Series **WX1YZ/6**

SET~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.

गणित (मानक) – सैद्धान्तिक

MATHEMATICS (Standard) – Theory

निर्धारित समय : **3** घण्टे

*Time allowed : **3** hours*

अधिकतम अंक : **80**

*Maximum Marks : **80***

नोट / NOTE :

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

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

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

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

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

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

(iv) **कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर–पुस्तिका में 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.

सामान्य निर्देश :

निम्नलिखित निर्देशों को बहुत सावधानी से पढ़िए और पालन कीजिए :

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

(ii) *प्रश्नपत्र **पाँच** खण्डों में विभाजित हैं – खण्ड **क, ख, ग, घ** तथा **ङ** ।*

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

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

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

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

(vii) *खण्ड – **ङ** में प्रश्न संख्या 36 से 38 प्रकरण अध्ययन/परिच्छेद आधारित **चार–चार** अंकों के प्रश्न हैं । आंतरिक विकल्प **दो–दो** अंकों के प्रश्न में दिया गया है ।*

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

(ix) *जहाँ आवश्यक हो स्वच्छ आकृतियाँ बनाएँ । यदि आवश्यक हो तो $\pi = \dfrac{22}{7}$ लें ।*

(x) *कैल्कुलेटर का उपयोग वर्जित है ।*

खण्ड – क

(बहुविकल्पीय प्रश्न)

खण्ड – क में 20 प्रश्न हैं और प्रत्येक प्रश्न का 1 अंक है ।

1. बिन्दुओं (0, 5) और (–3, 1) के बीच की दूरी है :

(A) 8 इकाई   (B) 5 इकाई

(C) 3 इकाई   (D) 25 इकाई

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** question 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** question number **21** to **25** are Very Short-Answer-I (SA-I) type questions of **2** marks each.*

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

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

(vii) *In Section–**E** question number **36** to **38** are Case Study / Passage based integrated units of assessment questions carrying **4** marks each. Internal choice is provided in **2** marks question 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** question in Section–**E**.*

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

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

SECTION – A
(Multiple Choice Questions)

Section – A consists of 20 questions of 1 mark each.

1. The distance between the points (0, 5) and (–3, 1) is :

    (A) 8 units   (B) 5 units

    (C) 3 units   (D) 25 units

2. यदि $\tan \theta = \dfrac{x}{y}$ है, तो $\cos \theta$ बराबर है :

(A) $\dfrac{x}{\sqrt{x^2 + y^2}}$

(B) $\dfrac{y}{\sqrt{x^2 + y^2}}$

(C) $\dfrac{x}{\sqrt{x^2 - y^2}}$

(D) $\dfrac{y}{\sqrt{x^2 - y^2}}$

3. बहुपद $3x^2 + 11x - 4$ के शून्यक हैं :

(A) $\dfrac{1}{3}, -4$

(B) $\dfrac{-1}{3}, 4$

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

(D) $\dfrac{-1}{3}, -4$

4. दो वृत्तों की परिधियों का अनुपात $4 : 5$ है । इनकी त्रिज्याओं का अनुपात क्या होगा ?

(A) $16 : 25$

(B) $25 : 16$

(C) $2 : \sqrt{5}$

(D) $4 : 5$

5. यदि किसी एक A.P. के पहले n पदों का योग $3n^2 + n$ और उसका सार्व अन्तर 6 हो, तो पहला पद होगा :

(A) 2

(B) 3

(C) 1

(D) 4

6. यदि द्विघात बहुपद $x^2 + (a + 1)\, x + b$ के शून्यक 2 और -3 हैं, तो

(A) $a = -7, b = -1$

(B) $a = 5, b = -1$

(C) $a = 2, b = -6$

(D) $a = 0, b = -6$

7. यदि $p^2 = \dfrac{32}{50}$ है, तो p है एक

(A) पूर्ण संख्या

(B) पूर्णांक

(C) परिमेय संख्या

(D) अपरिमेय संख्या

2. If $\tan \theta = \dfrac{x}{y}$, then $\cos \theta$ is equal to

(A) $\dfrac{x}{\sqrt{x^2 + y^2}}$

(B) $\dfrac{y}{\sqrt{x^2 + y^2}}$

(C) $\dfrac{x}{\sqrt{x^2 - y^2}}$

(D) $\dfrac{y}{\sqrt{x^2 - y^2}}$

3. The zeroes of the polynomial $3x^2 + 11x - 4$ are :

(A) $\dfrac{1}{3}, -4$

(B) $\dfrac{-1}{3}, 4$

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

(D) $\dfrac{-1}{3}, -4$

4. The circumferences of two circles are in the ratio 4 : 5. What is the ratio of their radii ?

(A) $16 : 25$

(B) $25 : 16$

(C) $2 : \sqrt{5}$

(D) $4 : 5$

5. If the sum of the first n terms of an A.P be $3n^2 + n$ and its common difference is 6, then its first term is

(A) 2

(B) 3

(C) 1

(D) 4

6. If the zeroes of the quadratic polynomial $x^2 + (a + 1)\, x + b$ are 2 and -3, then

(A) $a = -7, b = -1$

(B) $a = 5, b = -1$

(C) $a = 2, b = -6$

(D) $a = 0, b = -6$

7. If $p^2 = \dfrac{32}{50}$, then p is a/an

(A) whole number
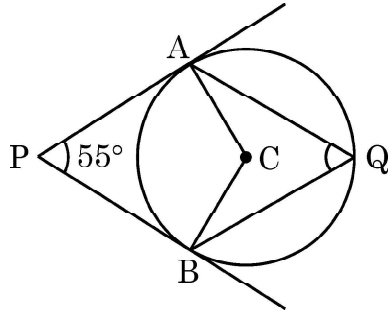
(B) integer

(C) rational number

(D) irrational number

8. यदि एक समकोण त्रिभुज में θ एक न्यून कोण हो, तो निम्न में कौन सा समीकरण सही **नहीं** है ?

(A) $\sin\theta \cot\theta = \cos\theta$

(B) $\cos\theta \tan\theta = \sin\theta$

(C) $\operatorname{cosec}^2\theta - \cot^2\theta = 1$

(D) $\tan^2\theta - \sec^2\theta = 1$

9. $3x - y = 3$ से निरूपित रेखा और y-अक्ष के प्रतिच्छेदन बिन्दु के निर्देशांक हैं :

(A) $(0, -3)$

(B) $(0, 3)$

(C) $(2, 0)$

(D) $(-2, 0)$

10. दी गई आकृति में, केंद्र C वाले वृत्त पर बाह्य बिंदु P से PA और PB स्पर्श रेखाएँ खींची गई हैं । वृत्त पर Q एक अन्य बिंदु है । ∠AQB का माप है :

(A) $62\frac{1}{2}°$

(B) $125°$

(C) $55°$

(D) $90°$

11. यदि बहुपद $x^2 - 1$ के शून्यक α और β हैं, तो $(α + β)$ का मान होगा :

(A) 2

(B) 1

(C) −1

(D) 0

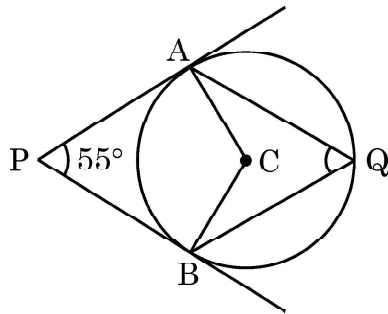12. यदि $\Delta PQR \sim \Delta ABC$, PQ = 6 cm, AB = 8 cm और ΔABC का परिमाप 36 cm हो, तो ΔPQR का परिमाप होगा :

(A) 20.25 cm

(B) 27 cm

(C) 48 cm

(D) 64 cm

8. If θ is an acute angle of a right angled triangle, then which of the following equation is **not** true ?

(A) $\sin θ \cot θ = \cos θ$

(B) $\cos θ \tan θ = \sin θ$

(C) $\csc^2 θ - \cot^2 θ = 1$

(D) $\tan^2 θ - \sec^2 θ = 1$

9. The point of intersection of the line represented by $3x - y = 3$ and the y-axis is given by

(A) (0, –3)

