Series : D7EGF

SET-2

रोल नं.
Roll No.

प्रश्न-पत्र कोड
Q.P. Code **430/7/2**

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

नोट / NOTE : [ ]

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

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

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

(IV) **कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में यथा स्थान पर प्रश्न का क्रमांक अवश्य लिखें।**
Please write down the Serial Number of the question in the answer-book at the given place before attempting it.

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

गणित (बुनियादी)
MATHEMATICS (BASIC)

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

सामान्य निर्देश :

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

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

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

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

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

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

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

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

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

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

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

खण्ड क

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

1. (1, 1) पर केंद्रित वृत्त बिंदु (2, – 3) से होकर गुज़रता है। वृत्त का व्यास है :

(A) $2\sqrt{17}$ (B) $\sqrt{13}$

(C) $2\sqrt{13}$ (D) $\sqrt{17}$

General Instructions :

Read the following instructions very carefully and strictly follow them :

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

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

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

(iv) *In **Section B,** Questions no. **21** to **25** are Very Short Answer (VSA) type questions, carrying **2** marks each.*

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

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

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

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

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

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

SECTION A

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

1. The diameter of a circle passing through (2, – 3) and centred at (1, 1) is :

(A) $2\sqrt{17}$ (B) $\sqrt{13}$

(C) $2\sqrt{13}$ (D) $\sqrt{17}$

2. यदि बिंदु P(a, $\frac{14}{3}$), बिंदुओं A(1, 2) तथा B(–1, 6) को जोड़ने वाले रेखाखंड को 2 : 1 के अनुपात में विभाजित करता है, तो 'a' का मान है :

(A) $\frac{1}{3}$ (B) $\frac{13}{3}$

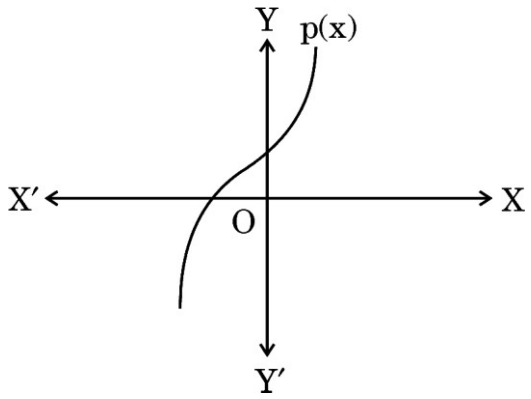
(C) $-\frac{1}{3}$ (D) $\frac{10}{3}$

3. समांतर श्रेढ़ी (AP) – 18, – 2, 14, ... का nवाँ पद है :

(A) 16n – 2 (B) 20n – 38

(C) 16n – 34 (D) 20n + 2

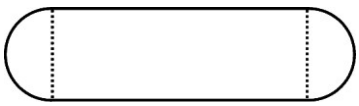
4. यहाँ बहुपद p(x) का ग्राफ दिखाया गया है। p(x) के शून्यकों की संख्या है :



(A) 3 (B) 0

(C) 2 (D) 1

5. दवा का एक कैप्सूल जिसकी लम्बाई 13 mm है, एक बेलन के आकार का है। इसके दोनों सिरों पर समान त्रिज्या वाला एक-एक अर्धगोला लगा हुआ है। यदि बेलनाकार भाग की लंबाई 8 mm है, तो कैप्सूल का व्यास है :



(A) 2 mm (B) 5 mm

(C) 2·5 mm (D) 4 mm

2. If point P(a, $\frac{14}{3}$) divides the line segment joining the points A(1, 2) and B(–1, 6) in the ratio 2 : 1, then the value of 'a' is :

(A) $\frac{1}{3}$ (B) $\frac{13}{3}$

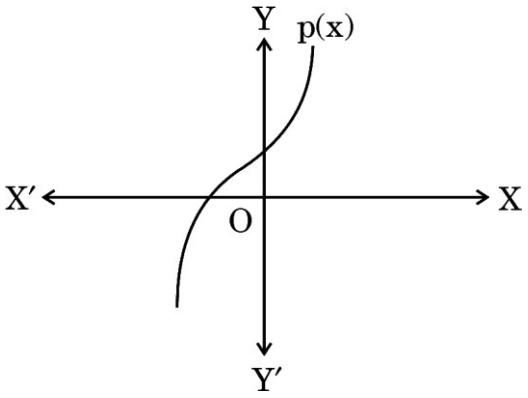
(C) $-\frac{1}{3}$ (D) $\frac{10}{3}$

3. The n^{th} term of the AP $-18, -2, 14, \ldots$ is :

(A) $16n - 2$ (B) $20n - 38$

(C) $16n - 34$ (D) $20n + 2$

4. The graph of the polynomial p(x) is shown here. The number of zeroes of p(x) is :



(A) 3 (B) 0

(C) 2 (D) 1

5. A medicine capsule of length 13 mm is in the shape of a cylinder with two hemispheres of same radii stuck to each of its ends. If the length of the cylindrical part is 8 mm, the diameter of the capsule is :



(A) 2 mm (B) 5 mm

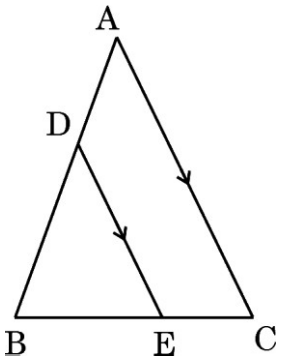
(C) 2·5 mm (D) 4 mm

6. किसी घटना के होने की प्रायिकता 0·098 है । यदि संभावित परिणामों की कुल संख्या 500 है, तो अनुकूल परिणामों की संख्या है :

(A) 98 (B) 50

(C) 49·5 (D) 49

7. दी गई आकृति में, DE || AC है । यदि BE = 5 cm, EC = 3 cm तथा AB = 10 cm है, तो AD की लंबाई है :



(A) $\frac{15}{4}$ cm (B) $\frac{80}{3}$ cm

(C) 6 cm (D) $\frac{10}{11}$ cm

8. 52 पत्तों की अच्छी प्रकार से फेंटी हुई एक ताश की गड्डी में से एक पत्ता निकाला जाता है । एक इक्का या एक काला बादशाह प्राप्त करने की प्रायिकता है :

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

(B) $\frac{1}{13}$

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

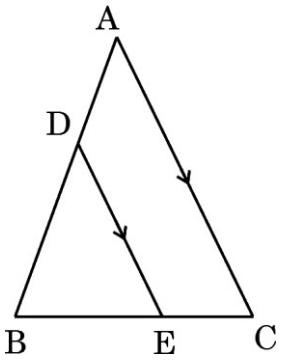
(D) $\frac{3}{13}$

6. The probability of happening of an event is 0·098. If total number of possible outcomes are 500, then the number of favourable outcomes is :

(A) 98 (B) 50

(C) 49·5 (D) 49

7. In the given figure, DE || AC. If BE = 5 cm, EC = 3 cm and AB = 10 cm, then the length of AD is :



(A) $\frac{15}{4}$ cm (B) $\frac{80}{3}$ cm

(C) 6 cm (D) $\frac{10}{11}$ cm

8. A card is drawn from a well shuffled deck of 52 playing cards. The probability of getting an ace or a black king is :

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

(B) $\frac{1}{13}$

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

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

9. एक विद्यालय के 35 छात्रों के भारों (kg में) का एक सर्वेक्षण किया गया तथा निम्नलिखित परिणाम प्राप्त हुए :

माध्य = 43 kg तथा माध्यक = 45 kg

अधिकतम छात्रों का भार है :

(A) 46 kg (B) 39 kg

(C) 49 kg (D) 42 kg

10. राजू ने जन्मदिन पर पहने जाने वाली शंक्वाकार टोपी पहनी है, जिसकी ऊँचाई 24 cm तथा व्यास 16 cm है। टोपी की तिर्यक ऊँचाई है :

(A) $8\sqrt{10}$ cm (B) 25 cm

(C) $10\sqrt{8}$ cm (D) $\sqrt{80}$ cm

11. एक द्विघात बहुपद के शून्यकों का योगफल 2 तथा गुणनफल – 7 है। यह बहुपद है :

(A) $x^2 - 2x + 7$ (B) $4(x^2 + 2x - 7)$

(C) $(x - 2)(x + 7)$ (D) $3(x^2 - 2x - 7)$

12. रैखिक समीकरण निकाय $4x - 12y = k$ तथा $x = 3y + 4$ असंगत पाया गया। k के मान के लिए निम्नलिखित में से कौन-सा सही है ?

