Series : EH5GF

SET ~ 1

प्रश्न–पत्र कोड
Q.P. Code **430/5/1**

रोल नं.
Roll No.

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

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नोट

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

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

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

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

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

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NOTE

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

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

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

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

गणित (बुनियादी)

MATHEMATICS (BASIC)

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

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

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सामान्य निर्देश :

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

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

(ii) *प्रश्न-पत्र* ***पाँच*** *खण्डों में विभाजित है –* ***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 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** ***स्रोत/प्रकरण इकाई आधारित*** **4** *अंकों के प्रश्न हैं। 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* **2** *अंकों वाले* **3** *प्रश्नों में आंतरिक विकल्प का प्रावधान दिया गया है।*

(ix) *जहाँ आवश्यक हो स्वच्छ आकृतियाँ बनाएँ। यदि आवश्यक हो तो* $\pi = \frac{22}{7}$ *लें, जहाँ अन्यथा नहीं दिया गया है।*

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

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General Instructions :

Read the following instructions carefully and follow them :

(i) *This Question Paper contains **38** questions. **All** questions are compulsory.*

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

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

(iv) *In Section–**B,** question numbers **21** to **25** are Very Short Answer (VSA) type questions of **2** marks each.*

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

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

(vii) *In Section–**E,** question numbers **36** to **38** are **case-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** questions of **2** marks in Section-**E**.*

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

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

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खण्ड – क

20 × 1 = 20

(बहुविकल्पीय प्रश्न)

इस खण्ड में **20** बहुविकल्पीय प्रश्न हैं, जिनमें प्रत्येक का **1** अंक है ।

1. $(2 - 5\sqrt{3})^2$

(A) एक ऋणात्मक पूर्णांक है ।
(B) एक अपरिमेय संख्या है ।
(C) एक परिमेय संख्या है ।
(D) एक धनात्मक पूर्णांक है ।

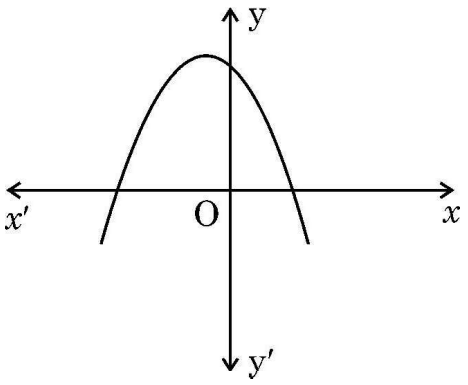
2. k का वह मान जिसके लिये द्विघात समीकरण $6x^2 + 4kx + k = 0$ के मूल वास्तविक तथा समान हैं, है

(A) 0
(B) $\frac{3}{4}$
(C) $\frac{-3}{2}$
(D) $\frac{2}{3}$

3. बिंदुओं (2, 3) तथा (–2, –3) के बीच की दूरी है

(A) $4\sqrt{13}$
(B) $\sqrt{40}$
(C) $2\sqrt{13}$
(D) 5

4. बहुपद $p(x)$ के दिए गए ग्राफ को ध्यानपूर्वक देखिये । बहुपद $p(x)$ के शून्यकों की संख्या है



(A) 0
(B) 1
(C) 3
(D) 2

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Section – A $20 \times 1 = 20$

(Multiple Choice Questions)

Section-A consists of **20** Multiple Choice Questions of **1** mark each.

1. $(2 - 5\sqrt{3})^2$ is

   (A) a negative integer
   (B) an irrational number
   (C) a rational number
   (D) a positive integer

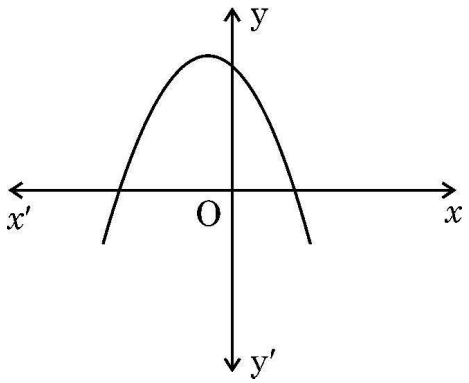
2. The value of k for which the roots of the quadratic equation $6x^2 + 4kx + k = 0$ are real and equal, is

   (A) 0
   (B) $\frac{3}{4}$
   (C) $\frac{-3}{2}$
   (D) $\frac{2}{3}$

3. The distance between the points (2, 3) and (–2, –3) is

   (A) $4\sqrt{13}$
   (B) $\sqrt{40}$
   (C) $2\sqrt{13}$
   (D) 5

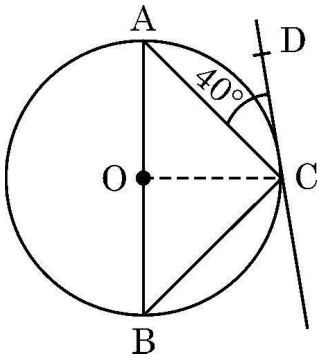
4. Observe the given graph of polynomial p(x). The number of zeroes of p(x) is



   (A) 0
   (B) 1
   (C) 3
   (D) 2

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5. दी गयी आकृति में, AB बिन्दु O पर केन्द्रित वृत्त का व्यास है । CD वृत्त की स्पर्श-रेखा है ताकि $\angle ACD = 40^\circ$ है । $\angle CBA$ का मान है



(A) 50° (B) 40°

(C) 80° (D) 45°

6. A.P. : –12, –19, –26, ... का 10वाँ पद है

(A) –75 (B) –65

(C) 51 (D) –82

7. समीकरण $x^2 - 8 = 0$ के मूल हैं

(A) परिमेय तथा भिन्न (B) अपरिमेय तथा भिन्न

(C) वास्तविक तथा समान (D) वास्तविक नहीं

8. बिंदुओं (–4, 5) तथा (0, –10) को जोड़ने वाले रेखाखंड को बिन्दु (x, 0) निम्न अनुपात में विभाजित करता है :

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

(C) 1 : 1 (D) 1 : 2

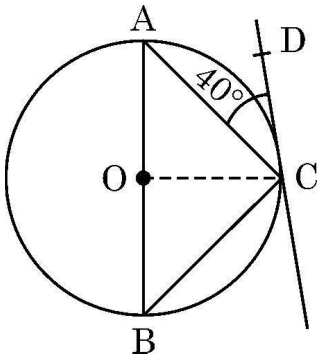
9. 52 पत्तों वाली ताश की गड्डी में से एक काला पत्ता खो गया है । बाकी बचे हुए पत्तों को अच्छी प्रकार से फेंटकर उनमें से यादृच्छया एक पत्ता निकाला गया । इसकी प्रायिकता कि निकाला गया पत्ता पान का बादशाह है, है

(A) $\frac{1}{52}$ (B) $\frac{1}{4}$

(C) $\frac{1}{51}$ (D) $\frac{1}{26}$

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5. In the given figure, AB is diameter of the circle with centre O. CD is tangent to the circle so that $\angle ACD = 40^\circ$. The value of $\angle CBA$ is



(A) 50° (B) 40°

(C) 80° (D) 45°

6. 10^{th} term of the A.P. : –12, –19, –26, ... is

(A) –75 (B) –65

(C) 51 (D) –82

7. The roots of the equation $x^2 - 8 = 0$ are

(A) rational and distinct (B) irrational and distinct

(C) real and equal (D) not real

8. The point $(x, 0)$ divides the line segment joining the points (–4, 5) and (0, –10) in the ratio

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

(C) 1 : 1 (D) 1 : 2

9. A black card is lost from a deck of 52 playing cards. Rest of the cards are shuffled and one card is drawn at random from the available cards. The probability that drawn card is 'king of hearts', is

(A) $\frac{1}{52}$ (B) $\frac{1}{4}$

(C) $\frac{1}{51}$ (D) $\frac{1}{26}$

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10. 25 cm भुजा वाले एक खोखले घन में, जितना बड़ा संभव हो सके, शंकु रखा गया है । शंकु के आधार की त्रिज्या है

(A) 5 cm (B) 12.5 cm

(C) 25 cm (D) 10 cm

11. यदि किसी घटना E के होने की प्रायिकता P(E) = 0.1 है, तो P($\overline{E}$) का मान है

