{3600\sqrt{3}}{x+y}$ y= 7200 m speed of jet plane = $\frac{7200}{30} = 240\text{m/sec}$	1 1 ½ 1 ½ 1

	SECTION E This section consists of 3 case-study based questions of 4 marks each.	
36.	Teaching Mathematics through activities is a powerful approach that enhances students' understanding and engagement. Keeping this in mind, Ms. Mukta planned a prime number game for class 5 students. She announces the number 2 in her class and asked the first student to multiply it by a prime number and then pass it to second student. Second student also multiplied it by a prime number and passed it to third student. In this way by multiplying to a prime number, the last student got 173250. Now, Mukta asked some questions as given below to the students : (i) What is the least prime number used by students ? (ii) (a) How many students are in the class ? **OR** (b) What is the highest prime number used by students ? (iii) Which prime number has been used maximum times ?	
Sol.	$173250 = 2 \times 5^3 \times 3^2 \times 7 \times 11$ (i) 3 (ii) (a) $173250 = 2 \times 5^3 \times 3^2 \times 7 \times 11$ Number of students in the class = 3 + 2 + 1 + 1 = 7 OR (ii) (b) $173250 = 2 \times 5^3 \times 3^2 \times 7 \times 11$ Highest prime number used by students = 11 (iii) 5	1 1 1 1 1 1

37.	A stable owner has four horses. He usually tie these horses with 7 m long rope to pegs at each corner of a square shaped grass field of 20 m length, to graze in his farm. But tying with rope sometimes results in injuries to his horses, so he decided to build fence around the area so that each horse can graze.  Based on the above, answer the following questions : (i) Find the area of the square shaped grass field. (ii) (a) Find the area of the total field in which these horses can graze. **OR** (b) If the length of the rope of each horse is increased from 7 m to 10 m, find the area grazed by one horse. (Use $\pi = 3.14$) (iii) What is area of the field that is left ungrazed, if the length of the rope of each horse is 7 cm ?	
Sol.	(i) Area of square shaped grass field = 400 m^2	1
	(ii) (a) area of total field that horses can graze = $4 \times \frac{1}{4} \times \frac{22}{7} \times 7 \times 7$	1
	= 154 m^2	1
	OR	
	(ii) (b) area grazed by one horse = $\frac{1}{4} \times 3.14 \times 10 \times 10$	1
	= 78.5 m^2	1
	(iii) Area of the field left ungrazed = area of square field - area of field in which horses can graze.	
	Area of field in which horses can graze = $4 \times \frac{1}{4} \times \frac{22}{7} \times 7 \times 7$	
	= 154 cm^2	½
	Area of the field left ungrazed = 400 – 0.0154 = 399.9846 m^2	½

38. Vocational training complements traditional education by providing practical skills and hands-on experience. While education equips individuals with a broad knowledge base, vocational training focuses on job-specific skills, enhancing employability thus making the student self-reliant. Keeping this in view, a teacher made the following table giving the frequency distribution of students/adults undergoing vocational training from the training institute.

Age (in years)	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54
Number of participants	62	132	96	37	13	11	10	4

From the above answer the following questions :

(i) What is the lower limit of the modal class of the above data ? **1**

(ii) (a) Find the median class of the above data. **2**

OR

(b) Find the number of participants of age less than 50 years who undergo vocational training. **2**

(iii) Give the empirical relationship between mean, median and mode. **1**

Sol.

(i) Modal class is 19.5 – 24.5

Lowe limit =19.5 1

(ii) (a)

Age (in years)	14.5-19.5	19.5-24.5	24.5-29.5	29.5-34.5	34.5-39.5	39.5-44.5	44.5-49.5	49.5-54.5
Number of participants	62	132	96	37	13	11	10	4
cf	62	194	290	327	340	351	361	365

Correct table 1

$\frac{n}{2} = \frac{365}{2} = 182.5$ ½

	median class = 19.5 – 24.5 OR (ii) (b) 62+132+96+37+13+11+10=361 (iii) 3median= mode + 2 mean	½ 2 1