(A) $k = 16$

(B) k कोई भी वास्तविक संख्या हो सकती है

(C) $k \neq 16$

(D) $k \neq 0$

13. दो पासे एक साथ फेंके जाते हैं। प्राप्त संख्याओं के समान होने की प्रायिकता है :

(A) $\frac{5}{6}$ (B) $\frac{1}{6}$

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

9. A survey, regarding the weight (in kg) of 35 students of a school, was conducted and the following result was obtained :

Mean = 43 kg and Median = 45 kg

Most of the students are of weight :

(A) 46 kg (B) 39 kg

(C) 49 kg (D) 42 kg

10. Raju is wearing a conical birthday cap of diameter 16 cm and height 24 cm. The slant height of the cap is :

(A) $8\sqrt{10}$ cm (B) 25 cm

(C) $10\sqrt{8}$ cm (D) $\sqrt{80}$ cm

11. A quadratic polynomial having sum and product of its zeroes as 2 and – 7 respectively, is :

(A) $x^2 - 2x + 7$ (B) $4(x^2 + 2x - 7)$

(C) $(x - 2)(x + 7)$ (D) $3(x^2 - 2x - 7)$

12. The system of linear equations $4x - 12y = k$ and $x = 3y + 4$ is found inconsistent. Which of the following is true for the value of k ?

(A) $k = 16$

(B) k can be any real number

(C) $k \neq 16$

(D) $k \neq 0$

13. Two dice are rolled together. The probability of getting a doublet is :

(A) $\frac{5}{6}$ (B) $\frac{1}{6}$

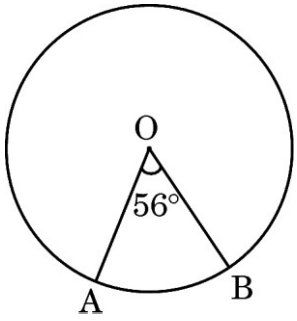
(C) $\frac{1}{3}$ (D) 1

14. 1232 का अभाज्य गुणनखंडन है :

(A) $2^3 \times 7 \times 14$ (B) 2, 4, 7

(C) $2^4 \times 7 \times 11$ (D) 2^4, 7, 11

15. 4·5 cm त्रिज्या वाले वृत्त के केंद्र पर चाप AB, 56° का कोण अंतरित करती है। चाप AB की लंबाई है : ($\pi = \frac{22}{7}$ प्रयोग कीजिए)



(A) 22 cm (B) 4·4 cm

(C) $\frac{44}{5}$ cm (D) 44 cm

16. यदि $\cos A = \frac{1}{m}$ है, तो sin A बराबर है :

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

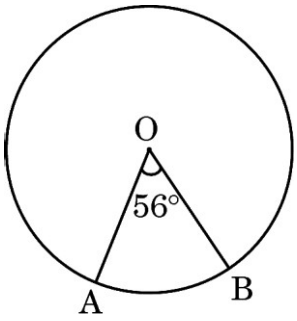
(C) $\sqrt{1 - m^2}$ (D) $\sqrt{m^2 - 1}$

14. Prime factorisation of 1232 is :

(A) $2^3 \times 7 \times 14$ (B) 2, 4, 7

(C) $2^4 \times 7 \times 11$ (D) 2^4, 7, 11

15. An arc AB subtends an angle of 56° at the centre of the circle of radius 4·5 cm. The length of the arc AB is : (Use $\pi = \frac{22}{7}$)



(A) 22 cm (B) 4·4 cm

(C) $\frac{44}{5}$ cm (D) 44 cm

16. If $\cos A = \frac{1}{m}$, then sin A equals :

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

(C) $\sqrt{1 - m^2}$ (D) $\sqrt{m^2 - 1}$

17. बिंदुओं (a, 1) और (b, – 2) को जोड़ने वाले रेखाखंड को y-अक्ष 2 : 1 के अनुपात में विभाजित करती है, तो a तथा b के बीच संबंध है :

(A) $a = b$ (B) $a + b = 0$

(C) $2b + a = 0$ (D) $a = 2b$

18. द्विघात समीकरण $4x^2 + 8n = 0$ के मूल वास्तविक तथा भिन्न हैं। n के मान के लिए निम्नलिखित में से कौन-सा सही है ?

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

(C) $n = 2$ (D) $n < 0$

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

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

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

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

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

19. *अभिकथन (A) :* न्यून कोण A के लिए, sec A का मान हमेशा 1 से अधिक होता है।

तर्क (R) : $\sec^2 A = \sqrt{1 + \tan^2 A}$.

20. *अभिकथन (A) :* रैखिक समीकरण युग्म $y = x$ और $y = 2x$ के अनंत रूप से अनेक हल हैं।

तर्क (R) : रैखिक समीकरण युग्म द्वारा निरूपित संपाती रेखाओं के अनंत रूप से अनेक हल होते हैं।

17. If y-axis divides the line segment joining the points (a, 1) and (b, – 2) in the ratio 2 : 1, then the relation between a and b is :

(A) $a = b$ (B) $a + b = 0$

(C) $2b + a = 0$ (D) $a = 2b$

18. The quadratic equation $4x^2 + 8n = 0$ has real and distinct roots. Which of the following is true for the value of n ?

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

(C) $n = 2$ (D) $n < 0$

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

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

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

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

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

19. *Assertion (A) :* For an acute angle A, the value of sec A is always greater than 1.

Reason (R) : $\sec^2 A = \sqrt{1 + \tan^2 A}$.

20. *Assertion (A) :* The pair of linear equations $y = x$ and $y = 2x$ has infinitely many solutions.

Reason (R) : A pair of linear equations represented by coincident lines has infinitely many solutions.

खण्ड ख

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

21. बिजली के बल्बों की लड़ी में, हरी रोशनी प्रत्येक 4 सेकण्ड में, लाल रोशनी प्रत्येक 6 सेकण्ड में तथा सफेद रोशनी प्रत्येक 8 सेकण्ड में चमकती है। स्विच ऑन करने पर सभी रोशनी एक साथ चमकीं। अगले दो मिनट में सभी रोशनी एक साथ कितनी बार चमकी थीं ?

22. एक बक्से में 40 गेंदें हैं जिन पर 21 से 60 तक संख्याएँ अंकित हैं। यदि बक्से में से एक गेंद को यादृच्छया निकाला जाए, तो प्रायिकता ज्ञात कीजिए कि प्राप्त संख्या :

(i) एक पूर्ण वर्ग है,

(ii) 8 का गुणज है।

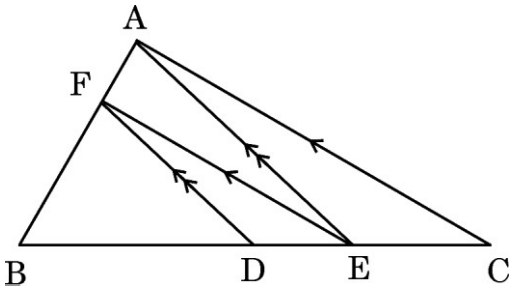
23. (क) निम्नलिखित रैखिक समीकरण युग्म को बीजगणितीय विधि से हल कीजिए :

$$\frac{x}{2} + \frac{2y}{3} = -1 \text{ तथा } x - \frac{y}{3} = 5$$

अथवा

(ख) एक आयत का परिमाप 36 cm है। यदि आयत की लम्बाई, इसकी चौड़ाई से 4 cm अधिक हो, तो आयत की विमाएँ ज्ञात कीजिए।

24. (क) दी गई आकृति में, EF || CA तथा DF || EA है। सिद्ध कीजिए कि $\frac{BD}{DE} = \frac{BE}{EC}$.



अथवा

SECTION B

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

21. In a string of light bulbs, green light flashes every 4^{th} second, red light flashes every 6^{th} second and white light flashes every 8^{th} second. When switched on, all of them flash together. In the next two minutes how many times did they flash together ?

22. A box contains 40 balls which are numbered from 21 to 60. If one ball is drawn at random from the box, find the probability that it bears :

(i) a perfect square number,

(ii) a multiple of 8.

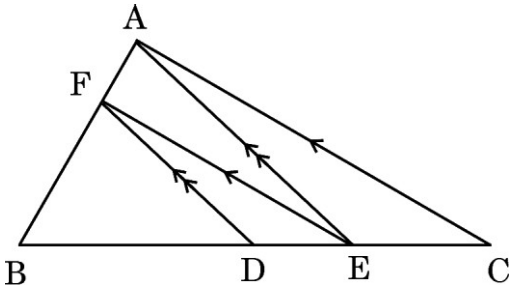
23. (a) Solve the following pair of linear equations algebraically :

$$\frac{x}{2} + \frac{2y}{3} = -1 \text{ and } x - \frac{y}{3} = 5$$

OR

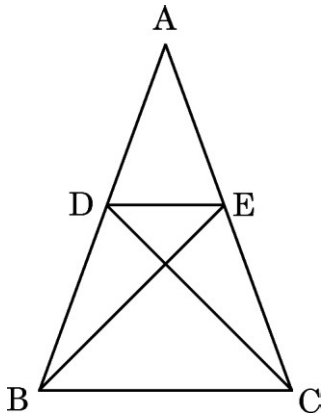
(b) The perimeter of a rectangle is 36 cm. If the length is 4 cm more than the breadth, find the dimensions of the rectangle.