(A) 0.9 (B) $\frac{1}{2}$

(C) 0.99 (D) –1

12. यदि tan A = 1 है, तो 3 sin A + cos A का मान है

(A) $4\sqrt{2}$ (B) 4

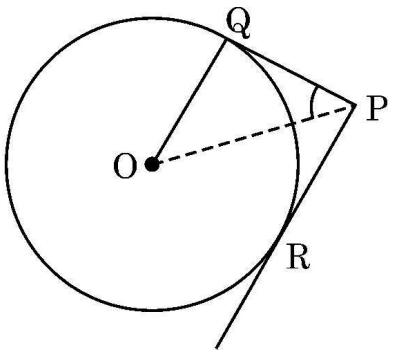
(C) $2\sqrt{2}$ (D) $4 \times 45^\circ$

13. ऐसा द्विघाती बहुपद जिसका सिर्फ एक शून्यक (–2) है, है

(A) $(x-2)^2$ (B) x^2-2

(C) x^2+2x (D) $(x+2)^2$

14. केन्द्र O वाले वृत्त पर बिन्दु P से दो स्पर्श-रेखायें PQ तथा PR इस प्रकार खींची गई हैं कि OQ = QP है । ∠OPQ का मान है



(A) 45° (B) 30°

(C) 60° (D) 90°

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10. The largest possible cone is just fitted inside a hollow cube of edge 25 cm. The radius of the base of the cone is

(A) 5 cm (B) 12.5 cm

(C) 25 cm (D) 10 cm

11. If E is an event such that P(E) = 0.1, then P($\overline{E}$) is equal to

(A) 0.9 (B) $\frac{1}{2}$

(C) 0.99 (D) –1

12. If tan A = 1, then 3 sin A + cos A is equal to

(A) $4\sqrt{2}$ (B) 4

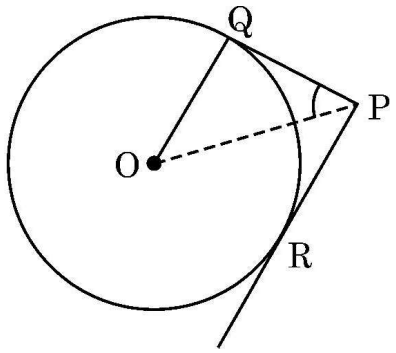
(C) $2\sqrt{2}$ (D) $4 \times 45^\circ$

13. A quadratic polynomial having only zero (–2) is

(A) $(x-2)^2$ (B) $x^2 - 2$

(C) $x^2 + 2x$ (D) $(x+2)^2$

14. PQ and PR are tangents to a circle with centre O such that OQ = QP. The value of $\angle$OPQ is equal to



(A) 45° (B) 30°

(C) 60° (D) 90°

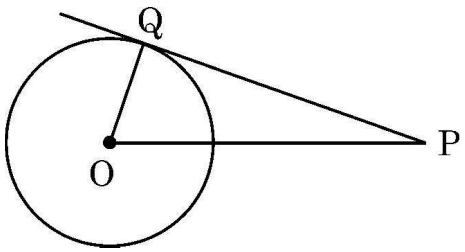
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15. निम्न में से क्या, आँकड़ों के सभी प्रेक्षणों पर निर्भर करता है ?

(A) माध्यक (B) माध्य

(C) सीमा (D) बहुलक

16. केन्द्र O वाले वृत्त पर स्पर्श-रेखा PQ खींची गयी है । यदि OQ = 3 cm, PQ = 5 cm है, तो OP बराबर है



(A) 5 cm (B) 4 cm

(C) $\sqrt{15}$ cm (D) $\sqrt{34}$ cm

17. दो पासों को एक साथ फेंका जाता है । सिर्फ एक पासे पर संख्या 4 आने की प्रायिकता है

(A) $\frac{11}{36}$ (B) $\frac{1}{3}$

(C) $\frac{5}{18}$ (D) $\frac{1}{4}$

18. 22 cm लम्बी चाप वृत्त के केन्द्र पर x^o का कोण अंतरित करती है । यदि वृत्त की त्रिज्या 36 cm है तो x का मान है

(A) 35 (B) 40

(C) 60 (D) 30

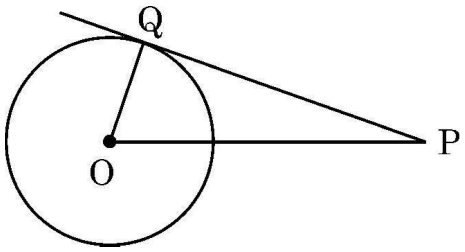
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15. Which of the following depends on all observations of a given data ?

(A) Median (B) Mean

(C) Range (D) Mode

16. PQ is tangent to the circle centred at O. If OQ = 3 cm, PQ = 5 cm, then OP is equal to



(A) 5 cm (B) 4 cm

(C) $\sqrt{15}$ cm (D) $\sqrt{34}$ cm

17. Two dice are rolled together. The probability that only one die shows number 4, is

(A) $\frac{11}{36}$ (B) $\frac{1}{3}$

(C) $\frac{5}{18}$ (D) $\frac{1}{4}$

18. An arc of length 22 cm subtends an angle of x° at the centre of the circle. If radius of circle is 36 cm, the value of x is

(A) 35 (B) 40

(C) 60 (D) 30

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(अभिकथन – तर्क आधारित प्रश्न)

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

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

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

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

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

19. **अभिकथन (A) :** लकड़ी के एक ठोस बेलन के एक सिरे से समान त्रिज्या वाले एक अर्धगोले को खोदकर बाहर निकालने पर बचे हुए ठोस का कुल पृष्ठीय क्षेत्रफल $2\pi r^2$ से बढ़ जाता है ।

तर्क (R) : अर्धगोले का वक्र पृष्ठीय क्षेत्रफल $2\pi r^2$ होता है ।

20. **अभिकथन (A) :** समकोण त्रिभुज ABC में $\angle B = 90^\circ$ है । इसलिये $\cos (A + C)$ का मान शून्य है ।

तर्क (R) : $A + B + C = 180^\circ$ तथा $\cos 90^\circ = 0$.

खण्ड – ख

(अति लघु–उत्तरीय प्रश्न) **$5 \times 2 = 10$**

प्रश्न संख्या **21** से **25** तक अति लघु–उत्तरीय प्रकार के प्रश्न हैं तथा प्रत्येक प्रश्न के **2** अंक हैं ।

21. जाँच कीजिये कि क्या $15^n \times 2^n$, जहाँ n एक प्राकृत संख्या है, अंक 0 पर समाप्त होती है ।

22. (a) मान ज्ञात कीजिये : $2 \tan^2 45^\circ + \cos^2 30^\circ - \sin^2 90^\circ$

अथवा

(b) $A = 30^\circ$ के लिए, सत्यापित कीजिये कि $\cos 2A = \dfrac{1 - \tan^2 A}{1 + \tan^2 A}$

• • •

(Assertion – Reason based questions)

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

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

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

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

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

19. **Assertion (A) :** When a hemisphere of same radius (r) is carved out from one side of a solid wooden cylinder, the total surface area of remaining solid is increased by $2\pi r^2$.

Reason (R) : Curved surface area of hemisphere is $2\pi r^2$.

20. **Assertion (A) :** In a right angle triangle ABC, $\angle B = 90^\circ$. Therefore the value of cos (A + C) is equal to 0.

Reason (R) : $A + B + C = 180^\circ$ and $\cos 90^\circ = 0$.

Section – B

(Very Short Answer Type Questions) **5 × 2 = 10**

Q. Nos. **21** to **25** are Very Short Answer type questions of **2** marks each.

21. Check whether $15^n \times 2^n$, n being a natural number, ends with the digit zero.

22. (a) Evaluate : $2\tan^2 45^\circ + \cos^2 30^\circ - \sin^2 90^\circ$.

OR

(b) Verify that $\cos 2A = \dfrac{1-\tan^2 A}{1+\tan^2 A}$ for $A = 30^\circ$.

• • •

23. बिंदुओं (–4, 1) तथा (6, 5) को जोड़ने वाले रेखाखंड को समत्रिभाजित करने वाले बिंदुओं के निर्देशांक ज्ञात कीजिये ।

24. (a) एक थैले में 40 कंचे हैं जिनमें से कुछ सफेद तथा शेष काले हैं । यदि एक काले कंचे को निकालने की प्रायिकता $\frac{3}{5}$ है, तो सफेद कंचों की संख्या ज्ञात कीजिये ।

अथवा

(b) पूर्व प्राथमिक कक्षा की अध्यापिका ने एक कटोरे में कुछ कार्ड डाले जिन पर 20 से 59 तक संख्याएँ अंकित हैं । एक विद्यार्थी यादृच्छया एक कार्ड निकालता है और उसकी संख्या पढ़ता है । इसकी क्या प्रायिकता है कि पढ़ी गयी संख्या (i) एक अभाज्य संख्या है (ii) एक पूर्ण वर्ग है ?