(B) (0, 3)

(C) (2, 0)

(D) (–2, 0)

10. In the given figure, PA and PB are tangents from external point P to a circle with centre C and Q is any point on the circle. Then the measure of ∠AQB is
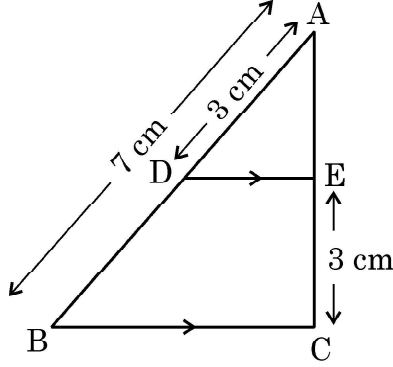

(A) 62½°

(B) 125°

(C) 55°

(D) 90°

11. If α and β are the zeroes of the polynomial $x^2 - 1$, then the value of (α + β) is

(A) 2

(B) 1

(C) –1

(D) 0

12. If ΔPQR ~ ΔABC; PQ = 6 cm, AB = 8 cm and the perimeter of ΔABC is 36 cm, then the perimeter of ΔPQR is

(A) 20.25 cm

(B) 27 cm

(C) 48 cm

(D) 64 cm

13. दी गई आकृति में, DE∥BC है । यदि AD = 3 cm, AB = 7 cm और EC = 3 cm है, तो AE की लंबाई होगी :
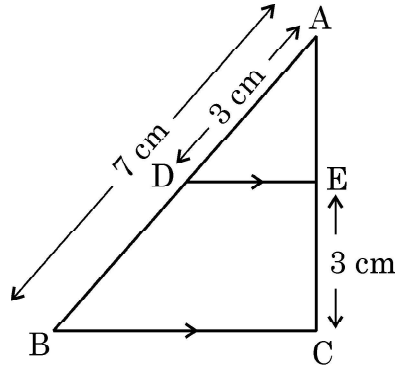

(A)   2 cm

(B)   2.25 cm

(C)   3.5 cm

(D)   4 cm

14. एक लंब–वृत्तीय शंकु का आयतन होगा, जिसके आधार का क्षेत्रफल 156 cm^2 तथा ऊर्ध्वाधर ऊँचाई 8 cm हैं,

(A)   2496 cm^3

(B)   1248 cm^3

(C)   1664 cm^3

(D)   416 cm^3

15. 52 ताश के पत्तों की अच्छी प्रकार से फेंटी गई गड्डी से एक पत्ता यादृच्छया निकाला जाता है । इस पत्ते का फेस (face) का पत्ता होने की प्रायिकता है

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

(B) $\dfrac{3}{13}$

(C) $\dfrac{4}{13}$

(D) $\dfrac{1}{13}$

16. यदि 'p' द्विघात समीकरण $x^2 - (p + q)\, x + k = 0$ का एक मूल है, तो 'k' का मान होगा :

(A)   p

(B)   q

(C)   p + q

(D)   pq

13. In the given figure, DE∥BC. If AD = 3 cm, AB = 7 cm and EC = 3 cm, then the length of AE is

   (A)   2 cm   (B)   2.25 cm

   (C)   3.5 cm   (D)   4 cm

14. The volume of a right circular cone whose area of the base is 156 cm^2 and the vertical height is 8 cm, is

   (A)   2496 cm^3 (B)   1248 cm^3

   (C)   1664 cm^3 (D)   416 cm^3

15. A card is drawn at random from a well shuffled deck of 52 playing cards. The probability of getting a face card is

   (A) $\dfrac{1}{2}$ (B) $\dfrac{3}{13}$

   (C) $\dfrac{4}{13}$ (D) $\dfrac{1}{13}$

16. If 'p' is a root of the quadratic equation $x^2 - (p + q)\,x + k = 0$, then the value of 'k' is

   (A)   p   (B)   q

   (C)   p + q   (D)   pq

17. संख्या 3 से 20 लिखे कार्डों को एक थैले में रखा जाता है और उन्हें अच्छी प्रकार मिला दिया जाता है । थैले से एक कार्ड यादृच्छया निकाला जाता है । निकाले गए कार्ड पर एक सम संख्या लिखी होने की प्रायिकता होगी :

(A) $\dfrac{9}{17}$ (B) $\dfrac{1}{2}$

(C) $\dfrac{5}{9}$ (D) $\dfrac{7}{18}$

18. रैखिक समीकरण : $ax + by = c$; $lx + my = n$ निकाय का एक अद्वितीय हल होने की शर्त है :

(A) $am \neq bl$ (B) $al \neq bm$

(C) $al = bm$ (D) $am = bl$

अभिकथन – तर्क आधारित प्रश्न : प्रश्न संख्या **19** तथा **20** प्रत्येक में एक अभिकथन (A) के पश्चात् एक तर्क (R) कथन दिया है । निम्न में से सही विकल्प चुनिए :

(A) (A) तथा (R) दोनों सत्य हैं तथा (R), कथन (A) की व्याख्या करता है ।

(B) (A) तथा (R) दोनों सत्य हैं, परन्तु (R) कथन (A) की व्याख्या नहीं करता ।

(C) (A) सत्य है, परन्तु (R) सत्य नहीं है ।

(D) (A) असत्य है, जबकि (R) सत्य है ।

19. **अभिकथन (A) :** $0 < \theta \leq 90°$ के लिए, $\operatorname{cosec} \theta - \cot \theta$ और $\operatorname{cosec} \theta + \cot \theta$ एक दूसरे के व्युत्क्रम हैं ।

तर्क (R) : $\operatorname{cosec}^2 \theta - \cot^2 \theta = 1$

20. **अभिकथन (A) :** यदि $5 + \sqrt{7}$, परिमेय गुणांक वाले द्विघात समीकरण का एक मूल है, तो इसका दूसरा मूल $5 - \sqrt{7}$ होगा ।

तर्क (R) : परिमेय गुणांकों वाले द्विघात समीकरण के करणी मूल संयुग्मी युग्मों में होते हैं ।

17. Cards bearing numbers 3 to 20 are placed in a bag and mixed thoroughly. A card is taken out of the bag at random. What is the probability that the number on the card taken out is an even number ?

(A) $\dfrac{9}{17}$ (B) $\dfrac{1}{2}$

(C) $\dfrac{5}{9}$ (D) $\dfrac{7}{18}$

18. The condition for the system of linear equations $ax + by = c$; $lx + my = n$ to have a unique solution is

(A) $am \neq bl$ (B) $al \neq bm$

(C) $al = bm$ (D) $am = bl$

Assertion – Reason Based Questions : In question numbers **19** and **20**, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option out of the following :

(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. **Statement A (Assertion) :** For $0 < \theta \leq 90°$, $\csc\theta - \cot\theta$ and $\csc\theta + \cot\theta$ are reciprocal of each other.

Statement R (Reason) : $\csc^2\theta - \cot^2\theta = 1$

20. **Statement A (Assertion) :** If $5 + \sqrt{7}$ is a root of a quadratic equation with rational co-efficients, then its other root is $5 - \sqrt{7}$.

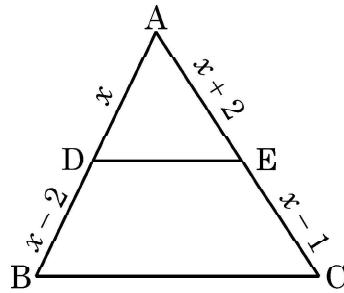**Statement R (Reason) :** Surd roots of a quadratic equation with rational co-efficients occur in conjugate pairs.