24. (a) In the given figure, EF || CA and DF || EA. Prove that $\frac{BD}{DE} = \frac{BE}{EC}$.



OR

(ख) दी गई आकृति में, Δ ABE $\cong \Delta$ ACD है। दर्शाइए कि Δ ADE $\sim \Delta$ ABC.



25. $\alpha = 45°$ तथा $\beta = 30°$ के लिए सत्यापित कीजिए कि $\sin^2 \alpha \cot \beta = \cos \beta \tan \alpha$.

खण्ड ग

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

26. (क) सिद्ध कीजिए कि :

$$\frac{\cot A - \cos A}{\cot A + \cos A} = \frac{(\text{cosec } A - 1)^2}{\cot^2 A}$$

अथवा

(ख) सिद्ध कीजिए कि :

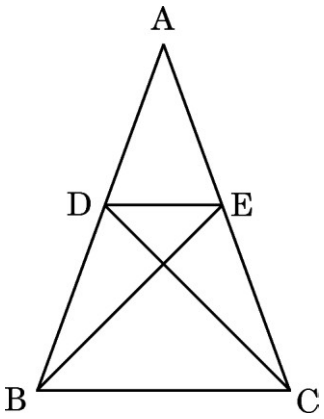
$$\frac{\cos A}{1 - \tan A} + \frac{\sin A}{1 - \cot A} = \sin A + \cos A$$

27. बहुपद $p(x) = 16x^2 - 8x - 3$ के शून्यक ज्ञात कीजिए तथा शून्यकों एवं इसके गुणांकों के बीच के संबंध की सत्यता की जाँच कीजिए।

28. यदि बिंदु P(a, –11), Q(5, b), R(2, 15) तथा S(1, 1) एक समांतर चतुर्भुज PQRS के शीर्ष बिंदु हैं, तो a तथा b के मान ज्ञात कीजिए। अत:, दर्शाइए कि PR $\neq$ QS है।

29. 14 cm त्रिज्या वाले वृत्त की जीवा केन्द्र पर 90° का कोण अंतरित करती है। इस प्रकार बने संगत लघु वृत्तखंड का क्षेत्रफल तथा परिमाप ज्ञात कीजिए। ($\sqrt{2}$ = 1·41 का प्रयोग कीजिए)

(b) In the given figure, Δ ABE $\cong$ Δ ACD. Show that Δ ADE ~ Δ ABC.



25. For $\alpha = 45°$ and $\beta = 30°$, verify that $\sin^2 \alpha \cot \beta = \cos \beta \tan \alpha$.

SECTION C

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

26. (a) Prove that :

$$\frac{\cot A - \cos A}{\cot A + \cos A} = \frac{(\text{cosec } A - 1)^2}{\cot^2 A}$$

OR

(b) Prove that :

$$\frac{\cos A}{1 - \tan A} + \frac{\sin A}{1 - \cot A} = \sin A + \cos A$$

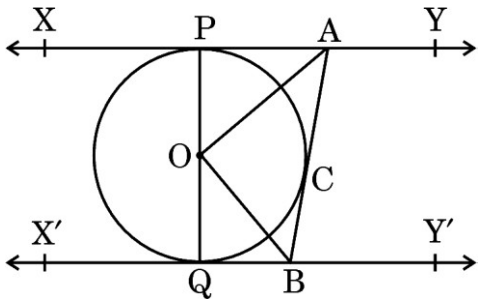
27. Find the zeroes of the polynomial $p(x) = 16x^2 - 8x - 3$ and verify the relationship between the zeroes and its coefficients.

28. If the points P(a, -11), Q(5, b), R(2, 15) and S(1, 1) are the vertices of a parallelogram PQRS, then find the values of a and b. Hence, show that PR $\neq$ QS.

29. In a circle of radius 14 cm, a chord subtends an angle of 90° at the centre. Find the area and perimeter of the minor segment so formed.

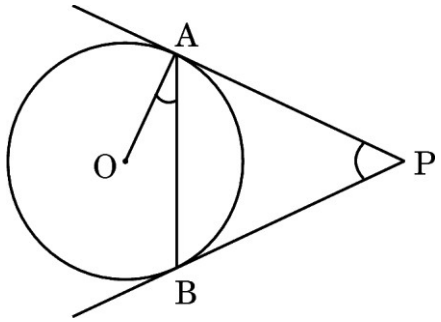
(Use $\sqrt{2} = 1{\cdot}41$)

30. (क) दी गई आकृति में, XY तथा X′Y′, O केंद्र वाले किसी वृत्त पर दो समांतर स्पर्श-रेखाएँ हैं। स्पर्श बिंदु C पर एक अन्य स्पर्श-रेखा AB, XY को A तथा X′Y′ को B पर प्रतिच्छेद करती है। सिद्ध कीजिए कि $\angle AOB = 90°$ है।



अथवा

(ख) केंद्र O वाले वृत्त पर बाह्य बिंदु P से दो स्पर्श-रेखाएँ PA तथा PB खींची गई हैं। सिद्ध कीजिए कि $\angle APB = 2\angle OAB$.



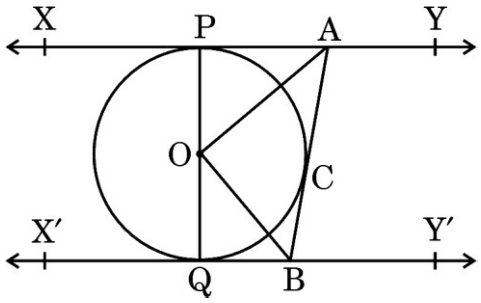
31. सिद्ध कीजिए कि $\sqrt{3}$ एक अपरिमेय संख्या है।

खण्ड घ

*इस खण्ड में **4** दीर्घ-उत्तरीय (LA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक के **5** अंक हैं।* $4\times5=20$

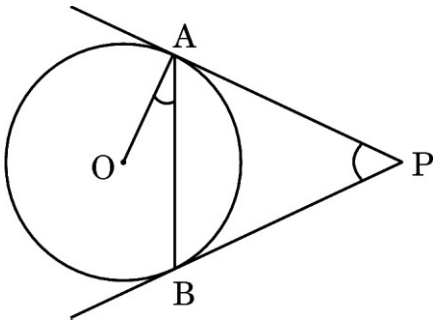
32. भूमि के एक बिंदु से एक 20 m ऊँचे भवन के शिखर पर लगी एक संचार मीनार के तल और शिखर के उन्नयन कोण क्रमश: 45° और 60° हैं। मीनार की ऊँचाई तथा प्रेक्षण बिंदु से मीनार की दूरी ज्ञात कीजिए। ($\sqrt{3}$ = 1·73 प्रयोग लीजिए)

30. (a) In the given figure, XY and X′Y′ are two parallel tangents to a circle with centre O. Another tangent AB with point of contact C, intersects XY at A and X′Y′ at B. Prove that ∠ AOB = 90°.



OR

(b) Two tangents PA and PB are dawn to a circle with centre O, from an external point P. Prove that ∠ APB = 2∠ OAB.



31. Prove that $\sqrt{3}$ is an irrational number.

SECTION D

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

32. From a point on the ground, the angles of elevation of the bottom and the top of a transmission tower fixed at the top of a 20 m high building are 45° and 60° respectively. Find the height of the tower and distance of point of observation from the tower. (Use $\sqrt{3}$ = 1·73)

33. (क) यदि किसी त्रिभुज की एक भुजा के समानांतर अन्य दो भुजाओं को भिन्न-भिन्न बिंदुओं पर प्रतिच्छेद करने के लिए एक रेखा खींची जाए, तो सिद्ध कीजिए कि अन्य दो भुजाएँ एक ही अनुपात में विभाजित हो जाती हैं।

अथवा

(ख) Δ ABC में, F, D और E क्रमशः भुजाओं AB, BC तथा CA के मध्य-बिंदु हैं। सिद्ध कीजिए कि :

(i) Δ AFE ~ Δ ABC

(ii) Δ DEF ~ Δ ABC

34. एक आयताकार खेत के विकर्ण की लंबाई, उसकी छोटी भुजा की लंबाई से 60 m अधिक है। यदि बड़ी भुजा, छोटी भुजा से 30 m अधिक लम्बी हो, तो खेत की विमाएँ ज्ञात कीजिए और खेत का क्षेत्रफल भी ज्ञात कीजिए।

35. (क) निम्नलिखित बारंबारता बंटन का माध्य और बहुलक ज्ञात कीजिए :

वर्ग	10 – 25	25 – 40	40 – 55	55 – 70	70 – 85	85 – 100	100 – 115
बारंबारता	8	7	5	16	4	9	1

अथवा

(ख) निम्नलिखित बारंबारता बंटन का माध्यक 49 है। यदि सभी बारंबारताओं का योगफल 50 हो, तो लुप्त बारंबारताएँ f_1 तथा f_2 ज्ञात कीजिए।

वर्ग	0 – 15	15 – 30	30 – 45	45 – 60	60 – 75	75 – 90
बारंबारता	5	f_1	12	15	f_2	8

33. (a) If a line a 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) In a Δ ABC, F, D and E are mid-points of sides AB, BC and CA respectively. Prove that :

(i) Δ AFE ~ Δ ABC

(ii) Δ DEF ~ Δ ABC

34. The length of the diagonal of a rectangular field is 60 m more than the length of its shorter side. If the larger side is 30 m longer than the shorter side, then find the dimensions of the field and hence its area.