25. दूरी सूत्र का प्रयोग करते हुए, सिद्ध कीजिये कि बिंदु (1, 5), (2, 3) तथा (3, 1) संरेखी हैं ।

खण्ड – ग

(लघु–उत्तरीय प्रश्न) **$6 \times 3 = 18$**

प्रश्न संख्या **26** से **31** तक लघु–उत्तरीय प्रकार के प्रश्न हैं तथा प्रत्येक प्रश्न के **3** अंक हैं ।

26. (a) यदि α, β बहुपद $3x^2 - 8x + 4$ के शून्यक हैं, तो चर x में ऐसा द्विघात बहुपद बनाइये जिसके शून्यक $\frac{1}{\alpha}$ तथा $\frac{1}{\beta}$ हैं ।

अथवा

(b) बहुपद $6x^2 - 7x - 3$ के शून्यक ज्ञात कीजिये तथा शून्यकों एवं गुणांकों के बीच के संबंध की सत्यता की जाँच कीजिये ।

27. दो क्रमागत सम संख्याओं के वर्गों का योग 452 है । संख्याएँ ज्ञात कीजिये ।

28. सिद्ध कीजिये $(\text{cosec A} + \sin \text{A})^2 + (\sec \text{A} + \cos \text{A})^2 = 7 + \tan^2 \text{A} + \cot^2 \text{A}$.

• • •

23. Find the coordinates of the points of trisection of line segment joining the points (–4, 1) and (6, 5).

24. (a) A bag contains 40 marbles out of which some are white and others are black. If the probability of drawing a black marble is $\frac{3}{5}$, then find the number of white marbles.

OR

(b) In a pre-primary class, a teacher put cards numbered 20 to 59 in a bowl. A student picked up a card at random and read the number. Find the probability that the number read was (i) a prime number (ii) a perfect square.

25. Using distance formula, prove that the points (1, 5), (2, 3) and (3, 1) are collinear.

Section – C

(Short Answer Type Questions) **6 × 3 = 18**

Q. Nos. **26** to **31** are Short Answer type questions of **3** marks each.

26. (a) If α, β are zeroes of the polynomial $3x^2 - 8x + 4$, then form a quadratic polynomial in x whose zeroes are $\frac{1}{\alpha}$ and $\frac{1}{\beta}$.

OR

(b) Find zeroes of the polynomial $6x^2 - 7x - 3$ and verify the relationship between zeroes and its coefficients.

27. The sum of the squares of two consecutive even numbers is 452. Find the numbers.

28. Prove that $(\text{cosec } A + \sin A)^2 + (\sec A + \cos A)^2 = 7 + \tan^2 A + \cot^2 A$.

• • •

29. तीन अलग-अलग सड़क के चौराहों पर ट्रैफिक लाइट क्रमश: 45 सेकंड, 75 सेकंड और 60 सेकंड पर बदल जाती हैं । यदि सभी एक साथ 5.00 a.m. पर बदलती हैं तो अगली बार तीनों एक साथ कब बदलेंगी ?

30. (a) एक गोलाकार काँच के बर्तन की बेलन के आकार की गर्दन है जिसकी लम्बाई 7 cm है और व्यास 8 cm है । गोलाकार भाग की त्रिज्या 10 cm है । बर्तन का आयतन ज्ञात कीजिये ।

अथवा

(b) 7 cm आधार त्रिज्या तथा 20 cm ऊँचाई वाले ठोस बेलन के प्रत्येक सिरे से एक शंकु खोदकर निकाला गया है । यदि शंकु की ऊँचाई 5 cm तथा उसके आधार की त्रिज्या 2.1 cm है, तो शेष ठोस का आयतन ज्ञात कीजिये ।

31. समांतर चतुर्भुज ABCD की बढ़ाई गयी भुजा AD पर स्थित E एक बिंदु है तथा BE भुजा CD को F पर प्रतिच्छेद करती है । दर्शाइये कि (i) $\Delta DFE \sim \Delta CFB$ (ii) $\Delta AEB \sim \Delta CBF$.

खण्ड – घ

(दीर्घ-उत्तरीय प्रश्न) **$4 \times 5 = 20$**

प्रश्न संख्या **32** से **35** तक दीर्घ-उत्तरीय प्रश्न हैं जिनमें प्रत्येक के **5** अंक हैं ।

32. ग्राफीय विधि द्वारा ज्ञात कीजिये कि क्या निम्न रैखिक समीकरण युग्म, $2x + 3y = 12$ तथा $x - y = 1$, का अद्वितीय हल है या अपरिमित रूप से अनेक हल हैं ।

33. (a) यदि किसी त्रिभुज की एक भुजा के समांतर अन्य दो भुजाओं को भिन्न-भिन्न बिंदुओं पर प्रतिच्छेद करने के लिये एक रेखा खींची जाये तो सिद्ध कीजिये कि अन्य दो भुजायें एक ही अनुपात में विभाजित हो जाती हैं ।

अथवा

(b) दिया गया है कि एक त्रिभुज ABC की भुजायें AB और AC तथा माध्यिका AD एक अन्य त्रिभुज PQR की भुजाओं PQ और PR तथा माध्यिका PM के क्रमश: समानुपाती हैं । दर्शाइये कि $\Delta ABC \sim \Delta PQR$ है ।

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29. The traffic lights at three different road crossings change after every 45 seconds, 75 seconds and 60 seconds respectively. If they change together at 5.00 a.m., then at what time they will change together next ?

30. (a) A spherical glass vessel has a cylindrical neck 7 cm long and 8 cm in diameter. The radius of spherical part is 10 cm. Find the volume of the vessel.

OR

(b) From each end of a solid cylinder of height 20 cm and base radius 7 cm, a cone of base radius 2.1 cm and height 5 cm is scooped out. Find the volume of the remaining solid.

31. Point E lies on the extended side AD of parallelogram ABCD. BE intersects CD at F. Show that (i) $\Delta DFE \sim \Delta CFB$ (ii) $\Delta AEB \sim \Delta CBF$.

Section – D

(Long Answer Type Questions) **4 × 5 = 20**

Q. Nos. **32** to **35** are Long Answer type questions of **5** marks each.

32. Determine graphically whether the following pair of linear equations

$2x + 3y = 12$ and $x - y = 1$

has unique solution or infinitely many solutions.

33. (a) If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, then prove that the other two sides are divided in the same ratio.

OR

(b) It is given that sides AB and AC and median AD of ΔABC are respectively proportional to sides PQ and PR and median PM of another ΔPQR. Show that $\Delta ABC \sim \Delta PQR$.

• • •

34. एक मीनार के पाद बिन्दु से एक भवन के शिखर का उन्नयन कोण 30° है और भवन के पाद बिन्दु से मीनार के शिखर का उन्नयन कोण 60° है । यदि मीनार 30 m ऊँची हो तो भवन की ऊँचाई तथा भवन और मीनार के बीच की दूरी ज्ञात कीजिये । ($\sqrt{3} = 1.73$ लीजिये ।)

35. (a) निम्न आँकड़ों का 'माध्य' तथा 'बहुलक' ज्ञात कीजिये :

वर्ग	10-25	25-40	40-55	55-70	70-85	85-100
छात्रों की संख्या	12	10	15	13	8	12

अथवा

(b) निम्नलिखित सारणी किसी अस्पताल में एक विशेष वर्ष में भर्ती हुए रोगियों की आयु को दर्शाती है :

आयु (वर्षों में)	5-15	15-25	25-35	35-45	45-55	55-65
रोगियों की संख्या	7	10	21	22	15	5

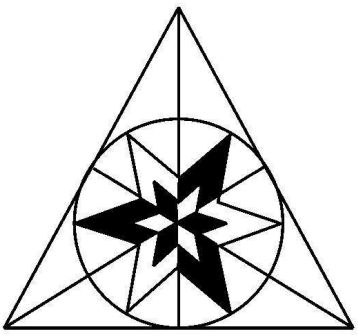
उपरोक्त आँकड़ों के 'बहुलक' तथा 'माध्यक' ज्ञात कीजिये ।

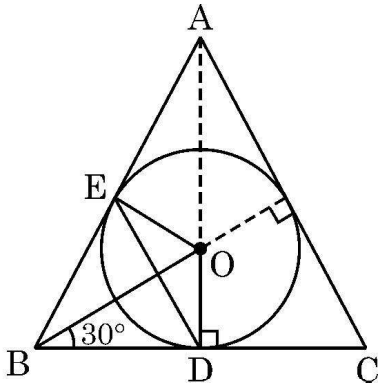
खण्ड – ङ

(स्रोत/प्रकरण अध्ययन आधारित प्रश्न) **$3 \times 4 = 12$**

प्रश्न संख्या **36** से **38** तक स्रोत/प्रकरण अध्ययन आधारित प्रश्न हैं । प्रत्येक प्रश्न के **4** अंक हैं ।

36.