खण्ड – ख

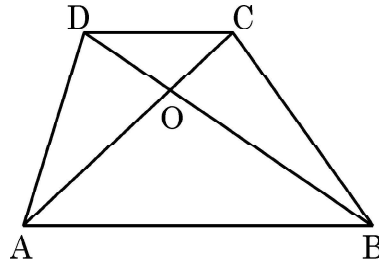इस खण्ड में अति लघु–उत्तरीय (VSA) प्रकार के प्रश्न हैं । प्रत्येक प्रश्न के **2** अंक हैं ।

21. वह अनुपात ज्ञात कीजिए जिसमें y-अक्ष, बिंदुओं $(5, -6)$ और $(-1, -4)$ को जोड़ने वाले रेखाखंड को काटता है ।

22. (A) दी गई आकृति में, ABC एक त्रिभुज है जिसमें DE∥BC । यदि AD $= x$, DB $= x - 2$, AE $= x + 2$ और EC $= x - 1$ है, तो x का मान ज्ञात कीजिए ।

अथवा

   (B) समलंब ABCD, जिसमें AB∥DC है, के विकर्ण AC और BD एक दूसरे को बिंदु O पर प्रतिच्छेद करते हैं । दर्शाइए कि $\dfrac{OA}{OC} = \dfrac{OB}{OD}$.

23. (A) दर्शाइए कि किसी भी प्राकृत संख्या 'n' के लिए, संख्या 6^n, अंक 0 पर समाप्त नहीं होती है ।

अथवा

   (B) 72 और 120 का LCM तथा HCF ज्ञात कीजिए ।

24. 18 m ऊँचाई वाले खंभे की भूमि पर छाया की लंबाई ज्ञात करें जब सूर्य का उन्नयन कोण θ ऐसा है कि $\tan θ = \dfrac{6}{7}$ है ।
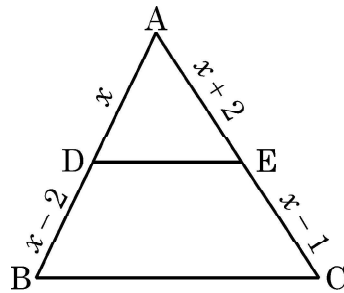
SECTION – B

Section – **B** consists of Very Short Answer (VSA) type of questions of **2** marks each.
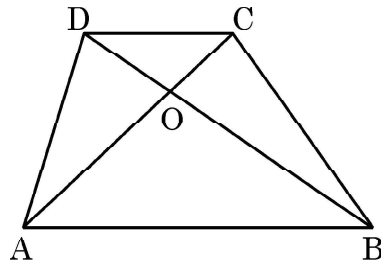
21. Find the ratio in which the y-axis divides the line segment joining the points $(5, -6)$ and $(-1, -4)$.

22. (A) In the given figure, ABC is a triangle in which DE‖BC. If AD = x, DB = $x - 2$, AE = $x + 2$ and EC = $x - 1$, then find the value of x.

OR

(B) Diagonals AC and BD of trapezium ABCD with AB‖DC intersect each other at point O. Show that $\dfrac{OA}{OC} = \dfrac{OB}{OD}$.

23. (A) Show that 6^n can not end with digit 0 for any natural number 'n'.
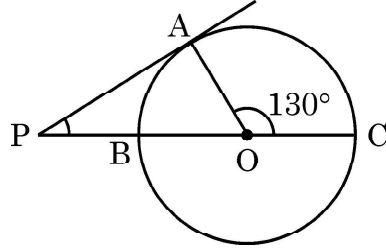
OR

(B) Find the LCM and HCF of 72 and 120

24. Find the length of the shadow on the ground of a pole of height 18 m when angle of elevation θ of the sun is such that $\tan\theta = \dfrac{6}{7}$.

25. दी गई आकृति में, PA बाहरी बिंदु P से खींचे गए वृत्त की स्पर्श रेखा है और BC व्यास के साथ वृत्त की छेदक रेखा PBC है । यदि $\angle AOC = 130°$ है, तो $\angle APB$ की माप ज्ञात कीजिए, जहाँ O वृत्त का केंद्र है ।


खण्ड – ग

इस खण्ड में लघु-उत्तरीय (SA) प्रकार के प्रश्न हैं । प्रत्येक प्रश्न के **3** अंक हैं :

26. सिद्ध कीजिए : $(\sin \theta + \cos \theta)(\tan \theta + \cot \theta) = \sec \theta + \operatorname{cosec} \theta$.

27. (A) एक प्राकृत संख्या को 12 से बढ़ाने पर संख्या अपने व्युत्क्रम से 160 गुना हो जाती है । संख्या ज्ञात कीजिए ।

अथवा

(B) यदि द्विघात समीकरण $x^2 + 12x - k = 0$ का एक मूल दूसरे मूल का तीन गुना हो, तो k का मान ज्ञात कीजिए ।

28. वह अनुपात ज्ञात कीजिए जिसमें बिंदुओं A(6, 3) और B(–2, –5) को मिलाने वाला रेखाखंड, x-अक्ष से विभाजित होता है ।

29. 21 cm त्रिज्या के एक वृत्त की एक चाप, केंद्र पर 60° का कोण अंतरित करती है । चाप द्वारा बनाए गए त्रिज्य खण्ड का क्षेत्रफल ज्ञात कीजिए । इस चाप की लंबाई भी ज्ञात कीजिए ।

30. दी गई आकृति में, AB = AC वाले, एक समद्विबाहु त्रिभुज ABC की बढ़ाई गई भुजा CB पर स्थित E एक बिंदु है । यदि AD $\perp$ BC और EF $\perp$ AC है, तो सिद्ध कीजिए कि $\triangle ABD \sim \triangle ECF$ है ।
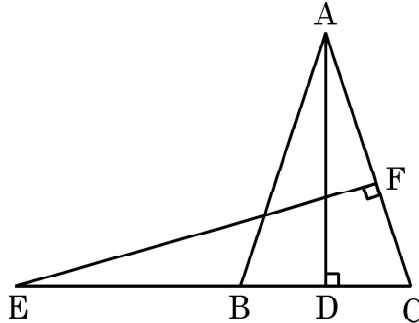
25. In the given figure, PA is a tangent to the circle drawn from the external point P and PBC is the secant to the circle with BC as diameter. If ∠AOC = 130°, then find the measure of ∠APB, where O is the centre of the circle.
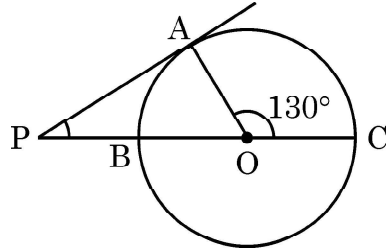
SECTION – C

Section – **C** consists of Short Answer (SA) type of questions of **3** marks each.

26. Prove that $(\sin \theta + \cos \theta)(\tan \theta + \cot \theta) = \sec \theta + \operatorname{cosec} \theta$.

27. (A) A natural number, when increased by 12, equals 160 times its reciprocal. Find the number.

OR

(B) If one root of the quadratic equation $x^2 + 12x - k = 0$ is thrice the other root, then find the value of k.

28. Find the ratio in which the line segment joining the points A(6, 3) and B(–2, –5) is divided by x-axis.

29. In a circle of radius 21 cm, an arc subtends an angle of 60° at the centre. Find the area of the sector formed by the arc. Also, find the length of the arc.

30. In the given figure, E is a point on the side CB produced of an isosceles triangle ABC with AB = AC. If AD ⊥ BC and EF ⊥ AC, then prove that ∆ABD ~ ∆ECF.
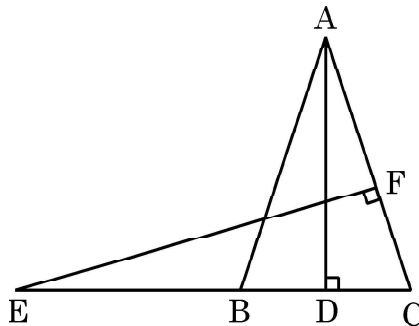
31. (A) अभाज्य गुणनखंड विधि का प्रयोग करके, 26, 65 और 117 का HCF और LCM ज्ञात कीजिए ।

अथवा

(B) सिद्ध कीजिए कि $\sqrt{2}$ एक अपरिमेय संख्या है ।

खण्ड – घ

इस खण्ड में दीर्घ–उत्तरीय (LA) प्रकार के प्रश्न हैं । प्रत्येक प्रश्न के **5** अंक हैं ।