35. (a) Find mean and mode of the following frequency distribution :

Class	10 – 25	25 – 40	40 – 55	55 – 70	70 – 85	85 – 100	100 – 115
Frequency	8	7	5	16	4	9	1

OR

(b) The median of the following frequency distribution is 49. Find the missing frequencies f_1 and f_2, when the sum of all frequencies is 50.

Class	0 – 15	15 – 30	30 – 45	45 – 60	60 – 75	75 – 90
Frequency	5	f_1	12	15	f_2	8

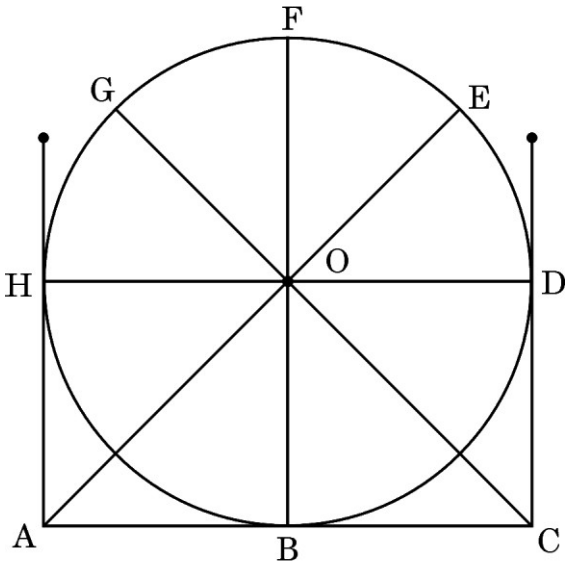
खण्ड ङ

*इस खण्ड में **3** प्रकरण अध्ययन आधारित प्रश्न हैं, जिनमें प्रत्येक के **4** अंक हैं।* $3 \times 4 = 12$

प्रकरण अध्ययन – 1

36.





ऊपर दिए गए चित्र में, आयताकार फ्रेम HACD में लगा एक वृत्ताकार गेट दिखाया गया है। इस चित्र की आकृति को देखिए। चार छड़ी परिधि के अनुदिश समान रूप से लगाई गई हैं, जो केंद्र O पर मिलती हैं। वृत्त की परिधि 22 फुट है।

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

(i) द्वार की ऊँचाई ज्ञात कीजिए। *1*

(ii) $\angle$ HOC का मान ज्ञात कीजिए। *1*

(iii) (क) दर्शाइए कि OHAB एक वर्ग है। *2*

अथवा

(ख) आयत HACD को लोहे की चादर से ढका जाए, तो चादर का क्षेत्रफल ज्ञात कीजिए। *2*

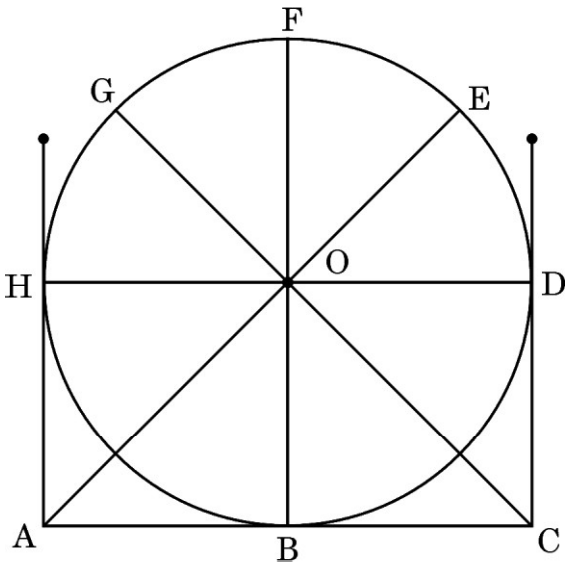
SECTION E

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

Case Study – 1

36.





The picture given above shows a circular gate fixed in a rectangular frame HACD. Observe the diagram of the same. Four rods are placed evenly along the circumference, intersecting at centre O. The circumference of the circle is 22 feet.

Based on the above information, answer the following questions :

(i) Find the height of the gate. *1*

(ii) Determine m $\angle$ HOC. *1*

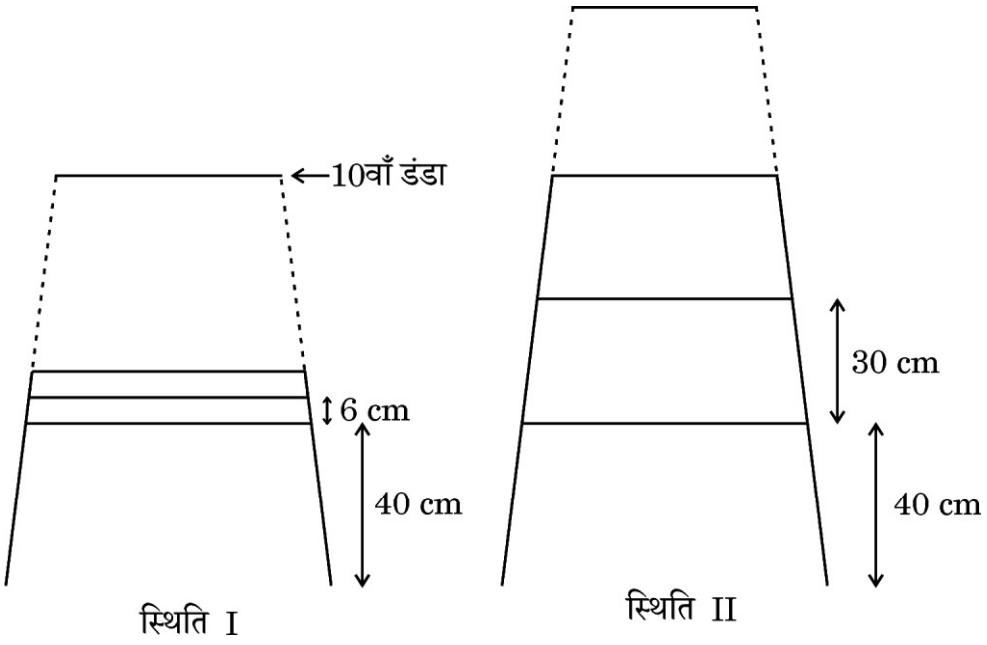
(iii) (a) Show that OHAB is a square. *2*

OR

(b) Find the area of the iron sheet, required to cover the rectangle HACD. *2*

प्रकरण अध्ययन – 2

37. एक फोल्ड होने वाली सीढ़ी के दस डंडे (steps) हैं। बंद स्थिति (स्थिति I) में, दो क्रमागत डंडों के बीच की दूरी 6 cm है तथा खोलने पर (स्थिति II) यही दूरी 30 cm हो जाती है। भूमि से प्रथम डंडे की दूरी 40 cm है। जब प्रत्येक डंडे की ऊँचाई भूमि से नापी जाती है, तो उसी क्रम में एक समांतर श्रेढ़ी (AP) बनती है।



