

Series : EH5GF



SET ~ 1



रोल नं.

Roll No.



• • •

प्रश्न-पत्र कोड 30/5/1  
Q.P. Code

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

- (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।

• • •

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 (मानक)



MATHEMATICS (Standard)

निर्धारित समय : 3 घण्टे

Time allowed : 3 hours

अधिकतम अंक : 80

Maximum Marks : 80



• • •  
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 प्रश्न (MCQs) 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 2 अंकों के 3 प्रश्नों में आंतरिक विकल्प का प्रावधान दिया गया है।
- (ix) जहाँ आवश्यक हो, स्वच्छ आकृतियाँ बनाएँ। यदि आवश्यक हो तो  $\pi = \frac{22}{7}$  लीजिए, यदि अन्यथा न दिया गया हो।
- (x) कैल्कुलेटर का उपयोग वर्जित है।



• • •

### 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**, question numbers **1** to **18** are Multiple Choice Questions (MCQs) and question numbers **19** and **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, carrying **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 Study based integrated 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 of **2** marks in Section–**E**.*
- (ix) *Draw neat diagrams wherever required. Take  $\pi = \frac{22}{7}$  wherever required, if not stated.*
- (x) *Use of calculators is **NOT** allowed.*



• • •

### खण्ड – क

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

1.  $(\sqrt{3} + 2)^2 + (\sqrt{3} - 2)^2$  एक 1  
 (A) धनात्मक परिमेय संख्या है। (B) ऋणात्मक परिमेय संख्या है।  
 (C) धनात्मक अपरिमेय संख्या है। (D) ऋणात्मक अपरिमेय संख्या है।
  
2. माना  $x = a^2 b^3 c^n$  और  $y = a^3 b^m c^2$ , जहाँ  $a, b, c$  अभाज्य संख्याएँ हैं। यदि  $x$  और  $y$  का LCM  $a^3 b^4 c^3$  है, तो  $m + n$  का मान है : 1  
 (A) 10 (B) 7  
 (C) 6 (D) 5
  
3. किसी अभाज्य संख्या  $p$  के लिए, यदि  $p, a^2$  को विभाजित करती है, जहाँ  $a$  कोई वास्तविक संख्या है, तो  $p$  निम्न में से किसको विभाजित करेगा ? 1  
 (A)  $a$  (B)  $a^{\frac{1}{2}}$   
 (C)  $a^{\frac{3}{2}}$  (D)  $a^{\frac{1}{8}}$
  
4. निम्न में से कौन सा समीकरण, एक द्विघात समीकरण है ? 1  
 (A)  $x^2 + 1 = (x - 1)^2$  (B)  $(x + \sqrt{x})^2 = 2x\sqrt{x}$   
 (C)  $x^3 + 3x^2 = (x + 1)^3$  (D)  $(x + 1)(x - 1) = (x + 1)^2$
  
5. यदि  $x^2 + bx + b = 0$  के दो भिन्न वास्तविक मूल हैं, तो  $b$  का मान हो सकता है : 1  
 (A) 0 (B) 4  
 (C) 3 (D) -3
  
6. नीचे दी गई आकृति में, बिन्दु P, Q, R, रेखा खंड AB को चार समान भागों में विभाजित करते हैं। 1  



A                  P                  Q                  R                  B

 बिन्दु Q, रेखा खंड PB को जिस अनुपात में विभाजित करेगा, वह है :  
 (A) 1 : 3 (B) 2 : 3  
 (C) 1 : 2 (D) 1 : 1

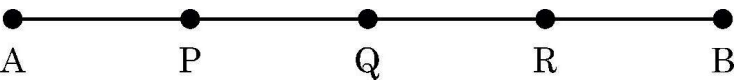


• • •

## SECTION – A

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

1.  $(\sqrt{3} + 2)^2 + (\sqrt{3} - 2)^2$  is a/an 1  
 (A) positive rational number (B) negative rational number  
 (C) positive irrational number (D) negative irrational number
  
2. Let  $x = a^2 b^3 c^n$  and  $y = a^3 b^m c^2$ , where a, b, c are prime numbers. If LCM of x and y is  $a^3 b^4 c^3$ , then the value of m + n 1  
 (A) 10 (B) 7  
 (C) 6 (D) 5
  