32. (A) एक A.P. के प्रथम सात पदों का योग 182 है । यदि इस A.P. का चौथा पद का 17वें पद से अनुपात 1 : 5 हो तो A.P. ज्ञात कीजिए ।
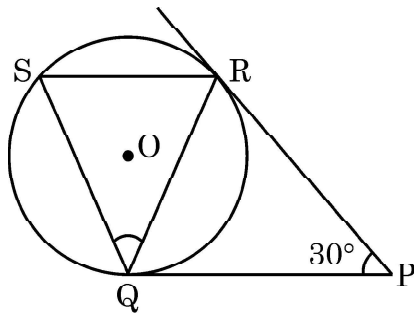
अथवा

(B) एक A.P. के प्रथम q पदों का योग $63q - 3q^2$ है । यदि इस A.P. का pवाँ पद – 60 हो, तो p का मान ज्ञात कीजिए । इस A.P. का 11वाँ पद भी ज्ञात कीजिए ।

33. (A) सिद्ध कीजिए कि किसी वृत के परिगत समांतर चतुर्भुज समचतुर्भुज होता है ।

अथवा

(B)

दी गई आकृति में, एक वृत्त पर दो स्पर्श रेखा PQ और PR इस प्रकार डली हैं कि $\angle RPQ = 30°$ है । स्पर्श रेखा PQ के समांतर, एक जीवा RS खींची गई है । $\angle RQS$ का माप ज्ञात कीजिए ।

31. (A) Find the HCF and LCM of 26, 65 and 117, using prime factorisation.

OR

(B) Prove that $\sqrt{2}$ is an irrational number.

SECTION – D

Section – D consists of Long Answer (LA) type questions of **5** marks each.
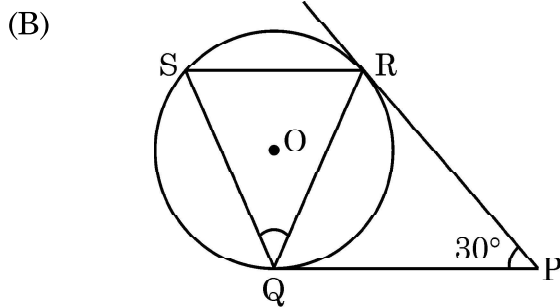
32. (A) The sum of first seven terms of an A.P. is 182. If its 4th term and the 17th term are in the ratio 1 : 5, find the A.P.

OR

(B) The sum of first q terms of an A.P. is $63q - 3q^2$. If its pth term is –60, find the value of p. Also, find the 11th term of this A.P.

33. (A) Prove that a parallelogram circumscribing a circle is a rhombus.

OR

(B)

In the given figure, tangents PQ and PR are drawn to a circle such that $\angle RPQ = 30°$. A chord RS is drawn parallel to the tangent PQ. Find the measure of $\angle RQS$.

34. एक बॉक्स में रखे 250 सेबों को तोला गया । इन सेबों के भारों का बंटन नीचे दी गई तालिका में दिया गया है :

भार (ग्रा. में)	80 – 100	100 – 120	120 – 140	140 – 160	160 – 180
सेबों की संख्या	20	60	70	x	60

    (i) x का मान ज्ञात कीजिए और सेबों के भारों का माध्य ज्ञात कीजिए ।   **3**

    (ii)   सेबों का बहुलक भार भी ज्ञात कीजिए ।   **2**

35. एक ठोस, एक लंब–वृत्तीय शंकु के आकार है, जो उसी त्रिज्या वाले एक अर्धगोले पर अध्यारोपित है । प्रत्येक की त्रिज्या 7 cm और शंकु की ऊँचाई, इसके व्यास के बराबर है । ठोस का आयतन ज्ञात कीजिए ।
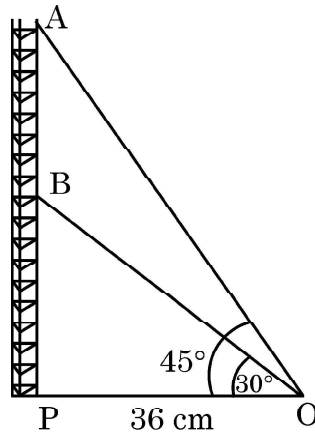
खण्ड – ङ

इस खण्ड में **3** स्रोत/प्रकरण इकाई आधारित प्रश्न हैं । प्रत्येक प्रश्न के **4** अंक हैं ।

36. रेडियो टॉवरों का उपयोग रेडियो और टेलीविज़न सहित संचार सेवाओं की एक शृंखला को प्रसारित करने के लिए किया जाता है । टॉवर या तो स्वयं एंटीना के रूप में कार्य करेगा या इसकी संरचना पर एक या अधिक एंटेना का समर्थन करेगा ।

इसी तरह की अवधारणा पर, दो खंडों A और B में एक रेडियो स्टेशन टॉवर बनाया गया था । टॉवर एक बिंदु O से तारों द्वारा समर्थित है ।

टॉवर के पाद और बिंदु O के बीच की दूरी 36 cm है । बिंदु O से खंड B के शिखर का उन्नयन कोण 30° तथा खंड A के शिखर का उन्नयन कोण 45° है ।

34. 250 apples of a box were weighed and the distribution of masses of the apples is given in the following table :

| Mass (in grams)	80 – 100	100 – 120	120 – 140	140 – 160	160 – 180
Number of apples	20	60	70	x	60

   (i)   Find the value of x and the mean mass of the apples.   **3**

   (ii)   Find the modal mass of the apples   **2**

35. A solid is in the shape of a right-circular cone surmounted on a hemisphere, the radius of each of them being 7 cm and the height of the cone is equal to its diameter. Find the volume of the solid.

SECTION – E

3 Case Study Based Questions. Each question is of **4** marks.

36. Radio towers are used for transmitting a range of communication services including radio and television. The tower will either act as an antenna itself or support one or more antennas on its structure. On a similar concept, a radio station tower was built in two Sections A and B. Tower is supported by wires from a point O.

Distance between the base of the tower and point O is 36 cm. From point O, the angle of elevation of the top of the Section B is 30° and the angle of elevation of the top of Section A is 45°.
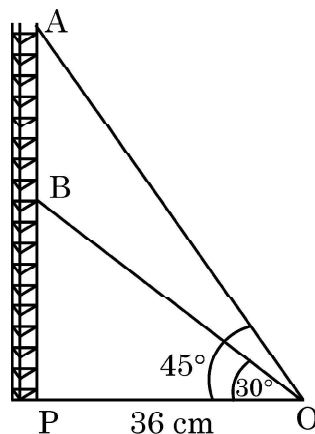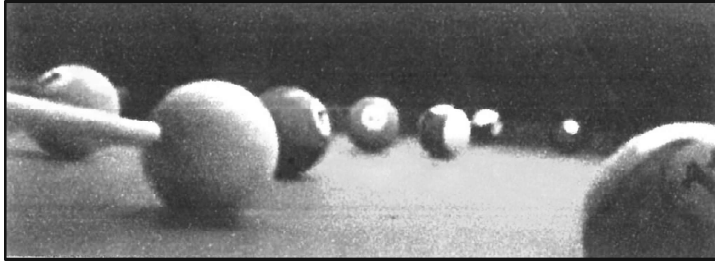
उपरोक्त सूचना के आधार पर, निम्न प्रश्नों के उत्तर दीजिए :

(i) बिंदु O से खंड B के शिखर तक लगी तार की लम्बाई ज्ञात कीजिए । **1**

(ii) AB की दूरी ज्ञात कीजिए । **2**

अथवा

ΔOPB का क्षेत्रफल ज्ञात कीजिए ।

(iii) टॉवर के पाद से खंड A की ऊँचाई ज्ञात कीजिए । **1**

37. "आठ गेंद" एक पूल टेबल पर खेला जाने वाला खेल है, जिसमें संख्या 1 से 15 तक लिखी 15 गेंदें और एक "क्यू गेंद" होती है, जो ठोस सफेद होती है । संख्या 1 से 15 तक लिखी 15 गेंदों में से, 8 ठोस (गैर–सफेद) रंग की हैं जिन पर संख्या 1 से 8 लिखी है और 7 धारीदार गेंदें हैं, जिन पर संख्या 9 से 15 लिखी है ।

संख्या 1 से 15 लिखी पूल बॉलों (नो क्यू बॉल) को एक बड़े कटोरे में डालकर मिला दिया जाता है, और बाद में एक गेंद यादृच्छया निकाली जाती है ।

उपरोक्त सूचना पर आधारित होकर, निम्न प्रश्नों के उत्तर दीजिए :

(i) संख्या 8 लिखी गेंद होने की प्रायिकता क्या है ?