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

(i) वह समांतर श्रेढ़ी लिखिए, जब सीढ़ी स्थिति I में खड़ी है। *1*

(ii) वह समांतर श्रेढ़ी लिखिए, जब सीढ़ी स्थिति II में खड़ी है। *1*

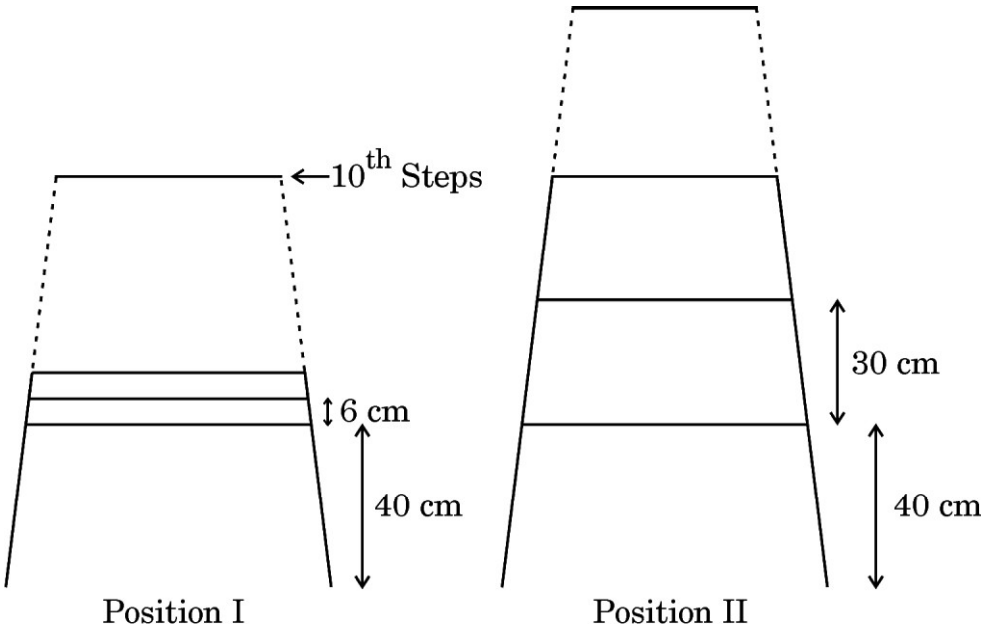
(iii) (क) दोनों स्थितियों में सीढ़ी की कुल ऊँचाई लिखिए। *2*

अथवा

(ख) उस स्थिति में सीढ़ी की ऊँचाई क्या होगी, जब सीढ़ी को केवल सातवें डंडे तक ही खोला जाता है ? *2*

Case Study – 2

37. A foldable ladder has ten steps. In folded position (Position I), the distance between every two consecutive steps is 6 cm, whereas in extended position (Position II) this distance becomes 30 cm. The height of the first step from the ground is 40 cm. When measured, the heights of different steps from the ground, taken in order, form an AP.



Based on the above information, answer the following questions :

(i) Write the AP when the ladder is standing in Position I. *1*

(ii) Write the AP when the ladder is standing in Position II. *1*

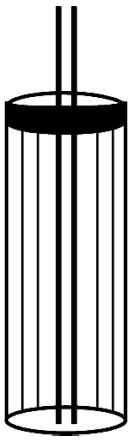
(iii) (a) Write the total height of the ladder in both the situations. *2*

OR

(b) What would be the height of the ladder when the ladder is opened till the seventh step only ? *2*

प्रकरण अध्ययन – 3

38.



तारिणी ने एक बेलनाकार काँच का गिलास खरीदा, जिसकी आंतरिक ऊँचाई 21 cm तथा आंतरिक व्यास 7 cm है। इसके साथ एक स्ट्रॉ (straw) भी आई, जिसकी लम्बाई 24 cm तथा आंतरिक व्यास 1 cm है। तारिणी ने गिलास में ऊपर से 1 cm की जगह छोड़ते हुए पानी भरा है।

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

(i) गिलास में भरे पानी का आयतन ज्ञात कीजिए। *1*

(ii) (क) तारिणी ने 7 बार स्ट्रॉ को पूरा भरते हुए पानी पिया। गिलास में बचे हुए पानी का आयतन ज्ञात कीजिए। *2*

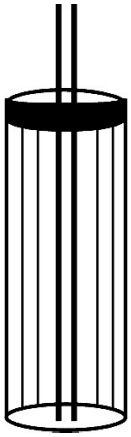
अथवा

(ख) खुले गिलास का आंतरिक कुल पृष्ठीय क्षेत्रफल ज्ञात कीजिए। *2*

(iii) स्ट्रॉ का आंतरिक वक्र पृष्ठीय क्षेत्रफल ज्ञात कीजिए। *1*

Case Study – 3

38.



Tarini bought a glass tumbler which is cylindrical in shape with inner height 21 cm and inner diameter 7 cm. It has a straw of length 24 cm and inner diameter 1 cm. Tarini filled the tumbler with water leaving 1 cm space from the top.

Based on the above information, answer the following questions :

(i) Find the volume of water filled in the tumbler. *1*

(ii) (a) She filled the straw completely 7 times and drank water. Find the volume of water left in the tumbler. *2*

OR

(b) Find the inner total surface area of the tumbler which is open at the top. *2*

(iii) Determine the inner curved surface area of the straw. *1*

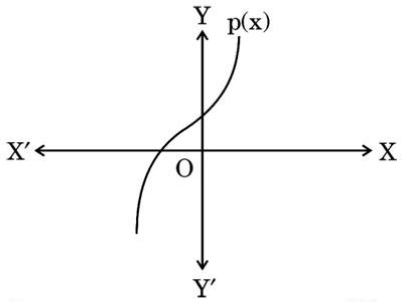
Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2026 (2nd Board Examination)
SUBJECT NAME : Mathematics Basic
(Q.P. CODE / Set No. 241/430-7-2)

General Instructions: -

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

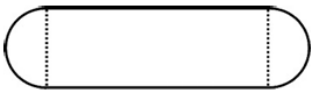
11	A full scale of marks _____ (example 0 to 80/70/60/50/40/30 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.
12	Every examiner has to necessarily do evaluation work for full working hours i.e., 8 hours every day and evaluate 20 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.
19	**If a candidate attempts both alternatives/options in a question where only one option/alternative is required to be attempted, the Evaluator shall award marks in both the options. The system will take the higher of two scores and disregard the other response.**
20	**In a question having two options/alternatives, if a candidate has attempted only one, then the evaluator shall mark "NA" (Not attempted) against the option that has not been attempted by the candidate.**

MARKING SCHEME
Mathematics Basic (Subject Code - 241
(PAPER CODE : 430/7/2)

Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Marks
	SECTION A *This section has **20** Multiple Choice Questions (MCQs) carrying **1** mark each. 20×1=20*	
1.	The diameter of a circle passing through (2, – 3) and centred at (1, 1) is : (A) $2\sqrt{17}$ (B) $\sqrt{13}$ (C) $2\sqrt{13}$ (D) $\sqrt{17}$	
Ans.	(A) $2\sqrt{17}$	**1**
2.	If point P(a, $\frac{14}{3}$) divides the line segment joining the points A(1, 2) and B(–1, 6) in the ratio 2 : 1, then the value of 'a' is : (A) $\frac{1}{3}$ (B) $\frac{13}{3}$ (C) $-\frac{1}{3}$ (D) $\frac{10}{3}$	
Ans.	(C) $-\frac{1}{3}$	**1**
3.	The n^{th} term of the AP – 18, – 2, 14, ... is : (A) 16n – 2 (B) 20n – 38 (C) 16n – 34 (D) 20n + 2	
Ans.	(C) 16n – 34	**1**
4.	The graph of the polynomial p(x) is shown here. The number of zeroes of p(x) is :  (A) 3 (B) 0 (C) 2 (D) 1	

Ans.	(D) 1	**1**

5. A medicine capsule of length 13 mm is in the shape of a cylinder with two hemispheres of same radii stuck to each of its ends. If the length of the cylindrical part is 8 mm, the diameter of the capsule is :



(A) 2 mm (B) 5 mm

(C) 2·5 mm (D) 4 mm

Ans.	(B) 5 mm	**1**

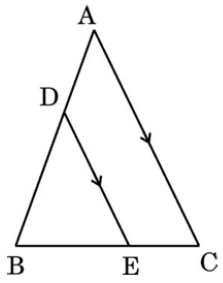
6. The probability of happening of an event is 0·098. If total number of possible outcomes are 500, then the number of favourable outcomes is :

(A) 98 (B) 50

(C) 49·5 (D) 49

Ans.	(D) 49	**1**

7. In the given figure, DE || AC. If BE = 5 cm, EC = 3 cm and AB = 10 cm, then the length of AD is :



(A) $\frac{15}{4}$ cm (B) $\frac{80}{3}$ cm

(C) 6 cm (D) $\frac{10}{11}$ cm

Ans.	(A) $\frac{15}{4}$ cm	**1**

8. A card is drawn from a well shuffled deck of 52 playing cards. The probability of getting an ace or a black king is :

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

(B) $\frac{1}{13}$

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

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

Ans.	(C) $\frac{3}{26}$	**1**

9. A survey, regarding the weight (in kg) of 35 students of a school, was conducted and the following result was obtained :

Mean = 43 kg and Median = 45 kg

Most of the students are of weight :

(A) 46 kg (B) 39 kg

(C) 49 kg (D) 42 kg

Ans.	(C) 49 kg	**1**

10. Raju is wearing a conical birthday cap of diameter 16 cm and height 24 cm. The slant height of the cap is :

(A) $8\sqrt{10}$ cm (B) 25 cm

(C) $10\sqrt{8}$ cm (D) $\sqrt{80}$ cm

Ans.	(A) $8\sqrt{10}$ cm	**1**

11. A quadratic polynomial having sum and product of its zeroes as 2 and – 7 respectively, is :

(A) $x^2 - 2x + 7$ (B) $4(x^2 + 2x - 7)$

(C) $(x - 2)(x + 7)$ (D) $3(x^2 - 2x - 7)$

Ans.	(D) $3(x^2 - 2x - 7)$	**1**

12. The system of linear equations $4x - 12y = k$ and $x = 3y + 4$ is found inconsistent. Which of the following is true for the value of k ?