3. For any prime number p, if p divides  $a^2$ , where a is any real number then p also divides 1  
 (A) a (B)  $a^{\frac{1}{2}}$   
 (C)  $a^{\frac{3}{2}}$  (D)  $a^{\frac{1}{8}}$
  
4. Which of the following equations is a quadratic equation ? 1  
 (A)  $x^2 + 1 = (x - 1)^2$  (B)  $(x + \sqrt{x})^2 = 2x\sqrt{x}$   
 (C)  $x^3 + 3x^2 = (x + 1)^3$  (D)  $(x + 1)(x - 1) = (x + 1)^2$
  
5. If  $x^2 + bx + b = 0$  has two real and distinct roots, then the value of b can be 1  
 (A) 0 (B) 4  
 (C) 3 (D) -3
  
6. In the figure given below, points P, Q, R divides the line segment AB in four equal parts. 1  



The point Q divides PB in the ratio

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



• • •

7. एक थैले में लाल गेंदों और काली गेंदों का अनुपात 3 : 7 है। एक गेंद यादृच्छया थैले से निकाली जाती है। इस निकाली गई गेंद के काले रंग की होने की प्रायिकता है :

1

- (A)  $\frac{3}{7}$  (B) 0.3  
(C) 0.7 (D)  $\frac{1}{7}$

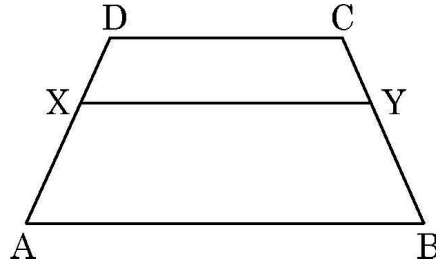
8. निम्न में से कौन सा कथन गलत है ?

1

- (A) दो समकोण त्रिभुज सदैव समरूप होते हैं।  
(B) दो वर्ग सदैव समरूप होते हैं।  
(C) दो समबाहु त्रिभुज सदैव समरूप होते हैं।  
(D) दो वृत्त सदैव समरूप होते हैं।

9. दी गई आकृति में, ABCD एक समलंब है जिसमें  $XY \parallel AB \parallel CD$  है। यदि  $AX = \frac{2}{3} AD$  है, तो  $CY : YB =$

1



- (A) 2 : 3 (B) 3 : 2  
(C) 1 : 3 (D) 1 : 2

10. निम्न में से कौन सा कथन गलत है ?

1

- (A) किसी वृत्त पर अनंत संख्या में स्पर्श-रेखाएँ खींची जा सकती हैं।  
(B) एक बाह्य बिंदु से वृत्त पर अनंत संख्या में स्पर्श-रेखाएँ खींची जा सकती हैं।  
(C) बाह्य बिंदु से वृत्त पर अनंत संख्या में छेदक रेखाएँ खींची जा सकती हैं।  
(D) वृत्त के स्पर्श बिंदु पर स्पर्श-रेखा और व्यास के बीच का कोण  $90^\circ$  होता है।



• • •

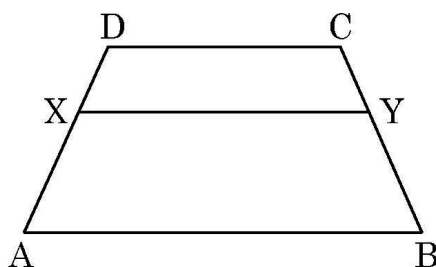
7. A bag contains red balls and black balls in the ratio 3 : 7. A ball is drawn at random. The probability that ball so drawn is black in colour, is 1

(A)  $\frac{3}{7}$  (B) 0.3  
(C) 0.7 (D)  $\frac{1}{7}$

8. Which of the following statements is false ? 1

(A) Two right triangles are always similar.  
(B) Two squares are always similar.  
(C) Two equilateral triangles are always similar.  
(D) Two circles are always similar.