ललित कला की कक्षा में, विद्यार्थियों को त्रिभुजीय आकार की टाइल (tile) पर ज्यामितीय पैटर्न बनाने को कहा गया ।

• • •

34. The angle of elevation of the top of a building from the foot of the tower is 30° and the angle of elevation of the top of the tower from the foot of the building is 60°. If the tower is 30 m high, find the height of the building and distance between the building and the tower. (Use $\sqrt{3} = 1.73$)

35. (a) Find 'mean' and 'mode' of the following data :

Class	10-25	25-40	40-55	55-70	70-85	85-100
Number of Students	12	10	15	13	8	12

OR

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

Age (in years)	5-15	15-25	25-35	35-45	45-55	55-65
Number of Patients	7	10	21	22	15	5

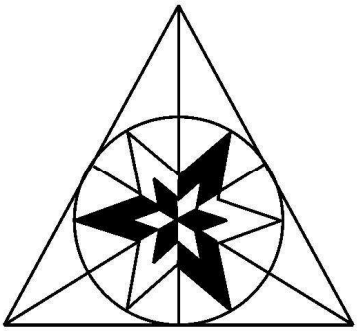
Find 'mode' and 'median' of the above data.

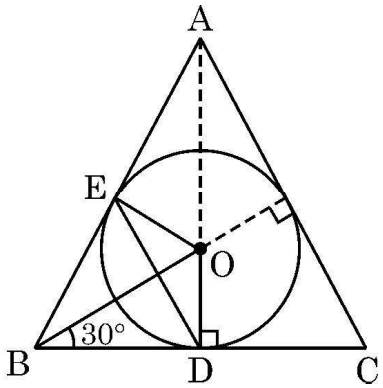
Section – E

(Case-study based Questions) **3 × 4 = 12**

Q. Nos. **36** to **38** are Case-study based Questions of **4** marks each.

36.





In a Fine Arts class, students were asked to design triangular tiles in geometric pattern.

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नीलिमा ने समबाहु त्रिभुज ABC के अन्तर्गत एक वृत्ताकार डिजाइन बनाया । वृत्त की त्रिज्या 4 cm है । दिये गये चित्र की सहायता से निम्न प्रश्नों के उत्तर दीजिये :

(i) OB की लम्बाई ज्ञात कीजिये । **1**

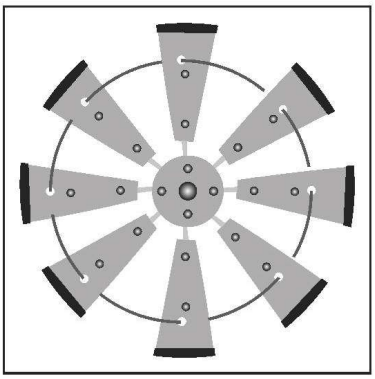
(ii) क्या DE || CA है ? तर्कसंगत उत्तर दीजिये । **1**

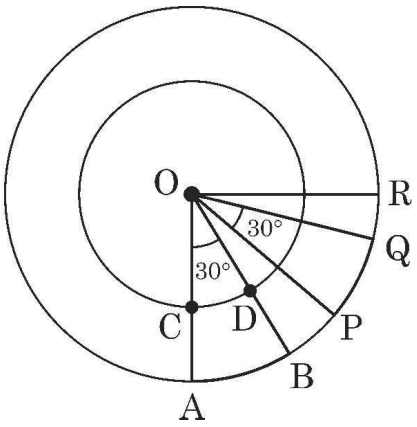
(iii) (a) चतुर्भुज OEBD के सभी कोणों की माप लिखिये । दर्शाइये कि OEBD एक चक्रीय चतुर्भुज है । **2**

अथवा

(iii) (b) ΔABC का परिमाप ज्ञात कीजिए । ($\sqrt{3} = 1.73$ लीजिये)

37.





एक किसान ने अपने खेत में सजावट के लिये एक पवनचक्की (windmill) लगायी । इसके समान चौड़ाई के आठ ब्लेड हैं जो कि एक वृत्त में समान रूप से व्यवस्थित हैं । एक वृत्ताकार तार इन सबको बाँधे रखता है ।

दिया गया आरेख दो ब्लेड OAB तथा OPQ को एक चौथाई वृत्त में दर्शाता है । दोनों वृत्त बिंदु O पर संकेन्द्रित हैं । $\angle AOB = \angle POQ = 30^\circ$, OA = 28 cm तथा OC = 21 cm है ।

(i) $\angle BOP$ का मान ज्ञात कीजिए । **1**

(ii) चाप CD की लम्बाई ज्ञात कीजिए । **1**

(iii) (a) क्षेत्र CABD का क्षेत्रफल ज्ञात कीजिए । **2**

अथवा

(iii) (b) क्षेत्र CABD का परिमाप ज्ञात कीजिए ।

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Neelima made a circular design inside an equilateral triangle ABC. The radius of the circle is 4 cm. Observe the diagram and answer the following questions :

(i) Determine the length OB. **1**

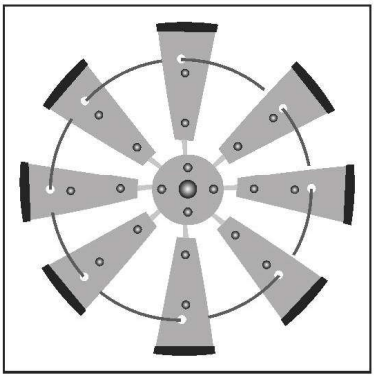
(ii) Is DE || CA ? Give reason for your answer. **1**

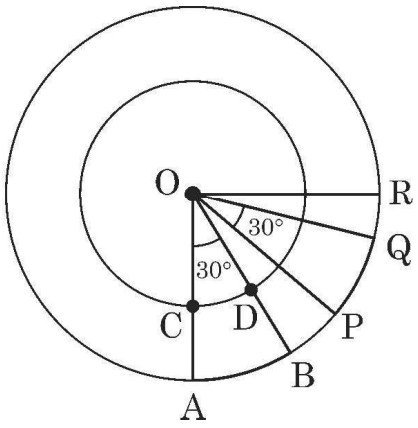
(iii) (a) Write all angles of quadrilateral OEBD and show that it is a cyclic quadrilateral. **2**

OR

(iii) (b) Find the perimeter of ΔABC. (Use $\sqrt{3} = 1.73$)

37.





A farmer has put up a decorative windmill in his farm in which there are eight blades of equal width and equally placed in a circular arrangement. A circular wire goes through them.

The diagram shows two blades OAB and OPQ in a quarter circle with centre O. $\angle AOB = \angle POQ = 30^\circ$, OA = 28 cm, OC = 21 cm.

O is the centre of both the circles.

(i) Determine the measure of $\angle BOP$. **1**

(ii) Find length of arc CD. **1**

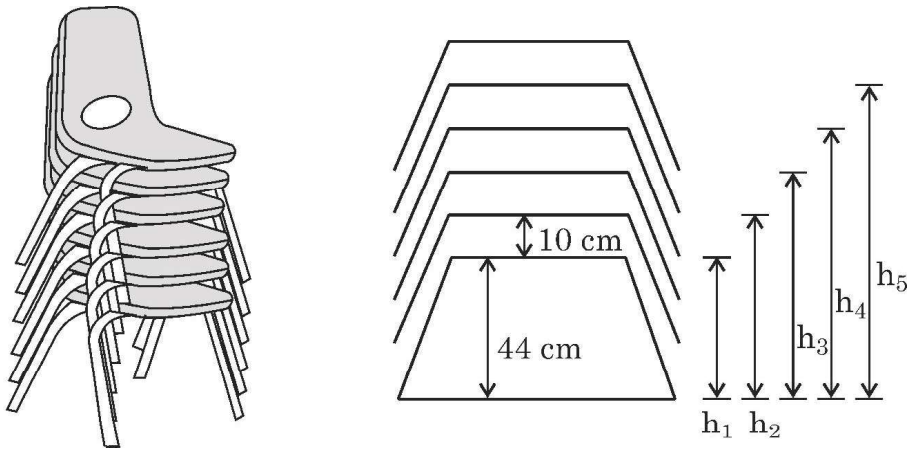
(iii) (a) Find the area of region CABD. **2**

OR

(iii) (b) Find perimeter of region CABD.