(A) $k = 16$

(B) k can be any real number

(C) $k \neq 16$

(D) $k \neq 0$

Ans.	(C) $k \neq 16$	**1**

13. Two dice are rolled together. The probability of getting a doublet is :

(A) $\frac{5}{6}$ (B) $\frac{1}{6}$

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

Ans.	(B) $\frac{1}{6}$	**1**

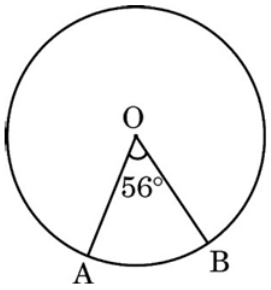
14. Prime factorisation of 1232 is :

(A) $2^3 \times 7 \times 14$ (B) 2, 4, 7

(C) $2^4 \times 7 \times 11$ (D) 2^4, 7, 11

Ans.	(C) $2^4 \times 7 \times 11$	**1**

15. An arc AB subtends an angle of 56° at the centre of the circle of radius 4·5 cm. The length of the arc AB is : (Use $\pi = \frac{22}{7}$)



(A) 22 cm (B) 4·4 cm

(C) $\frac{44}{5}$ cm (D) 44 cm

Ans.	(B) 4·4 cm	**1**

16. If $\cos A = \frac{1}{m}$, then sin A equals :

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

(C) $\sqrt{1-m^2}$ (D) $\sqrt{m^2-1}$

Ans.	(A) $\frac{\sqrt{m^2-1}}{m}$	**1**

17. If y-axis divides the line segment joining the points (a, 1) and (b, – 2) in the ratio 2 : 1, then the relation between a and b is :

(A) a = b (B) a + b = 0

(C) 2b + a = 0 (D) a = 2b

Ans.	(C) 2b + a = 0	**1**

18. The quadratic equation $4x^2 + 8n = 0$ has real and distinct roots. Which of the following is true for the value of n ?

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

(C) $n = 2$ (D) $n < 0$

Ans.	(D) $n < 0$	**1**

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

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

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

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

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

19. *Assertion (A) :* For an acute angle A, the value of sec A is always greater than 1.

Reason (R) : $\sec^2 A = \sqrt{1 + \tan^2 A}$.

Ans.	(C) Assertion (A) is true, but Reason (R) is false.	**1**

20. *Assertion (A) :* The pair of linear equations y = x and y = 2x has infinitely many solutions. *Reason (R) :* A pair of linear equations represented by coincident lines has infinitely many solutions.		
Ans.	(D) Assertion (A) is false, but Reason (R) is true.	**1**

SECTION B

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

21. In a string of light bulbs, green light flashes every 4^{th} second, red light flashes every 6^{th} second and white light flashes every 8^{th} second. When switched on, all of them flash together. In the next two minutes how many times did they flash together ?

Solution:	LCM (6, 8, 4) = 24 It means lights flash together every 24^{th} second. Number of times, lights flash together = $\frac{120}{24} = 5$	**1** **1**

22. A box contains 40 balls which are numbered from 21 to 60. If one ball is drawn at random from the box, find the probability that it bears :

(i) a perfect square number,

(ii) a multiple of 8.

Solution:	(i) Perfect squares are 25, 36, 49 P(a perfect square number) = $\frac{3}{40}$ (ii) Multiples of 8 are 24, 32, 40, 48, 56 P(a multiple of 8) = $\frac{5}{40}$ or $\frac{1}{8}$	**1** **1**

23. (a) Solve the following pair of linear equations algebraically :

$$\frac{x}{2} + \frac{2y}{3} = -1 \text{ and } x - \frac{y}{3} = 5$$

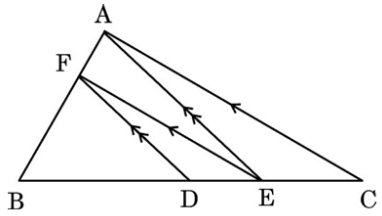
OR

(b) The perimeter of a rectangle is 36 cm. If the length is 4 cm more than the breadth, find the dimensions of the rectangle.

Solution(a):	$\frac{x}{2} + \frac{2y}{3} = -1 \Rightarrow 3x + 4y = -6$ $x - \frac{y}{3} = 5 \Rightarrow 3x - y = 15$	½ ½

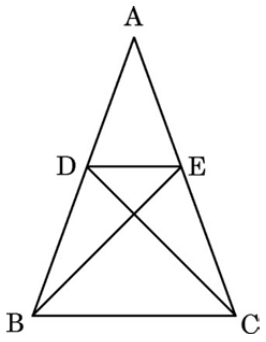
	Getting $x = \frac{18}{5}$ and $y = \frac{-21}{5}$	**1**
	OR	
Solution(b):	Let the length be a cm and breadth be b cm Therefore 2(a + b) = 36 and a = 4 + b Getting a = 11 and b = 7 ∴ length = 11 cm and breadth = 7 cm	 ½ ½ **1**

24. (a) In the given figure, EF || CA and DF || EA. Prove that $\frac{BD}{DE} = \frac{BE}{EC}$.



OR

(b) In the given figure, Δ ABE ≅ Δ ACD. Show that Δ ADE ~ Δ ABC.



Solution(a):	In ΔABC EF || CA $\Rightarrow \frac{BE}{EC} = \frac{BF}{FA}$ --- (i)	**1**
	In ΔABE DF || EA $\Rightarrow \frac{BD}{DE} = \frac{BF}{FA}$ --- (ii)	½
	From (i) and (ii), we get, $\frac{BD}{DE} = \frac{BE}{EC}$	½
	OR	
Solution(b):	Δ ABE ≅ Δ ACD Therefore AB = AC and AE = AD $\Rightarrow \frac{AB}{AD} = \frac{AC}{AE}$ In Δ ADE and Δ ABC, ∠A is common ∴ by SAS similarity Δ ADE ~ Δ ABC	 **1** ½ ½

25. For $\alpha = 45°$ and $\beta = 30°$, verify that $\sin^2 \alpha \cot \beta = \cos \beta \tan \alpha$.

Solution:	LHS $= \left(\frac{1}{\sqrt{2}}\right)^2 \times \sqrt{3} = \frac{\sqrt{3}}{2}$	**1**
	RHS $= 1 \times \frac{\sqrt{3}}{2} = \frac{\sqrt{3}}{2}$	**1**
	Hence verified	

SECTION C

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

26. (a) Prove that :

$$\frac{\cot A - \cos A}{\cot A + \cos A} = \frac{(\text{cosec } A - 1)^2}{\cot^2 A}$$

OR

(b) Prove that :

$$\frac{\cos A}{1 - \tan A} + \frac{\sin A}{1 - \cot A} = \sin A + \cos A$$

Solution(a):	LHS $= \frac{\frac{cosA}{sinA} - \text{cosA}}{\frac{cosA}{sinA} + \text{cosA}}$	**1**
	$= \frac{\cos A}{\cos A}\left(\frac{cosec\ A - 1}{cosec\ A + 1}\right)$	
	$= \frac{cosec\ A - 1}{cosec\ A + 1}$	**1**
	$= \frac{(cosec\ A - 1)^2}{cosec^2 A - 1}$	**1**
	$= \frac{(cosec\ A - 1)^2}{cot^2 A} = \text{RHS}$	

OR

Solution(b):	$\text{LHS} = \frac{\text{cosA}}{1 - \frac{\text{sinA}}{\text{cosA}}} + \frac{\text{sinA}}{1 - \frac{\text{cosA}}{\text{sinA}}}$	**1**
	$= \frac{\cos^2 A}{\text{cosA} - \text{sinA}} + \frac{\sin^2 A}{\text{sinA} - \text{cosA}}$	**1**
	$= \frac{1}{\text{cosA} - \text{sinA}}\left(\cos^2 A - \sin^2 A\right)$	½
	$= \text{cosA} + \text{sinA} = \text{RHS}$	½

27. Find the zeroes of the polynomial $p(x) = 16x^2 - 8x - 3$ and verify the relationship between the zeroes and its coefficients.