9. In the adjoining figure, ABCD is a trapezium in which  $XY \parallel AB \parallel CD$ . If  $AX = \frac{2}{3}AD$ , then  $CY : YB =$  1



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

10. Which of the following statements is false ? 1

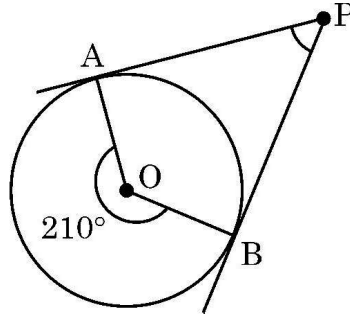
(A) Infinite number of tangents can be drawn to a circle.  
(B) Infinite number of tangents can be drawn to a circle from a point outside the circle.  
(C) Infinite number of secants can be drawn to a circle from a point outside the circle.  
(D) Angle between tangent and diameter at point of contact is  $90^\circ$ .



• • •

11. दी गई आकृति में, PA तथा PB वृत्त जिसका केन्द्र O है, पर दो स्पर्श-रेखाएँ हैं। कोण APB की माप है :

1



- (A)  $210^\circ$  (B)  $150^\circ$   
(C)  $105^\circ$  (D)  $30^\circ$

12.  $\frac{1 - \tan^2 30^\circ}{1 + \tan^2 30^\circ} =$

1

- (A)  $\sin 60^\circ$  (B)  $\cos 60^\circ$   
(C)  $\tan 60^\circ$  (D)  $\sec 60^\circ$

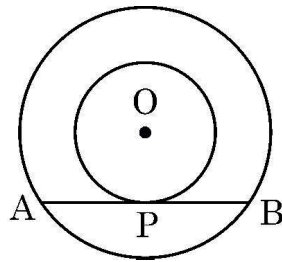
13. 1.8 m लंबा एक प्रेक्षक एक चिमनी से 38.2 m की दूरी पर है। उसकी आँखों से चिमनी के शिखर का उन्नयन कोण  $45^\circ$  है। चिमनी की ऊँचाई है :

1

- (A) 38.2 m (B) 36.4 m  
(C) 40 m (D)  $(38.2)\sqrt{2}$  m

14. दी गई आकृति में, दो संकेन्द्रीय वृत्तों की त्रिज्याओं का योग 16 cm है। बड़े वृत्त की जीवा AB, जो छोटे वृत्त को P पर स्पर्श करती है, की लम्बाई 16 cm है। इन दोनों वृत्तों की त्रिज्याओं का अंतर है :

1



- (A) 8 cm (B) 4 cm  
(C) 2 cm (D) 3 cm

15. 12 cm ऊँचाई तथा 13 cm तिर्यक ऊँचाई का एक शंकु, इसकी त्रिज्या के समान त्रिज्या वाले एक अर्धगोले पर अध्यारोपित है। इस ठोस की कुल ऊँचाई है :

1

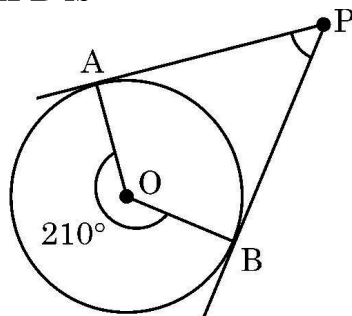
- (A) 17 cm (B) 18 cm  
(C) 22 cm (D) 23 cm



• • •

11. In the adjoining figure, PA and PB are tangents to a circle with centre O. The measure of angle APB is

1



- (A)  $210^\circ$  (B)  $150^\circ$   
(C)  $105^\circ$  (D)  $30^\circ$

12.  $\frac{1 - \tan^2 30^\circ}{1 + \tan^2 30^\circ}$  is equal to

1

- (A)  $\sin 60^\circ$  (B)  $\cos 60^\circ$   
(C)  $\tan 60^\circ$  (D)  $\sec 60^\circ$

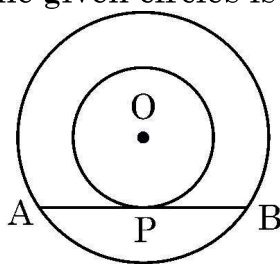
13. An observer 1.8 m tall stands away from a chimney at a distance of 38.2 m along the ground. The angle of elevation of top of chimney from the eyes of observer is  $45^\circ$ . The height of chimney above the ground is