• • •

38. एक टैन्ट हाऊस का मालिक फर्नीचर को किराये पर देने का काम करता है । जगह बचाने के लिये वह अपनी दुकान में कुर्सियों को एक के ऊपर एक रखता जाता है ।



दिये गये आरेख में, कुर्सी की गद्दी की जमीन से ऊँचाई को $h_1, h_2, h_3, ...$ से प्रस्तुत किया गया है । पहली कुर्सी की गद्दी जमीन से 44 cm ऊँची है तथा हर दो गद्दियों के बीच की दूरी 10 cm है ।

(i) h_1, h_2, h_3, h_4 और h_5 के मान इसी क्रम में लिखिये । **1**

(ii) दर्शाइये कि उपरोक्त मान एक A.P. बनाते हैं । A.P. का प्रथम पद तथा सार्वअंतर लिखिये । **1**

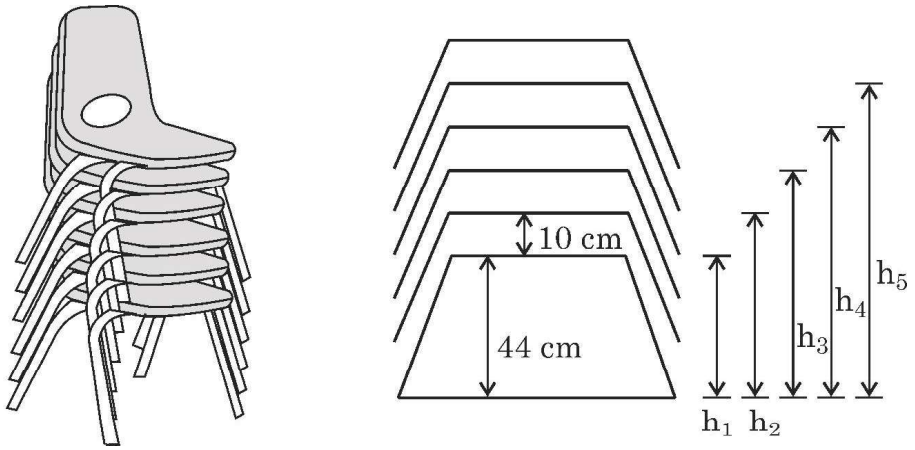
(iii) (a) यदि कुर्सियों को अधिकतम 160 cm तक की ऊँचाई तक रखा जा सकता है तो बताइये एक ढेर (stack) में अधिकतम कितनी कुर्सियाँ आयेंगी ? **2**

अथवा

(iii) (b) क्या यह संभव है कि 15 कुर्सियों का ढेर (stack) बनाया जाये जबकि अधिकतम ऊँचाई 180 cm तक ही हो सकती है ? अपने उत्तर का औचित्य सिद्ध कीजिये ।

• • •

38. A tent house owner provides furniture on rent. He stacks chairs in his shop to save space.



In the diagram, the height of seat of chair from ground is represented by h_1, h_2, h_3, ... The height of first seat is 44 cm from ground level and gap between every two seats is 10 cm.

(i) Write the values of h_1, h_2, h_3, h_4 and h_5 in this order only. **1**

(ii) Show that the above values form an A.P. Write its first term and common difference. **1**

(iii) (a) If chairs can be stacked up to the maximum height of 160 cm, then find the maximum number of chairs in a stack. **2**

OR

(iii) (b) Is it possible to stack 15 chairs if maximum height of the stack can not be more than 180 cm ? Justify your answer.

• • •

Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2025
SUBJECT NAME MATHEMATICS (BASIC) (Q.P. CODE 430/5/1)

General Instructions: -

1	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully.
2	**"Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, evaluation done and several other aspects. It's leakage to public in any manner could lead to derailment of the examination system and affect the life and future of millions of candidates. Sharing this policy/document to anyone, publishing in any magazine and printing in News Paper/Website etc. may invite action under various rules of the Board and IPC."**
3	Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one's own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. **However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and due marks be awarded to them. In class-X, while evaluating two competency-based questions, please try to understand given answer and even if reply is not from marking scheme but correct competency is enumerated by the candidate, due marks should be awarded.**
4	The Marking scheme carries only suggested value points for the answers. These are in the nature of Guidelines only and do not constitute the complete answer. The students can have their own expression and if the expression is correct, the due marks should be awarded accordingly.
5	The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. If there is any variation, the same should be zero after deliberation and discussion. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.
6	Evaluators will mark (✓) wherever answer is correct. For wrong answer CROSS 'X" be marked. Evaluators will not put right (✓) while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing.**
7	If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totaled up and written in the left-hand margin and encircled. This may be followed strictly.
8	If a question does not have any parts, marks must be awarded in the left-hand margin and encircled. This may also be followed strictly.
9	If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note **"Extra Question"**.
10	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
11	A full scale of marks _____(example 0 to 80/70/60/50/40/30 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.
12	Every examiner has to necessarily do evaluation work for full working hours i.e., 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines).This is in view of the reduced syllabus and number of questions in question paper.
13	Ensure that you do not make the following common types of errors committed by the Examiner in the past:- ● Leaving answer or part thereof unassessed in an answer book. ● Giving more marks for an answer than assigned to it. ● Wrong totaling of marks awarded on an answer.

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

MARKING SCHEME
MATHEMATICS (Basic)

Section – A **20 × 1 = 20**

(Multiple Choice Questions)

Section-A consists of **20** Multiple Choice Questions of **1** mark each.

1. $(2-5\sqrt{3})^2$ is

(A) a negative integer (B) an irrational number

(C) a rational number (D) a positive integer

Ans: (B) an irrational number	1

2. The value of k for which the roots of the quadratic equation $6x^2 + 4kx + k = 0$ are real and equal, is

(A) 0 (B) $\frac{3}{4}$

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

Ans: (A) 0	1

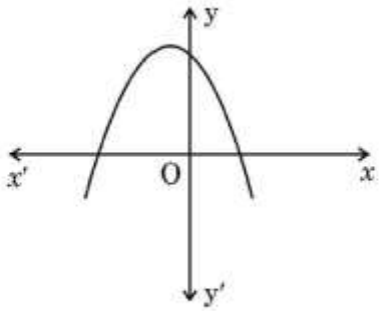
3. The distance between the points (2, 3) and (–2, –3) is

(A) $4\sqrt{13}$ (B) $\sqrt{40}$

(C) $2\sqrt{13}$ (D) 5

Ans: (C) $2\sqrt{13}$	1

4. Observe the given graph of polynomial p(x). The number of zeroes of p(x) is

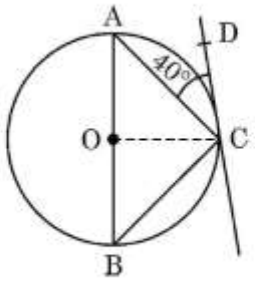


(A) 0 (B) 1

(C) 3 (D) 2

Ans: (D) 2	1

5. In the given figure, AB is diameter of the circle with centre O. CD is tangent to the circle so that $\angle ACD = 40^\circ$. The value of $\angle CBA$ is



(A) 50° (B) 40°

(C) 80° (D) 45°

Ans: (B) 40°	1

6. 10^{th} term of the A.P. : –12, –19, –26, ... is

(A) –75 (B) –65

(C) 51 (D) –82

Ans: (A) – 75	1

7. The roots of the equation $x^2 - 8 = 0$ are

(A) rational and distinct (B) irrational and distinct

(C) real and equal (D) not real

Ans: (B) irrational and distinct	1

8. The point $(x, 0)$ divides the line segment joining the points $(-4, 5)$ and $(0, -10)$ in the ratio

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

(C) 1 : 1 (D) 1 : 2

Ans: (D) 1 : 2	1

9. A black card is lost from a deck of 52 playing cards. Rest of the cards are shuffled and one card is drawn at random from the available cards. The probability that drawn card is 'king of hearts', is

(A) $\frac{1}{52}$ (B) $\frac{1}{4}$

(C) $\frac{1}{51}$ (D) $\frac{1}{26}$

Ans: (C) $\frac{1}{51}$	1

10. The largest possible cone is just fitted inside a hollow cube of edge 25 cm. The radius of the base of the cone is

(A) 5 cm (B) 12.5 cm

(C) 25 cm (D) 10 cm

Ans: (B) 12·5 cm	1

11. If E is an event such that P(E) = 0.1, then P($\overline{E}$) is equal to

(A) 0.9 (B) $\frac{1}{2}$

(C) 0.99 (D) –1

Ans: (A) 0·9	1

12. If tan A = 1, then 3 sin A + cos A is equal to

(A) $4\sqrt{2}$ (B) 4

(C) $2\sqrt{2}$ (D) $4 \times 45^\circ$

Ans: (C) $2\sqrt{2}$	1

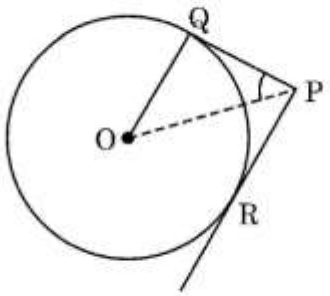
13. A quadratic polynomial having only zero (–2) is

(A) $(x-2)^2$ (B) x^2-2

(C) x^2+2x (D) $(x+2)^2$

Ans: (D) $(x + 2)^2$	1

14. PQ and PR are tangents to a circle with centre O such that OQ = QP. The value of ∠OPQ is equal to



(A) 45° (B) 30°

(C) 60° (D) 90°

Ans: (A) 45°	1

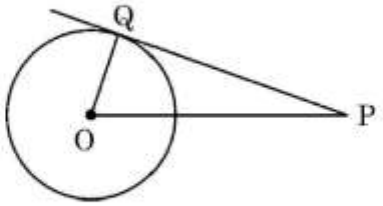
15. Which of the following depends on all observations of a given data ?