(ii) निकाली गई गेंद पर एक सम संख्या लिखी होने की प्रायिकता क्या है ?

अथवा

निकाली गई गेंद पर '3 का गुणन' संख्या लिखी होने की प्रायिकता क्या है ?

(iii) निकाली गई गेंद एक ठोस रंगीन और सम संख्या लिखी होने की प्रायिकता क्या है ?

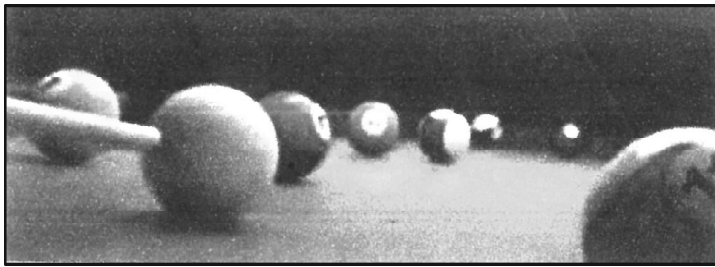Based on the above information, answer the following questions :

(i) Find the length of the wire from the point O to the top of Section B. **1**

(ii) Find the distance AB. **2**

OR

Find the area of ΔOPB.

(iii) Find the height of the Section A from the base of the tower. **1**

37. "Eight Ball" is a game played on a pool table with 15 balls numbered 1 to 15 and a "cue ball" that is solid and white. Of the 15 numbered balls, eight are solid (non-white) coloured and numbered 1 to 8 and seven are striped balls numbered 9 to 15.

The 15 numbered pool balls (no cue ball) are placed in a large bowl and mixed, then one ball is drawn out at random.

Based on the above information, answer the following questions :

(i) What is the probability that the drawn ball bears number 8 ?

(ii) What is the probability that the drawn ball bears an even number ?

OR

What is the probability that the drawn ball bears a number, which is a multiple of 3 ?

(iii) What is the probability that the drawn ball is a solid coloured and bears an even number ?

38. गणित का एक कोचिंग संस्थान दो बैचों I और II में कक्षाएँ संचालित करता है और अमीर और गरीब बच्चों की फीस अलग-अलग होती है । बैच I में 20 गरीब और 5 अमीर बच्चे हैं, जबकि बैच II में 5 गरीब और 25 अमीर बच्चे हैं । बैच I से फीस का कुल मासिक संग्रह ₹ 9000 है और बैच II से ₹ 26,000 है । मान लीजिए कि प्रत्येक गरीब बच्चा ₹ x प्रति माह का भुगतान करता है और प्रत्येक अमीर बच्चा ₹ y प्रति माह का भुगतान करता है ।
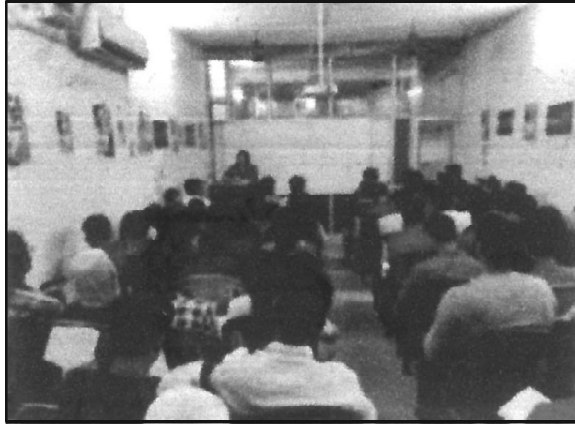
उपरोक्त सूचना के आधार पर, निम्न प्रश्नों के उत्तर दीजिए :

(i) उपरोक्त सूचना को x और y में व्यक्त कीजिए । 1

(ii) प्रत्येक गरीब बच्चे द्वारा प्रति माह भुगतान करने वाली फीस ज्ञात कीजिए । 2

अथवा

एक गरीब और एक अमीर बच्चे की प्रति माह की फीस का अन्तर ज्ञात कीजिए ।

(iii) यदि बैच II में, 10 गरीब और 20 अमीर बच्चे हों, तो इस बैच से प्रति माह कितनी फीस राशि प्राप्त होगी ? 1

———————

38. A coaching institute of Mathematics conducts classes in two batches I and II and fees for rich and poor children are different. In batch I, there are 20 poor and 5 rich children, whereas in batch II, there are 5 poor and 25 rich children. The total monthly collection of fees from batch I is ₹ 9000 and from batch II is ₹ 26,000. Assume that each poor child pays ₹ x per month and each rich child pays ₹ y per month.

Based on the above information, answer the following questions :

(i) Represent the information given above in terms of x and y. **1**

(ii) Find the monthly fee paid by a poor child. **2**

OR

Find the difference in the monthly fee paid by a poor child and a rich child.

(iii) If there are 10 poor and 20 rich children in batch II, what is the total monthly collection of fees from batch II ? **1**

	Marking Scheme **Strictly Confidential** **(For Internal and Restricted use only)** **Secondary School Examination, 2023** **MATHEMATICS PAPER CODE 30/6/3**

General Instructions: -

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

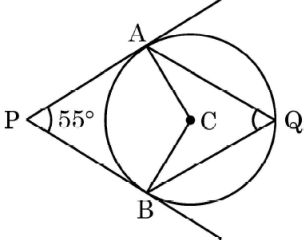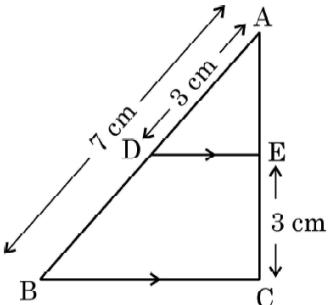| 9	**In Q1-Q20, if a candidate attempts the question more than once (without canceling the previous attempt), marks shall be awarded for the first attempt only and the other answer scored out with a note "Extra Question".**
10	**In Q21-Q38, if a student has attempted an extra question, answer of the 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 totaling of marks awarded on an answer. ● Wrong transfer of marks from the inside pages of the answer book to the title page. ● Wrong question wise totaling on the title page. ● Wrong totaling of marks of the two columns on the title page. ● Wrong grand total. ● Marks in words and figures not tallying/not same. ● Wrong transfer of marks from the answer book to online award list. ● Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.) ● Half or a part of answer marked correct and the rest as wrong, but no marks awarded.
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 totaled 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.

2

Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Marks
	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	
1.	The distance between the points (0, 5) and (–3, 1) is : (A) 8 units (B) 5 units (C) 3 units (D) 25 units	
Sol.	(B) 5 units	1
2.	If $\tan \theta = \dfrac{x}{y}$, then $\cos \theta$ is equal to (A) $\dfrac{x}{\sqrt{x^2 + y^2}}$ (B) $\dfrac{y}{\sqrt{x^2 + y^2}}$ (C) $\dfrac{x}{\sqrt{x^2 - y^2}}$ (D) $\dfrac{y}{\sqrt{x^2 - y^2}}$	
Sol.	(B) $\dfrac{y}{\sqrt{x^2 + y^2}}$	1
3.	The zeroes of the polynomial $3x^2 + 11x - 4$ are : (A) $\dfrac{1}{3}, -4$ (B) $\dfrac{-1}{3}, 4$ (C) $\dfrac{1}{3}, 4$ (D) $\dfrac{-1}{3}, -4$	
Sol.	(A) $\dfrac{1}{3}, -4$	1
4.	The circumferences of two circles are in the ratio 4 : 5. What is the ratio of their radii ? (A) 16 : 25 (B) 25 : 16 (C) $2 : \sqrt{5}$ (D) 4 : 5	
Sol.	(D) 4 : 5	1