1

- (A) 38.2 m (B) 36.4 m  
(C) 40 m (D)  $(38.2)\sqrt{2}$  m

14. In the adjoining figure, the sum of radii of two concentric circles is 16 cm. The length of chord AB which touches the inner circle at P is 16 cm. The difference of the radii of the given circles is

1



- (A) 8 cm (B) 4 cm  
(C) 2 cm (D) 3 cm

15. A cone of height 12 cm and slant height 13 cm is surmounted on a hemisphere having radius equal to that of cone. The entire height of the solid is

1

- (A) 17 cm (B) 18 cm  
(C) 22 cm (D) 23 cm



• • •

16. यदि  $x$  माध्यक +  $y$  माध्य =  $z$  बहुलक; माध्य, माध्यक और बहुलक के बीच का आनुभविक संबंध है, तो  $x + y + z$  का मान है :

1

- (A) 6 (B) 3  
(C) 2 (D) 1

17. निम्न आँकड़े, 100 विद्यार्थियों द्वारा एक कक्षा-परीक्षा में प्राप्त किए गए अंक दर्शाते हैं :

1

|                         |    |    |    |    |    |    |    |    |
|-------------------------|----|----|----|----|----|----|----|----|
| प्राप्तंक               | 20 | 29 | 28 | 33 | 42 | 38 | 43 | 25 |
| विद्यार्थियों की संख्या | 6  | 28 | 24 | 15 | 2  | 4  | 1  | 20 |

किन दो आँकड़ों की औसत, माध्यक है ?

- (A) 29 और 33 (B) 25 और 28  
(C) 28 और 29 (D) 33 और 38

18. एक पाँसा फेंकने पर, 3 से बड़ी भाज्य संख्या के प्राप्त होने की प्रायिकता है :

1

- (A)  $\frac{1}{6}$  (B)  $\frac{1}{3}$   
(C)  $\frac{1}{2}$  (D)  $\frac{2}{3}$

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

- (A) अभिकथन (A) तथा तर्क (R) दोनों सत्य हैं और तर्क (R), अभिकथन (A) की पूर्ण व्याख्या करता है।  
(B) अभिकथन (A) तथा तर्क (R) दोनों सत्य हैं, परन्तु तर्क (R), अभिकथन (A) की पूर्ण व्याख्या नहीं करता है।  
(C) अभिकथन (A) सत्य है, परन्तु तर्क (R) असत्य है।  
(D) अभिकथन (A) असत्य है, परन्तु तर्क (R) सत्य है।

19. अभिकथन (A) : एक न्यूनकोण  $\theta$  के लिए  $\sin \theta = \frac{3}{5} \Rightarrow \cos \theta = -\frac{4}{5}$

तर्क (R) :  $\theta$ ,  $(0^\circ \leq \theta \leq 90^\circ)$  के किसी मान के लिए  $\sin^2 \theta + \cos^2 \theta = 1$

1

20. अभिकथन (A) : एक समांतर श्रेढ़ी : 3, 6, 9, ..., 198 में अंतिम पद (प्रथम पद की ओर) से 10वाँ पद, 168 है।

तर्क (R) : यदि 'a' और 'l', एक समांतर श्रेढ़ी के प्रथम और अंतिम पद हों, जहाँ 'd' समान्तर श्रेढ़ी का सार्व-अंतर है, तो अंतिम पद से nवाँ पद दिया जाता है  $l - (n - 1)d$  से।

1



• • •

16. If  $x$  median +  $y$  mean =  $z$  mode; is the empirical relationship between mean, median and mode, then the value of  $x + y + z$  is 1  
 (A) 6 (B) 3  
 (C) 2 (D) 1

17. Following data shows the marks obtained by 100 students in a class test : 1

|                           |    |    |    |    |    |    |    |    |
|---------------------------|----|----|----|----|----|----|----|----|
| <b>Marks obtained</b>     | 20 | 29 | 28 | 33 | 42 | 38 | 43 | 25 |
| <b>Number of students</b> | 6  | 28 | 24 | 15 | 2  | 4  | 1  | 20 |

The median will be the average of which two observations ?