(A) Median (B) Mean

(C) Range (D) Mode

Ans: (B) Mean	1

16. PQ is tangent to the circle centred at O. If OQ = 3 cm, PQ = 5 cm, then OP is equal to



(A) 5 cm (B) 4 cm

(C) $\sqrt{15}$ cm (D) $\sqrt{34}$ cm

Ans: (D) $\sqrt{34}$ cm	1

17. Two dice are rolled together. The probability that only one die shows number 4, is

(A) $\frac{11}{36}$ (B) $\frac{1}{3}$

(C) $\frac{5}{18}$ (D) $\frac{1}{4}$

Ans: (C) $\frac{5}{18}$	1

18. An arc of length 22 cm subtends an angle of x° at the centre of the circle. If radius of circle is 36 cm, the value of x is

(A) 35 (B) 40

(C) 60 (D) 30

Ans: (A) 35	1

(Assertion – Reason based questions)

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

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

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

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

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

19. **Assertion (A) :** When a hemisphere of same radius (r) is carved out from one side of a solid wooden cylinder, the total surface area of remaining solid is increased by $2\pi r^2$.

Reason (R) : Curved surface area of hemisphere is $2\pi r^2$.

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

20. **Assertion (A) :** In a right angle triangle ABC, $\angle B = 90^\circ$. Therefore the value of cos (A + C) is equal to 0.

Reason (R) : $A + B + C = 180^\circ$ and $\cos 90^\circ = 0$.

Ans: (A)	Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).	1

Section – B

(Very Short Answer Type Questions) **5 × 2 = 10**

Q. Nos. **21** to **25** are Very Short Answer type questions of **2** marks each.

21. Check whether $15^n \times 2^n$, n being a natural number, ends with the digit zero.

Solution:	$15^n \times 2^n = 5^n \times 3^n \times 2^n$	1
	$\Rightarrow$ 2 and 5 both are the factors of the given number	
	$\therefore$ the given number ends with the digit zero.	1

22. (a) Evaluate : $2\tan^2 45^\circ + \cos^2 30^\circ - \sin^2 90^\circ$.

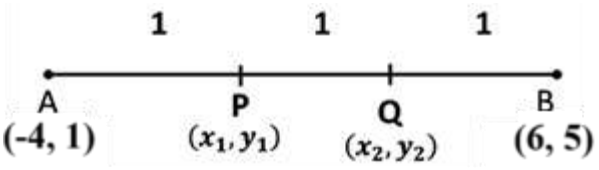
OR

(b) Verify that $\cos 2A = \dfrac{1-\tan^2 A}{1+\tan^2 A}$ for $A = 30^\circ$.

Solution: (a)	$2(1)^2 + \left(\dfrac{\sqrt{3}}{2}\right)^2 - (1)^2$	1½
	$= \dfrac{7}{4}$	½
	OR	
(b)	$\text{LHS} = \cos 60^\circ = \dfrac{1}{2}$	½
	$\text{RHS} = \dfrac{1-\tan^2 30^\circ}{1+\tan^2 30^\circ} = \dfrac{1-\frac{1}{3}}{1+\frac{1}{3}}$	1
	$= \dfrac{1}{2} = \text{LHS}$	½

23. Find the coordinates of the points of trisection of line segment joining the points (–4, 1) and (6, 5).

Solution:



AP : PB = 1 : 2

$\therefore x_1 = \frac{-8+6}{3} = \frac{-2}{3}$, $y_1 = \frac{5+2}{3} = \frac{7}{3}$

Coordinates of point P are $\left(\frac{-2}{3}, \frac{7}{3}\right)$ ½ + ½

AQ : QB = 2 : 1

$\therefore x_2 = \frac{12-4}{3} = \frac{8}{3}$, $y_2 = \frac{10+1}{3} = \frac{11}{3}$

Coordinates of point Q are $\left(\frac{8}{3}, \frac{11}{3}\right)$ ½ + ½

24. (a) A bag contains 40 marbles out of which some are white and others are black. If the probability of drawing a black marble is $\frac{3}{5}$, then find the number of white marbles.

OR

(b) In a pre-primary class, a teacher put cards numbered 20 to 59 in a bowl. A student picked up a card at random and read the number. Find the probability that the number read was (i) a prime number (ii) a perfect square.

Solution: (a) Let the number of black marbles be n.

P (drawing a black marble) $= \frac{n}{40}$ ½

$\therefore \frac{3}{5} = \frac{n}{40} \Rightarrow n = 24$ 1

Hence, number of white marbles = 16 ½

OR

(b) Total number of cards = 40

(i) P (a prime number) $= \frac{9}{40}$ 1

(ii) P (no. is perfect square) $= \frac{3}{40}$ 1

25. Using distance formula, prove that the points (1, 5), (2, 3) and (3, 1) are collinear.

Solution: Let A(1, 5), B(2, 3) and C(3, 1) be the points

$AB = \sqrt{1^2 + (-2)^2} = \sqrt{5}$ ½

$BC = \sqrt{1^2 + (-2)^2} = \sqrt{5}$	½
$AC = \sqrt{2^2 + (-4)^2} = \sqrt{20}$ or $2\sqrt{5}$	½
$\therefore$ AB + BC = AC, therefore points A, B and C are collinear.	½

Section – C

(Short Answer Type Questions) **6 × 3 = 18**

Q. Nos. **26** to **31** are Short Answer type questions of **3** marks each.

26. (a) If α, β are zeroes of the polynomial $3x^2 - 8x + 4$, then form a quadratic polynomial in x whose zeroes are $\frac{1}{\alpha}$ and $\frac{1}{\beta}$.

OR

(b) Find zeroes of the polynomial $6x^2 - 7x - 3$ and verify the relationship between zeroes and its coefficients.

Solution:

(a) $p(x) = 3x^2 - 8x + 4$

$\alpha + \beta = \frac{8}{3}, \alpha\beta = \frac{4}{3}$ ½ + ½

$\therefore \frac{1}{\alpha} + \frac{1}{\beta} = \frac{\alpha + \beta}{\alpha\beta} = 2$ ½

and $\frac{1}{\alpha\beta} = \frac{3}{4}$ ½

$\therefore$ required polynomial is $x^2 - 2x + \frac{3}{4}$ 1

or $k(4x^2 - 8x + 3)$, where k is a non-zero real number.

OR

(b) $p(x) = 6x^2 - 7x - 3 = (2x - 3)(3x + 1)$

Zeroes of p(x) are $\frac{3}{2}$ and $-\frac{1}{3}$ 1

Sum of zeroes $= \frac{3}{2} - \frac{1}{3} = \frac{7}{6} = -\frac{\text{coefficient of x}}{\text{coeffiecient of x}^2}$ 1

Product of zeroes $= \frac{3}{2} \times \frac{-1}{3} = \frac{-3}{6} = \frac{\text{constant term}}{\text{coeffiecient of x}^2}$ 1

27. The sum of the squares of two consecutive even numbers is 452. Find the numbers.

Solution: Let the two consecutive even numbers be x and x + 2. ½

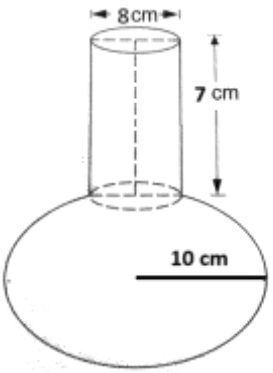
A.T.Q.