3

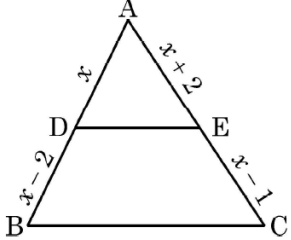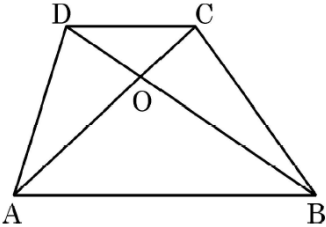|		
5.	If the sum of the first n terms of an A.P be $3n^2 + n$ and its common difference is 6, then its first term is (A) 2 (B) 3 (C) 1 (D) 4	
Sol.	(D) 4	1
6.	If the zeroes of the quadratic polynomial $x^2 + (a + 1) x + b$ are 2 and –3, then (A) a = –7, b = –1 (B) a = 5, b = –1 (C) a = 2, b = – 6 (D) a = 0, b = – 6	
Sol.	(D) a = 0, b = – 6	1
7.	If $p^2 = \dfrac{32}{50}$, then p is a/an (A) whole number (B) integer (C) rational number (D) irrational number	
Sol.	(C) rational	1
8.	If θ is an acute angle of a right angled triangle, then which of the following equation is **not** true ? (A) $\sin θ \cot θ = \cos θ$ (B) $\cos θ \tan θ = \sin θ$ (C) $\csc^2 θ - \cot^2 θ = 1$ (D) $\tan^2 θ - \sec^2 θ = 1$	
Sol.	(D) $\tan^2 - \sec^2 θ = 1$	1
9.	The point of intersection of the line represented by $3x - y = 3$ and the y-axis is given by (A) (0, –3) (B) (0, 3) (C) (2, 0) (D) (–2, 0)	
Sol.	(A) (0, – 3)	1

10.	In the given figure, PA and PB are tangents from external point P to a circle with centre C and Q is any point on the circle. Then the measure of ∠AQB is (A) 62½° (B) 125° (C) 55° (D) 90°	
Sol.	(A) $62\frac{1}{2}^{\circ}$	1
11.	If α and β are the zeroes of the polynomial $x^2 - 1$, then the value of $(\alpha + \beta)$ is (A) 2 (B) 1 (C) −1 (D) 0	
Sol.	(D) 0	1
12.	If $\Delta PQR \sim \Delta ABC$; PQ = 6 cm, AB = 8 cm and the perimeter of ΔABC is 36 cm, then the perimeter of ΔPQR is (A) 20.25 cm (B) 27 cm (C) 48 cm (D) 64 cm	
Sol.	(B) 27 cm	1
13.	In the given figure, DE∥BC. If AD = 3 cm, AB = 7 cm and EC = 3 cm, then the length of AE is (A) 2 cm (B) 2.25 cm (C) 3.5 cm (D) 4 cm	
Sol.	(B) 2·25 cm	1

5

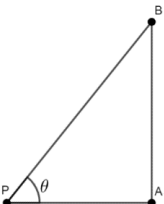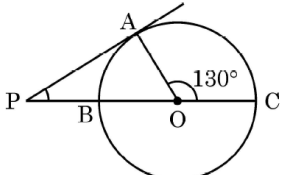| 14.	The volume of a right circular cone whose area of the base is 156 cm² and the vertical height is 8 cm, is (A) 2496 cm³ (B) 1248 cm³ (C) 1664 cm³ (D) 416 cm³	
Sol.	(D) 416 cm³	1
15.	A card is drawn at random from a well shuffled deck of 52 playing cards. The probability of getting a face card is (A) $\frac{1}{2}$ (B) $\frac{3}{13}$ (C) $\frac{4}{13}$ (D) $\frac{1}{13}$	
Sol.	(B) $\frac{3}{13}$	1
16.	If 'p' is a root of the quadratic equation $x^2 - (p + q)\, x + k = 0$, then the value of 'k' is (A) p (B) q (C) p + q (D) pq	
Sol.	(D) pq	1
17.	Cards bearing numbers 3 to 20 are placed in a bag and mixed thoroughly. A card is taken out of the bag at random. What is the probability that the number on the card taken out is an even number ? (A) $\frac{9}{17}$ (B) $\frac{1}{2}$ (C) $\frac{5}{9}$ (D) $\frac{7}{18}$	
Sol.	(B) $\frac{1}{2}$	1
18.	The condition for the system of linear equations $ax + by = c$; $lx + my = n$ to have a unique solution is (A) am ≠ bl (B) al ≠ bm (C) al = bm (D) am = bl	
Sol.	(A) am ≠ bl	1

	Assertion – Reason Based Questions : In question numbers **19** and **20**, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option out of the following : (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.	**Statement A (Assertion) :** For $0 < \theta \leq 90°$, $\operatorname{cosec} \theta - \cot \theta$ and $\operatorname{cosec} \theta + \cot \theta$ are reciprocal of each other. **Statement R (Reason) :** $\operatorname{cosec}^2 \theta - \cot^2 \theta = 1$	
Sol.	(A)	1
20.	**Statement A (Assertion) :** If $5 + \sqrt{7}$ is a root of a quadratic equation with rational co-efficients, then its other root is $5 - \sqrt{7}$. **Statement R (Reason) :** Surd roots of a quadratic equation with rational co-efficients occur in conjugate pairs.	
Sol.	(A)	1
	SECTION – B Section – **B** consists of Very Short Answer (VSA) type of questions of **2** marks each.	
21.	Find the ratio in which the y-axis divides the line segment joining the points $(5, -6)$ and $(-1, -4)$.	
Sol.	 Let $P(0, y)$ be the point on y axis which divides AB in the ratio $k : 1$ $$\frac{-k + 5}{k + 1} = 0 \implies k = 5$$	$\frac{1}{2}$ 1

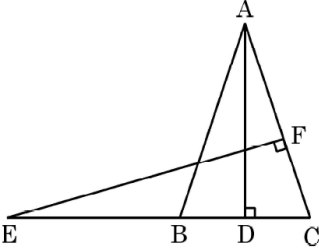|		Ratio is 5 : 1	$\frac{1}{2}$
22(A).		In the given figure, ABC is a triangle in which DE∥BC. If AD = x, DB = $x - 2$, AE = $x + 2$ and EC = $x - 1$, then find the value of x.	
Sol.		In Δ ABC, DE ∥ BC $$\frac{AD}{DB} = \frac{AE}{EC} \Rightarrow \frac{x}{x-2} = \frac{x+2}{x-1}$$ $$x(x-1) = (x+2)(x-2)$$ $$x^2 - x = x^2 - 4 \Rightarrow x = 4$$	1 1
		OR	
22(B).		Diagonals AC and BD of trapezium ABCD with AB∥DC intersect each other at point O. Show that $\dfrac{OA}{OC} = \dfrac{OB}{OD}$.	
Sol.		In Δ AOB and Δ COD, ∠ OAB = ∠ OCD ∠ OBA = ∠ ODC Therefore, Δ AOB ~ Δ COD ∴ $\frac{OA}{OC} = \frac{OB}{OD}$	$1\frac{1}{2}$ $\frac{1}{2}$

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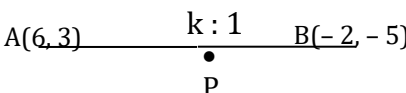
23(A).	Show that 6^n can not end with digit 0 for any natural number 'n'.	
Sol.	If 6^n ends with digit 0, it would be divisible by 5. So, prime factorization of 6^n would contain 5. But $6^n = (2 \times 3)^n$, the only prime factorization of 6^n are 2 and 3 as per fundamental theorem of Arithmetic . There is no other prime in the factorization of 6^n. So, there is no natural number n for which 6^n ends with digit zero.	2
	OR	
23(B).	Find the LCM and HCF of 72 and 120	
Sol.	$72 = 2^3 \times 3^2$ $120 = 2^3 \times 3 \times 5$ HCF = 24 LCM = 360	1 1
24.	Find the length of the shadow on the ground of a pole of height 18 m when angle of elevation θ of the sun is such that $\tan \theta = \frac{6}{7}$.	
Sol.	Pole of height AB = 18 m AP = length of shadow In $\triangle$ APB, $\tan \theta = \frac{18}{AP}$ $\frac{6}{7} = \frac{18}{AP}$ $\Rightarrow$ AP = 21 m	1 $\frac{1}{2}$ $\frac{1}{2}$
25.	In the given figure, PA is a tangent to the circle drawn from the external point P and PBC is the secant to the circle with BC as diameter. If $\angle AOC = 130°$, then find the measure of $\angle APB$, where O is the centre of the circle. 	