Solution:

$p(x) = 16x^2 - 8x - 3$

$= (4x - 3)(4x + 1)$

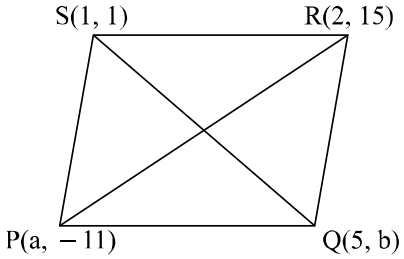
Zeroes of $p(x)$ are $\frac{3}{4}, \frac{-1}{4}$ — **1**

Sum of zeroes $= \frac{3}{4} + \frac{-1}{4} = \frac{2}{4} = -\frac{-8}{16} = -\frac{\text{coefficient of x}}{\text{coefficient of } x^2}$ — **1**

Product of zeroes $= \frac{3}{4} \times \left(\frac{-1}{4}\right) = \frac{-3}{16} = \frac{\text{constant}}{\text{coefficient of } x^2}$. — **1**

28. If the points P(a, −11), Q(5, b), R(2, 15) and S(1, 1) are the vertices of a parallelogram PQRS, then find the values of a and b. Hence, show that PR ≠ QS.

Solution:



Mid pt. of SQ = Mid pt. of PR

$\Rightarrow \left(\frac{5+1}{2}, \frac{b+1}{2}\right) = \left(\frac{a+2}{2}, \frac{-11+15}{2}\right)$ — **1**

$\Rightarrow$ a = 4, b = 3 — **1**

$\therefore$ P(4, − 11) and Q(5, 3)

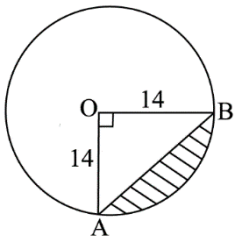
PR $= \sqrt{(2-4)^2 + (15+11)^2} = \sqrt{680}$ — **½**

QS $= \sqrt{(5-1)^2 + (3-1)^2} = \sqrt{20}$ — **½**

PR ≠ QS.

29. In a circle of radius 14 cm, a chord subtends an angle of 90° at the centre. Find the area and perimeter of the minor segment so formed.
(Use $\sqrt{2}$ = 1·41)

Solution:



AB $= 14\sqrt{2} = 14 \times 1.41 = 19.74$ cm — **½**

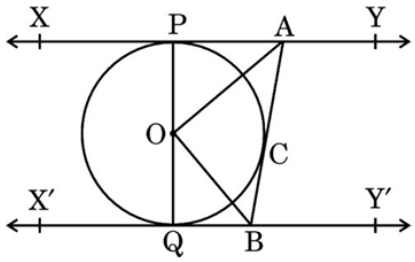
Perimeter of minor segment

$= 19.74 + \frac{90}{360} \times 2 \times \frac{22}{7} \times 14$ — **1**

$= 41.74$ cm

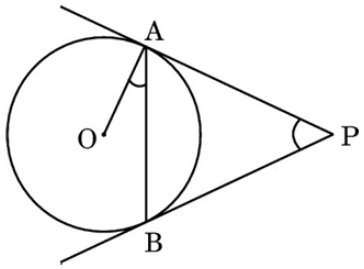
	Area of the minor segment $= \frac{90}{360} \times \frac{22}{7} \times 14 \times 14 - \frac{1}{2} \times 14 \times 14$ $= 56\ cm^2$	**1** **½**

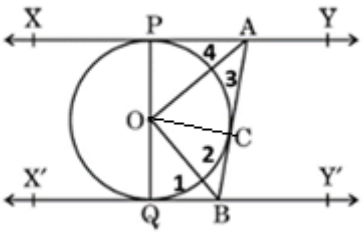
30. (a) In the given figure, XY and $X'Y'$ are two parallel tangents to a circle with centre O. Another tangent AB with point of contact C, intersects XY at A and $X'Y'$ at B. Prove that $\angle AOB = 90°$.



OR

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



Solution(a):	Join OC  Δ OQB $\cong \Delta$ OCB $\Rightarrow \angle 1 = \angle 2$ Δ OCA $\cong \Delta$ OPA $\Rightarrow \angle 3 = \angle 4$ $\angle QBC + \angle PAC = 180^o$ (Co-interior angles) $\therefore \angle 1 + \angle 2 + \angle 3 + \angle 4 = 180°$ $\Rightarrow 2(\angle 2 + \angle 3) = 180° \Rightarrow \angle 2 + \angle 3 = 90°$ Thus in Δ AOB, $\angle AOB = 90°$	**½** **½** **1** **1**
	OR	
Solution(b):	PA = PB $\Rightarrow \angle$ PAB = $\angle$ PBA $\therefore \angle$ APB + 2 $\angle$ PAB = 180^o --- (i)	**½** **1**

	Also OA ⊥ PA $\Rightarrow \angle OAB + \angle PAB = 90°$ --- (ii) Using (i) and (ii) $2\angle OAB = \angle APB$.	**1** **½**

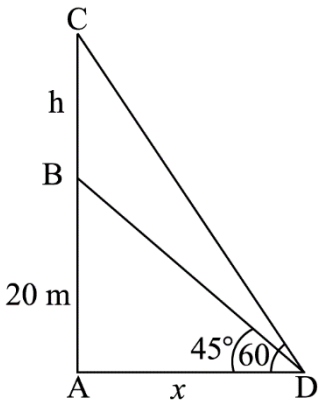
31. Prove that $\sqrt{3}$ is an irrational number.

Solution:	Let $\sqrt{3}$ be a rational number	
	$\therefore \sqrt{3} = \frac{a}{b}$, where a & b are co-prime & $b \neq 0$.	**½**
	$\Rightarrow a^2 = 3b^2$	
	$\Rightarrow$ 3 divides a^2 thus 3 divides a --- (i)	**1**
	Let, for some integer k	
	$a = 3k \Rightarrow b^2 = 3k^2$	**½**
	$\Rightarrow$ 3 divides b^2 thus 3 divides b --- (ii)	**½**
	Using (i) and (ii) a & b both are divisible by 3 which contradicts our assumption	**½**
	$\therefore \sqrt{3}$ is an irrational number.	

SECTION D

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

32. From a point on the ground, the angles of elevation of the bottom and the top of a transmission tower fixed at the top of a 20 m high building are 45° and 60° respectively. Find the height of the tower and distance of point of observation from the tower. (Use $\sqrt{3}$ = 1·73)

Solution:		**For correct fig: 1**
	Let BC be the tower fixed on building AB.	
	$\tan 45° = 1 = \frac{20}{x}$	**1**

	$\Rightarrow x = 20$ Distance of point of observation from the tower = 20 m $\tan 60° = \sqrt{3} = \frac{h+20}{x}$ $\Rightarrow h + 20 = x\sqrt{3}$ $\Rightarrow h = 20(\sqrt{3}-1)$ $= 20 \times 0.73 = 14.6$ m Height of the tower = 14.6 m	½ **1** **1** ½

33. (a) If a line a 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) In a Δ ABC, F, D and E are mid-points of sides AB, BC and CA respectively. Prove that :

(i) Δ AFE ~ Δ ABC

(ii) Δ DEF ~ Δ ABC

Solution(a):

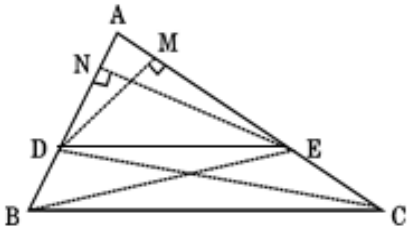


Figure ½

Given: In Δ ABC, DE ∥ BC

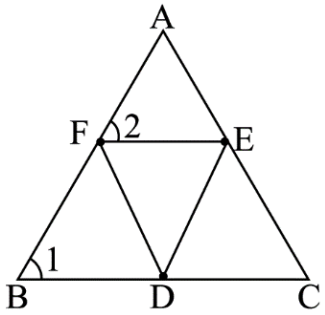
To Prove: $\frac{AD}{DB} = \frac{AE}{EC}$ **1**

Construction: Draw DM ⊥ AC, EN ⊥ AB, join BE and CD

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

$\frac{ar(\Delta ADE)}{ar(\Delta DCE)} = \frac{\frac{1}{2} \times AE \times DM}{\frac{1}{2} \times EC \times DM} = \frac{AE}{EC}$ .....(ii) **1**

As ΔDBE and ΔDCE lie on the same base and between same parallels BC and DE

	$\therefore$ ar (ΔDBE) = ar (ΔDCE) or $\frac{\text{ar}(\Delta ADE)}{\text{ar}(\Delta DBE)} = \frac{\text{ar}(\Delta ADE)}{\text{ar}(\Delta DCE)}$ .....(iii) From (i), (ii) and (iii), we get $\frac{AD}{DB} = \frac{AE}{EC}$	**1** **½**
	OR	
Solution(b):	 (i) E & F are the mid points of AC & AB respectively $\frac{AF}{FB} = \frac{AE}{EC} = 1$ $\therefore$ EF || BC (By converse of BPT) $\Rightarrow \angle 1 = \angle 2$ Also $\angle$A is common in Δ AFE and Δ ABC. $\therefore \Delta$ AFE ~ Δ ABC. (ii) EF || BC (proved above) similarly DE || AB $\therefore$ BDEF is a parallelogram $\angle$B = $\angle$E Similarly AFDE and DCEF are parallelograms $\therefore \angle A = \angle D$ and $\angle C = \angle F$ $\therefore \Delta$ DEF ~ Δ ABC.	**1** **½** **½** **½** **1** **½** **1**
34.	The length of the diagonal of a rectangular field is 60 m more than the length of its shorter side. If the larger side is 30 m longer than the shorter side, then find the dimensions of the field and hence its area.	
Solution:	Let the shorter side be x m $\therefore$ longer side is $(x + 30)$ m Also $x^2 + (x + 30)^2 = (x + 60)^2$ $\Rightarrow x^2 - 60x - 2700 = 0$ $\Rightarrow (x - 90)(x + 30) = 0$ $\Rightarrow x = 90, \quad x = -30$ (Rejected)	**½** **1** **1** **1**

	Longer side = 120 m and Shorter side = 90 m Area of the field = 10800 m^2	**1** **½**

35. (a) Find mean and mode of the following frequency distribution :

Class	10 – 25	25 – 40	40 – 55	55 – 70	70 – 85	85 – 100	100 – 115
Frequency	8	7	5	16	4	9	1

OR

(b) The median of the following frequency distribution is 49. Find the missing frequencies f_1 and f_2, when the sum of all frequencies is 50.