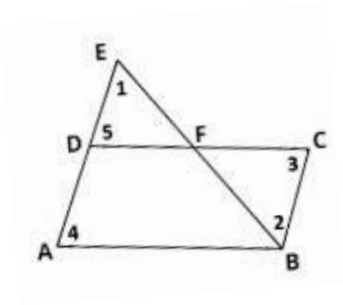
$x^2 + (x + 2)^2 = 452$ 1

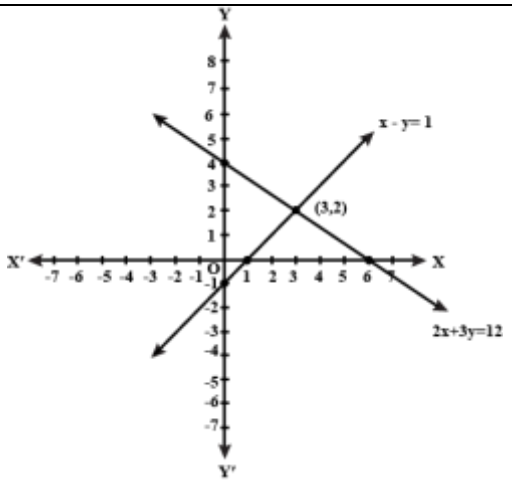
$\Rightarrow x^2 + 2x - 224 = 0$

$\Rightarrow (x + 16)(x - 14) = 0$ 1

$\Rightarrow x = 14$

Required numbers are 14 and 16.	½
28. Prove that $(\text{cosec } A + \sin A)^2 + (\sec A + \cos A)^2 = 7 + \tan^2 A + \cot^2 A$.	
Solution: $\text{LHS} = \text{cosec}^2 A + \sin^2 A + 2 \text{ cosec } A \sin A + \sec^2 A + \cos^2 A + 2 \cos A \sec A$ $= (\sin^2 A + \cos^2 A) + (1 + \tan^2 A) + (1 + \cot^2 A) + 4$ $= 7 + \tan^2 A + \cot^2 A = \text{RHS}$	1 1 1
29. The traffic lights at three different road crossings change after every 45 seconds, 75 seconds and 60 seconds respectively. If they change together at 5.00 a.m., then at what time they will change together next ?	
Solution: $45 = 3^2 \times 5, 75 = 3 \times 5^2, 60 = 2^2 \times 3 \times 5$ LCM $(45, 75, 60) = 2^2 \times 3^2 \times 5^2 = 900$ 900 seconds = 15 minutes Lights will change together at 5:15 a.m. again	1½ ½ ½ ½
30. (a) A spherical glass vessel has a cylindrical neck 7 cm long and 8 cm in diameter. The radius of spherical part is 10 cm. Find the volume of the vessel. **OR** (b) From each end of a solid cylinder of height 20 cm and base radius 7 cm, a cone of base radius 2.1 cm and height 5 cm is scooped out. Find the volume of the remaining solid.	
Solution:  (a) Volume of the vessel $= \frac{4}{3} \times \frac{22}{7} \times 10 \times 10 \times 10 + \frac{22}{7} \times 4 \times 4 \times 7$ $= 4190{\cdot}4 + 352 = 4542{\cdot}48$ cu. cm **OR** (b) Volume of cylinder $= \frac{22}{7} \times 7 \times 7 \times 20 = 3080$ cu. cm Volume of cones $= 2 \times \frac{1}{3} \times \frac{22}{7} \times \frac{21}{10} \times \frac{21}{10} \times 5 = 46{\cdot}2$ cu. cm	1 + 1 1 1 1

Volume of remaining solid = 3080 – 46·2 = 3033·8 cu. cm	1
31. Point E lies on the extended side AD of parallelogram ABCD. BE intersects CD at F. Show that (i) ΔDFE ~ ΔCFB (ii) ΔAEB ~ ΔCBF.	
Solution:  (i) In △DFE and △CFB ∠5 = ∠3 (Alternate Interior Angle) ∠1 = ∠2 (Alternate Interior Angle) ∴ By AA similarity criterion, △DFE ~ △CFB (ii) In △AEB and △CBF ∠1 = ∠2 (Alternate Interior Angle) ∠4 = ∠3 (Opposite angles of a parallelogram) ∴ By AA similarity criterion, △AEB ~ △CBF	Correct Figure ½ 1 ½ ½ ½
Section – D **(Long Answer Type Questions)** **4 × 5 = 20** Q. Nos. **32** to **35** are Long Answer type questions of **5** marks each. 32. Determine graphically whether the following pair of linear equations $2x + 3y = 12$ and $x - y = 1$ has unique solution or infinitely many solutions.	
Solution: Correct graph of each equation	2 + 2



Since lines are intersecting at a point so, equations have unique solution. 1

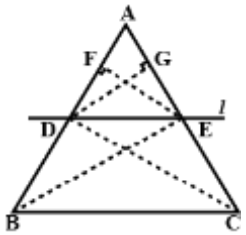
33. (a) If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, then prove that the other two sides are divided in the same ratio.

OR

(b) It is given that sides AB and AC and median AD of ΔABC are respectively proportional to sides PQ and PR and median PM of another ΔPQR. Show that $\Delta ABC \sim \Delta PQR$.

Solution:

Correct Figure ½



Given: In Δ ABC, DE || BC

To Prove: $\frac{AD}{DB} = \frac{AE}{EC}$ 1

Construction: Join BE, DC, Draw DG $\perp$ AC and EF $\perp$ AB

Proof: $\frac{ar(\Delta ADE)}{ar(\Delta BDE)} = \frac{\frac{1}{2} \times AD \times EF}{\frac{1}{2} \times DB \times EF} = \frac{AD}{DB}$ .....(i) 1

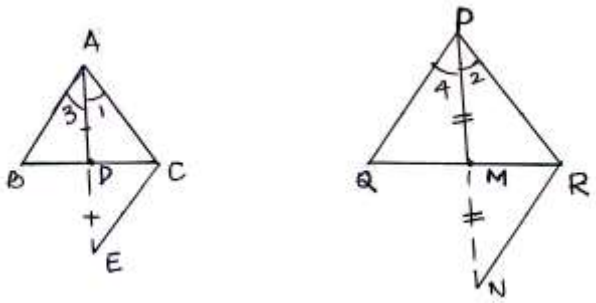
and $\frac{ar(\Delta ADE)}{ar(\Delta CDE)} = \frac{\frac{1}{2} \times AE \times DG}{\frac{1}{2} \times EC \times DG} = \frac{AE}{EC}$ ..... (ii) 1

As ΔBDE and ΔCDE are on the same base DE and between the same parallels DE and BC.

$\therefore$ ar(ΔBDE) = ar(ΔCDE) .....(iii) 1

From (i), (ii) and (iii), we get $\frac{AD}{DB} = \frac{AE}{EC}$ ½

OR



Correct Figure 1

Extend AD to E and PM to N such that AD = DE and PM = MN.

Proving $\Delta DAB \cong \Delta DEC$ (By SAS congruency criterion) — 1

Similarly, $\Delta MPQ \cong \Delta MNR$

$\therefore AB = CE$ and $PQ = NR$ (by cpct) — ½

Given $\frac{AB}{PQ} = \frac{AD}{PM} = \frac{AC}{PR}$

$\Rightarrow \frac{CE}{NR} = \frac{AE/2}{PN/2} = \frac{AC}{PR}$

$\Rightarrow \frac{CE}{NR} = \frac{AE}{PN} = \frac{AC}{PR}$ — 1

Hence $\Delta CAE \sim \Delta RPN$ (By SSS similarity criterion) — ½

$\Rightarrow \angle 1 = \angle 2$, similarly $\angle 3 = \angle 4$

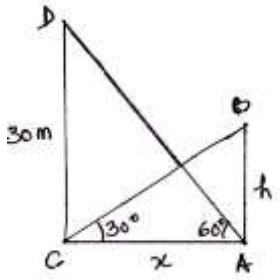
Adding, we get $\angle 1 + \angle 3 = \angle 2 + \angle 4$ — ½

or $\angle BAC = \angle QPR$

Hence, $\Delta ABC \sim \Delta PQR$ (By SAS similarity criterion) — ½

34. The angle of elevation of the top of a building from the foot of the tower is 30° and the angle of elevation of the top of the tower from the foot of the building is 60°. If the tower is 30 m high, find the height of the building and distance between the building and the tower. (Use $\sqrt{3} = 1.73$)

Solution:



Correct Figure 1

Let AB be the building and CD be the tower.