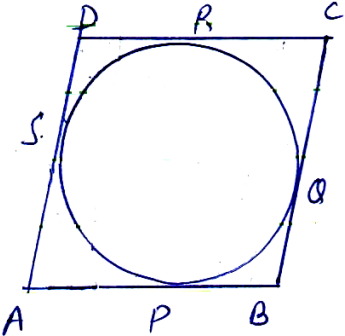| Sol.	$\angle$ AOB $= 180° - 30° = 50°$	$\dfrac{1}{2}$
	$\angle$ OAP $= 90°$	$\dfrac{1}{2}$
	$\therefore \angle$ APB $= 180 - (50° + 90°) = 40°$	1
	SECTION C This section comprises of Short Answer (SA) type questions of 3 marks each.	
26.	Prove that $(\sin \theta + \cos \theta)(\tan \theta + \cot \theta) = \sec \theta + \operatorname{cosec} \theta$.	
Sol.	LHS $= (\sin \theta + \cos \theta)\left(\dfrac{sin\ \theta}{\cos \theta} + \dfrac{\cos \theta}{\sin \theta}\right)$	1
	$= (\sin \theta + \cos \theta)\left(\dfrac{sin^2\ \theta + \cos^2 \theta}{\cos \theta \sin \theta}\right)$	1
	$= \dfrac{(sin\ \theta + \cos \theta)\ .(1)}{cos\ \theta \sin \theta}$	$\dfrac{1}{2}$
	$= \sec \theta + \operatorname{cosec} \theta = $ RHS	$\dfrac{1}{2}$
27(A).	A natural number, when increased by 12, equals 160 times its reciprocal. Find the number.	
Sol.	Let the natural number be x	
	ATQ, $x + 12 = \dfrac{160}{x}$	1
	$x^2 + 12x = 160$	
	$x^2 + 12x - 160 = 0$	1
	$(x + 20)(x - 8) = 0$	
	$x \neq -20,\ x = 8$	1

10

	⇒ Required natural number is 8	
	OR	
27(B).	If one root of the quadratic equation $x^2 + 12x - k = 0$ is thrice the other root, then find the value of k.	
Sol.	$x^2 + 12x - k = 0$ Let the roots be α, 3α $α + 3α = -12 \Rightarrow α = -3$ $α \cdot 3α = -k \Rightarrow 3α^2 = -k$ $\Rightarrow k = -27$	$\frac{1}{2}$ 1 1 $\frac{1}{2}$
28.	Find the ratio in which the line segment joining the points A(6, 3) and B(−2, −5) is divided by x-axis.	
Sol.	Let P(x, 0) be the point on x axis which divides AB in the ratio k : 1 $\frac{-5k+3}{k+1} = 0 \Rightarrow k = \frac{3}{5}$ A(6, 3) —— k : 1 —— B(− 2, − 5) • P Ratio is 3 : 5	$\frac{1}{2}$ 2 $\frac{1}{2}$
29.	In a circle of radius 21 cm, an arc subtends an angle of 60° at the centre. Find the area of the sector formed by the arc. Also, find the length of the arc.	
Sol.	$A = \frac{60}{360} \times \frac{22}{7} \times 21 \times 21 = 231$ cm² Length of arc $= \frac{60}{360} \times 2 \times \frac{22}{7} \times 21$ $= 22$ cm	$1\frac{1}{2}$ $1\frac{1}{2}$

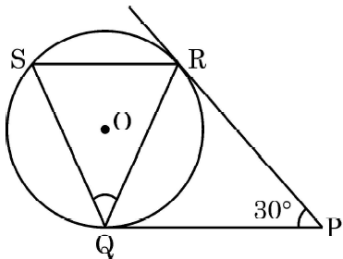| 30.	In the given figure, E is a point on the side CB produced of an isosceles triangle ABC with AB = AC. If AD ⊥ BC and EF ⊥ AC, then prove that ∆ABD ~ ∆ECF.	
Sol.	Given ABC is an isosceles triangle, $\therefore AB = AC \Rightarrow \angle B = \angle C$ In ∆ ABD and ∆ ECF, ∠ ADB = ∠ EFC (90° each, given) ∠ ABD = ∠ ECF $\therefore$ ∆ ABD ~ ∆ ECF	1 1 1
31(A).	Find the HCF and LCM of 26, 65 and 117, using prime factorisation.	
Sol.	26 = 13 x 2 65 = 13 x 5 117 = 13 x 3 x 3 $\therefore$ HCF = 13 LCM = 13 x 2 x 3 x 5 x 3 = 1170	1 1 1
	OR	
31(B).	Prove that $\sqrt{2}$ is an irrational number.	
Sol.	Let $\sqrt{2}$ be a rational number. $\therefore \sqrt{2} = \frac{p}{q}$, where q≠0 and let p & q be co-primes. $2q^2 = p^2 \Rightarrow p^2$ is divisible by 2 $\Rightarrow$ p is divisible by 2 $\Rightarrow$ p = 2a, where 'a' is some integer ----- (i) $4a^2 = 2q^2 \Rightarrow q^2 = 2a^2 \Rightarrow q^2$ is divisible by 2 $\Rightarrow$ q is divisible by 2 $\Rightarrow$ q = 2b, where 'b' is some integer ----- (ii) (i) and (ii) leads to contradiction as 'p' and 'q' are co-primes. $\therefore \sqrt{2}$ is an irrational number.	½ 1 ½ 1
	SECTION D	

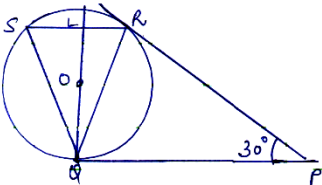|	This section comprises of Long Answer (LA) type questions of 5 marks each.	
32(A).	The sum of first seven terms of an A.P. is 182. If its 4th term and the 17th term are in the ratio 1 : 5, find the A.P.	
Sol.	Let a be the first term and d be the common difference.	
	$$S_7 = 182 \Rightarrow \frac{7}{2}(2a + 6d) = 182$$	1
	$$\Rightarrow 2a + 6d = \frac{182 \times 2}{7} = 52$$	
	a + 3d = 26 -------- (i)	1
	$$\frac{a_4}{a_{17}} = \frac{1}{5} \Rightarrow \frac{a + 3d}{a + 16d} = \frac{1}{5} \Rightarrow 5a + 15d = a + 16d$$	1
	4a = d --------(ii)	$\frac{1}{2}$
	Solving (i) and (ii)	
	a = 2 and d=8	$\frac{1}{2}+\frac{1}{2}$
	∴ AP is 2, 10, 18, 26, ….	$\frac{1}{2}$
	OR	
32(B).	The sum of first q terms of an A.P. is $63q - 3q^2$. If its pth term is −60, find the value of p. Also, find the 11th term of this A.P.	
Sol.	$S_q = 63q - 3q^2$	

	$\therefore S_1 = 60 \Rightarrow a_1 = 60$ (1st term)	1
	$S_2 = 63(2) - 3(2)^2 = 126 - 12 = 114$	
	$a_1 + a_2 = 114 \Rightarrow a_2 = 114 - 60 = 54$	1
	$d = a_2 - a_1 = 54 - 60 = -6$	1
	$a_p = -60$	
	$60 + (p - 1)d = -60$	
	$(p - 1)(-6) = -120 \Rightarrow p = 21$	1
	$a_{11} = a + 10d = 60 + 10(-6) = 0$	1
33(A).	Prove that a parallelogram circumscribing a circle is a rhombus.	
Sol.	ABCD is a parallelogram touching the circle at P, Q, R, S by sides AB, BC, CD, DA respectively. We know that tangents drawn from the external point to a circle are equal. $\therefore AP = AS$ --------(i)	1 for correct figure

14

	PB = BQ --------(ii) CR = CQ --------(iii) DR = DS ---------(iv)	2
	Adding (i), (ii), (iii), (iv) (AP + PB) + (CR + DR) = (AS + DS) + (BQ + CQ) AB + CD = AD + BC ABCD is a parallelogram $\Rightarrow$ AB = CD, AD = BC $\Rightarrow$ 2AB = 2AD $\Rightarrow$ AB = AD $\Rightarrow$ ABCD is a rhombus.	1 $\frac{1}{2}$ $\frac{1}{2}$

<div align="center">OR</div>

33(B)	(B) In the given figure, tangents PQ and PR are drawn to a circle such that $\angle RPQ = 30°$. A chord RS is drawn parallel to the tangent PQ. Find the measure of $\angle RQS$.	