Class	0 – 15	15 – 30	30 – 45	45 – 60	60 – 75	75 – 90
Frequency	5	f_1	12	15	f_2	8

Solution(a):

Class	x_i	f_i	u_i	f_iu_i
10 – 25	17.5	8	– 3	– 24
25 – 40	32.5	7	– 2	– 14
40 – 55	47.5	5	– 1	– 5
55 – 70	62.5	16	0	0
70 – 85	77.5	4	1	4
85 -100	92.5	9	2	18
100 – 115	107.5	1	3	3
Total		50		– 18

Correct table 2

Mean = $62.5 + \frac{-18}{50} \times 15 = 57.1$ **1**

Modal class is 55 – 70

Mode = $55 + \frac{16 - 5}{2 \times 16 - 5 - 4} \times 15$ **1 ½**

$= 55 + \frac{165}{23} = 62.17$ **½**

OR

Solution(b):

Class	Frequency	Cf
0-15	5	5
15-30	f_1	$5 + f_1$
30-45	12	$17 + f_1$
45-60	15	$32 + f_1$
60-75	f_2	$32 + f_1 + f_2$
75-90	8	$40 + f_1 + f_2$
Total	50	

Correct table 1

Thus, $f_1 + f_2 = 10$ ½

$49 = 45 + \left(\frac{25 - (17 + f_1)}{15}\right) \times 15$ **2**

$f_1 = 4$ **1**

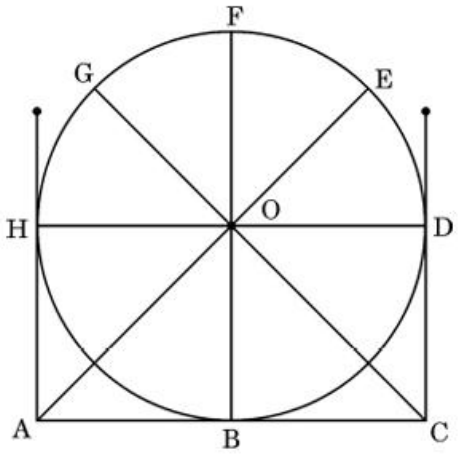
$f_2 = 6$ ½

SECTION E

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

36.





The picture given above shows a circular gate fixed in a rectangular frame HACD. Observe the diagram of the same. Four rods are placed evenly along the circumference, intersecting at centre O. The circumference of the circle is 22 feet.

Based on the above information, answer the following questions :

(i) Find the height of the gate. *1*

(ii) Determine m $\angle$ HOC. *1*

(iii) (a) Show that OHAB is a square. *2*

OR

(b) Find the area of the iron sheet, required to cover the rectangle HACD. *2*

Solution:

(i) $2 \times \frac{22}{7} \times r = 22 \Rightarrow 2r = 7$ **1**

$\therefore$ height of the gate = 7 feet

(ii) $\angle HOC = 3 \times \frac{360}{8} = 135°$ **1**

(iii) (a) Since frame is rectangular

Therefore $\angle HAB = 90°$, ½

HA and AB are tangents thus all angles of OHAB are 90° each. **1**

This is a rectangle.

Also OH = OB (radii) ½

$\therefore$ OHAB is a square.

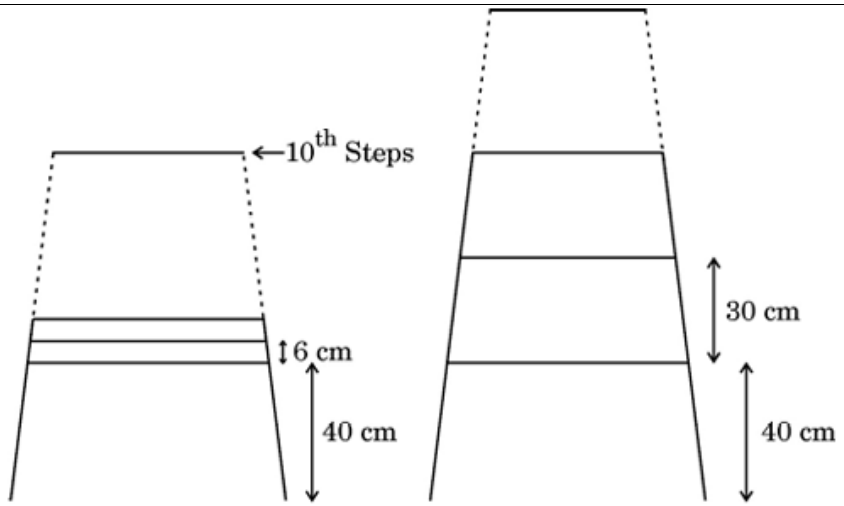
OR

(b) In rectangle HACD, AC = HD = 2r and CD = OB = r

$\therefore$ Area of sheet required = $2r^2 = 2 \times \frac{7}{2} \times \frac{7}{2}$ **1**

$= \frac{49}{2}$ or 24.5 sq. feet **1**

37. A foldable ladder has ten steps. In folded position (Position I), the distance between every two consecutive steps is 6 cm, whereas in extended position (Position II) this distance becomes 30 cm. The height of the first step from the ground is 40 cm. When measured, the heights of different steps from the ground, taken in order, form an AP.



Based on the above information, answer the following questions :

(i) Write the AP when the ladder is standing in Position I. *1*

(ii) Write the AP when the ladder is standing in Position II. *1*

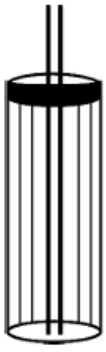
(iii) (a) Write the total height of the ladder in both the situations. *2*

OR

(b) What would be the height of the ladder when the ladder is opened till the seventh step only ? *2*

Solution:	(i) A.P. formed is 40, 46, 52, 58, ----- (ii) A.P. formed is 40, 70, 100, 130, ---- (iii) (a) In position - I Total height = $a_{10} = 40 + 9 \times 6 = 94$ cm. In position - II Total height = $a_{10} = 40 + 9 \times 30 = 310$ cm	**1** **1** **1** **1**
	OR	
	(b) Height of the ladder till 7^{th} step = $40 + 6 \times 30 = 220$ Total height = 220 + 18 = 238 cm.	**1½** **½**

38.



Tarini bought a glass tumbler which is cylindrical in shape with inner height 21 cm and inner diameter 7 cm. It has a straw of length 24 cm and inner diameter 1 cm. Tarini filled the tumbler with water leaving 1 cm space from the top.

Based on the above information, answer the following questions :

(i) Find the volume of water filled in the tumbler. *1*

(ii) (a) She filled the straw completely 7 times and drank water. Find the volume of water left in the tumbler. *2*

OR

(b) Find the inner total surface area of the tumbler which is open at the top. *2*

(iii) Determine the inner curved surface area of the straw. *1*

Solution:

(i) Volume of water in tumbler $= \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times (21 - 1)$ ½

$= 770 \text{ cm}^3$ ½

(ii) (a) Volume of water drank $= 7 \times \frac{22}{7} \times \frac{1}{2} \times \frac{1}{2} \times 24$

$= 132 \text{ cm}^3$ **1**

Volume of water left in the tumbler $= 770 - 132$

$= 638 \text{ cm}^3$ **1**

OR

(ii) (b) Inner TSA $= 2 \times \frac{22}{7} \times 21 \times \frac{7}{2} + \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2}$ **1**

$= 462 + 38.5 = 500.5 \text{ cm}^2$ **1**

(iii) Inner CSA of straw $= 2 \times \frac{22}{7} \times \frac{1}{2} \times 24 = \frac{528}{7} \text{ cm}^2$ or 75.43 cm^2 **1**