In $\triangle ACD$, $\tan 60° = \frac{30}{x} \Rightarrow x = 10\sqrt{3}$ .....(i) — 1 + ½

In $\triangle CAB$, $\tan 30° = \frac{h}{x} \Rightarrow x = h\sqrt{3}$ ..... (ii) — 1 + ½

Using (i) and (ii) $h = 10$, $x = 10 \times 1{\cdot}73 = 17{\cdot}3$ — ½ + ½

$\therefore$ Height of the building = 10 m and distance between the building and the tower = 17·3 m

35. (a) Find 'mean' and 'mode' of the following data :

Class	10-25	25-40	40-55	55-70	70-85	85-100
Number of Students	12	10	15	13	8	12

OR

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

Age (in years)	5-15	15-25	25-35	35-45	45-55	55-65
Number of Patients	7	10	21	22	15	5

Find 'mode' and 'median' of the above data.

Solution: (a)

CI	x_i	f_i	$u_i = \frac{x_i - 47{\cdot}5}{15}$	$f_i u_i$
10 – 25	17·5	12	– 2	– 24
25 – 40	32·5	10	– 1	– 10
40 – 55	47·5	15	0	0
55 – 70	62·5	13	1	13
70 – 85	77·5	8	2	16
85 – 100	92·5	12	3	36
		70		31

Correct Table 1½

$\text{Mean} = 47{\cdot}5 + 15 \times \frac{31}{70} = 54{\cdot}14$ 1½

Modal class is 40 – 55

$\text{Mode} = 40 + 15 \times \frac{15 - 10}{30 - 10 - 13}$ 1½

$= 50{\cdot}71$ ½

OR

(b)

C I	5-15	15-25	25-35	35-45	45-55	55-65
f	7	10	21	22	15	5
cf	7	17	38	60	75	N = 80

Correct Table 1

Median class is 35 – 45

$\text{Median} = 35 + \frac{10}{22} \times (40 - 38)$ 1½

$= 35{\cdot}91$ ½

Modal class is 35 – 45

$\text{Mode} = 35 + \frac{22 - 21}{44 - 21 - 15} \times 10$	1½
$= 36{\cdot}25$	½

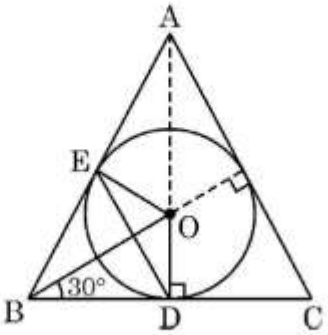
Section – E

(Case-study based Questions) **3 × 4 = 12**

Q. Nos. **36** to **38** are Case-study based Questions of **4** marks each.

36.





In a Fine Arts class, students were asked to design triangular tiles in geometric pattern.

Neelima made a circular design inside an equilateral triangle ABC. The radius of the circle is 4 cm. Observe the diagram and answer the following questions :

(i) Determine the length OB.

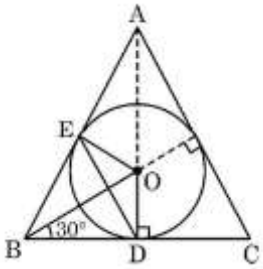
(ii) Is DE || CA ? Give reason for your answer.

(iii) (a) Write all angles of quadrilateral OEBD and show that it is a cyclic quadrilateral.

OR

(iii) (b) Find the perimeter of ΔABC. (Use $\sqrt{3} = 1.73$)

Solution:



(i) In $\triangle ODB$, $\sin 30° = \frac{4}{OB} \Rightarrow OB = 8$ cm — 1

(ii) Yes, DE || CA — ½

Δ ABC is an equilateral triangle and AD$\perp$ BC

$\Rightarrow$ D is the mid point of BC — ½

Similarly, E is the mid point of AB, so DE || CA

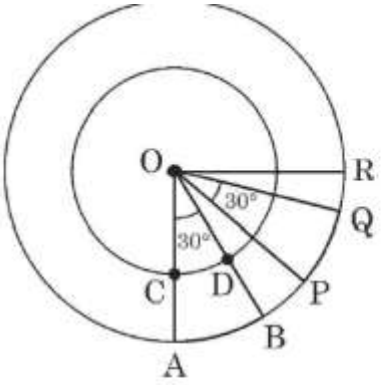
(iii) (a) $\angle EBD = 60° \Rightarrow \angle EOD = 120°$ — ½

$\angle OEB = \angle ODB = 90°$ — ½

(radius is perpendicular to the tangent through the point of contact)

	$\angle OEB + \angle ODB = 90° + 90° = 180°$ $\therefore$ quad. OEBD is a cyclic quad. **OR**	½ ½
	(iii) (b) In $\triangle OBD$, $\cos 30° = \frac{BD}{8} \Rightarrow BD = 6{\cdot}92$ cm $BC = 2\ BD = 13.84$ cm $\therefore$ Perimeter of Δ ABC = 41·52 cm	1 1

37. 



A farmer has put up a decorative windmill in his farm in which there are eight blades of equal width and equally placed in a circular arrangement. A circular wire goes through them.

The diagram shows two blades OAB and OPQ in a quarter circle with centre O. $\angle AOB = \angle POQ = 30°$, OA = 28 cm, OC = 21 cm.

O is the centre of both the circles.

(i) Determine the measure of $\angle BOP$.

(ii) Find length of arc CD.

(iii) (a) Find the area of region CABD.

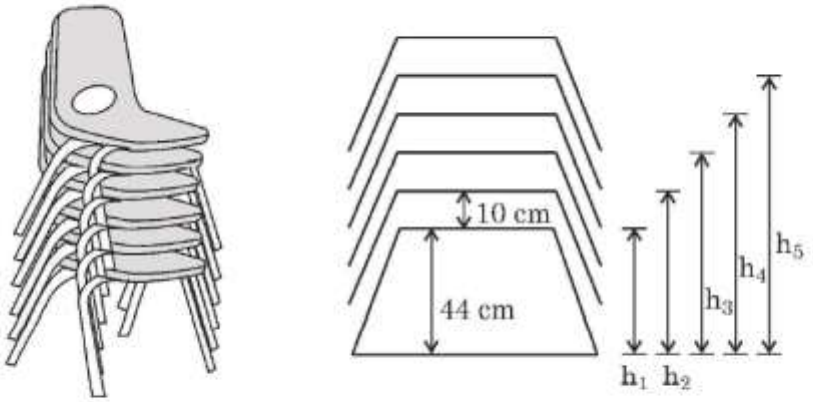
OR

(iii) (b) Find perimeter of region CABD.

Solution: (i)	$\angle AOC = 90°$ and blades are equally placed $\therefore \angle BOP = \frac{1}{2}(90° - 60°) = 15°$	 1
(ii)	Length of arc CD $= \frac{30}{360} \times 2 \times \frac{22}{7} \times 21 = 11$ cm	1
(iii) (a)	Area CABD $= \frac{30}{360} \times \frac{22}{7} \times (28^2 - 21^2)$	1
	$= 89.8$ sq. cm	1

OR (iii) (b) Length of arc AB $= \frac{30}{360} \times 2 \times \frac{22}{7} \times 28 = \frac{44}{3} = 14{\cdot}67$ cm Perimeter of CABD $= 14{\cdot}67 + 11 + 2 \times (28 - 21) = 39{\cdot}67$ cm	1 1

38. A tent house owner provides furniture on rent. He stacks chairs in his shop to save space.



In the diagram, the height of seat of chair from ground is represented by h_1, h_2, h_3, ... The height of first seat is 44 cm from ground level and gap between every two seats is 10 cm.

(i) Write the values of h_1, h_2, h_3, h_4 and h_5 in this order only.

(ii) Show that the above values form an A.P. Write its first term and common difference.

(iii) (a) If chairs can be stacked up to the maximum height of 160 cm, then find the maximum number of chairs in a stack.

OR

(iii) (b) Is it possible to stack 15 chairs if maximum height of the stack can not be more than 180 cm ? Justify your answer.

Solution: (i)	$h_1 = 44$, $h_2 = 54$, $h_3 = 64$, $h_4 = 74$, $h_5 = 84$	1
(ii)	Since gap between heights of seats of every two adjacent chairs is same $\therefore h_1, h_2, h_3$, ... form an A.P. Here, $a = 44$ and $d = 10$	½ ½

(iii) (a)	$160 = 44 + (n - 1) \times 10$ $\Rightarrow n = 12{\cdot}6$ $\therefore$ maximum 12 chairs can be stacked up. **OR**	1 ½ ½
(iii) (b)	$h_{15} = 44 + 14 \times 10$ $= 184$ cm 184 cm $>$ 180 cm $\therefore$ 15 chairs cannot be stacked up	1 ½ ½