Sol.	PQ = PR (tangents drawn from an external point to the circle)	
	$\therefore \angle PQR = \angle PRQ$	1
	In $\triangle$ PQR, $\angle$ PQR $= \angle$ PRQ $= \frac{1}{2}(180° - 30°) = 75°$	
	Draw a perpendicular QL from Q to QP	1
	Now, $\angle$ PQL $= 90°$	
	$\therefore \angle$ RQL $= 90° - 75° = 15°$	1
	$\triangle$RQL $\cong \triangle$ SQL (SAS)	1
	$\therefore \angle$ RQL $= \angle$ SQL $= 15°$	
	$\therefore \angle$ RQS $= 15° + 15° = 30°$	1

34.	250 apples of a box were weighed and the distribution of masses of the apples is given in the following table :	

Mass (in grams)	80 – 100	100 – 120	120 – 140	140 – 160	160 – 180
Number of apples	20	60	70	x	60

(i) Find the value of x and the mean mass of the apples.　　　　**3**

(ii) Find the modal mass of the apples　　　　**2**

Sol.	(i) $20 + 60 + 70 + x + 60 = 250$	
	$x = 250 - 210 = 40$	1

Mass	80 – 100	100 – 120	120 – 140	140 – 160	160 – 180	Total
No. of apples f_i	20	60	70	x = 40	60	250
x_i	90	110	130	150	170	
$x_i f_i$	1800	6600	9100	6000	10200	33700

1 for correct table

Mean mass $= \frac{33700}{250} = 134 \cdot 8$　　　　1

16

	Mean mass $= 134.8$ g	
	(ii) Modal class $= 120\text{-}140$	$\frac{1}{2}$
	$\text{Mode} = 120 + \frac{(70 - 60)}{(140 - 60 - 40)} \times 20$	1
	$= 125$	$\frac{1}{2}$
	Hence modal mass $= 125$ g	
35.	A solid is in the shape of a right-circular cone surmounted on a hemisphere, the radius of each of them being 7 cm and the height of the cone is equal to its diameter. Find the volume of the solid.	
Sol.	Radius of cone $=$ radius of hemisphere $= 7$ cm	
	$\therefore$ Height of cone $= 14$ cm	1
	Volume of solid $=$ Volume of hemisphere $+$ volume of cone	
	$= \frac{2}{3}\pi(7)^3 + \frac{1}{3}\pi(7)^2 14$	$1\frac{1}{2} + 1\frac{1}{2}$
	$= \frac{1}{3} \times \frac{22}{7} \times 7 \times 7(14 + 14)$	
	$= \frac{154}{3} \times 28 = \frac{4312}{3}\ cm^2$ or $1437.33\ cm^2$	1
	SECTION E This section comprises of 3 case-study based questions of 4 marks each.	

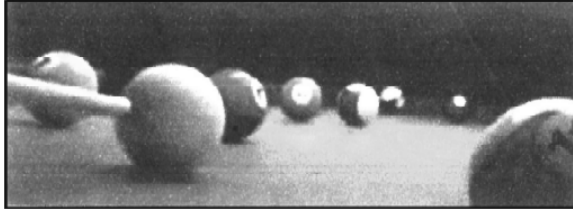|		
36.	Radio towers are used for transmitting a range of communication services including radio and television. The tower will either act as an antenna itself or support one or more antennas on its structure. On a similar concept, a radio station tower was built in two Sections A and B. Tower is supported by wires from a point O. Distance between the base of the tower and point O is 36 cm. From point O, the angle of elevation of the top of the Section B is 30° and the angle of elevation of the top of Section A is 45°. Based on the above information, answer the following questions : (i) Find the length of the wire from the point O to the top of Section B. (ii) Find the distance AB. **OR** Find the area of ΔOPB. (iii) Find the height of the Section A from the base of the tower.	
Sol.	(i) In Δ OBP, $\cos 30° = \dfrac{OP}{OB}$ $\dfrac{\sqrt{3}}{2} = \dfrac{36}{OB} \Rightarrow OB = \dfrac{72}{\sqrt{3}}$ $= 24\sqrt{3}$ cm	$\dfrac{1}{2}$ $\dfrac{1}{2}$

(ii)In Δ OBP, tan 30° = $\frac{PB}{36}$ ⇒ PB = $\frac{36}{\sqrt{3}}$

$$PB = 12\sqrt{3}$$

1

In Δ OAP, tan 45° = $\frac{AP}{36}$ ⇒ AP = 36 cm

AB = AP – PB = 36 – 12$\sqrt{3}$ = 12(3 – $\sqrt{3}$) cm

$\frac{1}{2}$
$\frac{1}{2}$

OR

(ii)Area of Δ OPB = $\frac{1}{2}$ × OP × PB

$$= \frac{1}{2} \times 36 \times 12\sqrt{3} = 216\sqrt{3} \text{ cm}^2$$

1+1

(ii)   AP = 36 cm

1

37.	"Eight Ball" is a game played on a pool table with 15 balls numbered 1 to 15 and a "cue ball" that is solid and white. Of the 15 numbered balls, eight are solid (non-white) coloured and numbered 1 to 8 and seven are striped balls numbered 9 to 15.	
	The 15 numbered pool balls (no cue ball) are placed in a large bowl and mixed, then one ball is drawn out at random. Based on the above information, answer the following questions : (i) What is the probability that the drawn ball bears number 8 ? (ii) What is the probability that the drawn ball bears an even number ? **OR** What is the probability that the drawn ball bears a number, which is a multiple of 3 ? (iii) What is the probability that the drawn ball is a solid coloured and bears an even number ?	
Sol.	(i)P (drawing ball bearing number 8) $= \frac{1}{15}$	1
	(ii)Even numbers = 2, 4, 6, 8, 10, 12, 14	$\frac{1}{2}$
	No. of favourable outcomes = 7	
	P (even number) $= \frac{7}{15}$	$1\frac{1}{2}$
	OR	
	(ii)Multiples of 3 are 3, 6, 9, 12, 15	$\frac{1}{2}$
	No. of favourable outcomes = 5	

	$\therefore$ P(multiple of 3) $= \frac{5}{15} = \frac{1}{3}$	$1\frac{1}{2}$
	(iii) Solid colour and even number 2, 4, 6, 8	
	P(solid colour and bear an even no.) $= \frac{4}{15}$	1
38.	A coaching institute of Mathematics conducts classes in two batches I and II and fees for rich and poor children are different. In batch I, there are 20 poor and 5 rich children, whereas in batch II, there are 5 poor and 25 rich children. The total monthly collection of fees from batch I is ₹ 9000 and from batch II is ₹ 26,000. Assume that each poor child pays ₹ x per month and each rich child pays ₹ y per month. Based on the above information, answer the following questions : (i)　Represent the information given above in terms of x and y. (ii)　Find the monthly fee paid by a poor child. **OR** Find the difference in the monthly fee paid by a poor child and a rich child. (iii)　If there are 10 poor and 20 rich children in batch II, what is the total monthly collection of fees from batch II ?	
Sol.	(i)20x + 5y = 9000 5x + 25y = 26000	1

(ii)Solving the equations x = 200, y = 1000 Monthly fee paid by poor child = ₹200 **OR** (ii) getting x=200 and y= 1000 Difference in the fee = 1000 – 200 = ₹ 800 (iii)10x + 20y = 10(200) + 20(1000) = ₹ 22000	2 $1+\frac{1}{2}$ $\frac{1}{2}$ 1	