- (A) 29 and 33 (B) 25 and 28  
 (C) 28 and 29 (D) 33 and 38
18. The probability of getting a composite number greater than 3 on throwing a die is 1  
 (A)  $\frac{1}{6}$  (B)  $\frac{1}{3}$   
 (C)  $\frac{1}{2}$  (D)  $\frac{2}{3}$

**Directions :** In Question Numbers **19** and **20**, a statement of **Assertion (A)** is followed by a statement of **Reason (R)**. Choose the correct option from following :

- (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).  
 (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of (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  $\theta$ ,  $\sin \theta = \frac{3}{5} \Rightarrow \cos \theta = -\frac{4}{5}$ .

**Reason (R) :** For any value of  $\theta$ , ( $0^\circ \leq \theta \leq 90^\circ$ )

$$\sin^2 \theta + \cos^2 \theta = 1.$$

1

20. **Assertion (A) :** For an A.P., 3, 6, 9, ..., 198, 10<sup>th</sup> term from the end is 168.

**Reason (R) :** If 'a' and 'l' are the first term and last term of an A.P. with common difference 'd', then n<sup>th</sup> term from the end of the given A.P. is  $l - (n - 1)d$ .

1



## खण्ड – ख

इस खण्ड में 5 अति लघु-उत्तरीय प्रश्न हैं। प्रत्येक प्रश्न के 2 अंक हैं।

21. (a) 2 kg सेब और 1 kg अंगूर का मूल्य किसी दिन ₹ 320 था। 4 kg सेब और 2 kg अंगूर का मूल्य ₹ 600 हो जाता है। यदि 1 kg सेब और 1 kg अंगूर का मूल्य क्रमशः ₹  $x$  और ₹  $y$  है, तो इस स्थिति को बीजगणित के एक समीकरण निकाय के रूप में व्यक्त कीजिए और जाँच कीजिए कि क्या यह समीकरण निकाय संगत है या नहीं।

2

अथवा

- (b)  $x$  और  $y$  के लिए हल कीजिए :

$$\sqrt{2}x + \sqrt{3}y = 5 \text{ और}$$

$$\sqrt{3}x - \sqrt{8}y = -\sqrt{6}$$

2

22. रेखा खंड AB के सिरो के निर्देशांक  $A(-2, -2)$  तथा  $B(2, -4)$  हैं। रेखा खंड AB पर बिन्दु P इस प्रकार स्थित है कि  $BP = \frac{4}{7} AB$ । बिंदु P के निर्देशांक ज्ञात कीजिए।

2

23. (a) दिया गया है कि  $\sin(A - B) = \sin A \cos B - \cos A \sin B$ ; इसका प्रयोग करके,  $\sin 15^\circ$  का मान ज्ञात कीजिए।

2

अथवा

- (b) यदि  $\sin A = y$  है, तो  $\cos A$  और  $\tan A$  को  $y$  के पदों में व्यक्त कीजिए।

2

24. यदि AD और PS क्रमशः  $\triangle ABC$  और  $\triangle PQR$  की माधिकाएँ हैं जिससे  $\triangle ABD \sim \triangle PQS$  हैं। सिद्ध कीजिए कि  $\triangle ABC \sim \triangle PQR$ ।

2

25. 52 पत्तों की एक गड्डी को फेंकते समय एक पत्ता गिर जाता है। प्रायिकता ज्ञात कीजिए कि गिरा हुआ पत्ता
- (i) एक तस्वीर वाला पत्ता नहीं है।
- (ii) काले रंग का बादशाह है।

2



**SECTION – B**

**This section has 5 very short answer type questions of 2 marks each.**

21. (a) The cost of 2 kg apples and 1 kg of grapes on a day was found to be ₹ 320. The cost of 4 kg apples and 2 kg grapes was found to be ₹ 600. If cost of 1 kg of apples and 1 kg of grapes is ₹  $x$  and ₹  $y$  respectively, represent the given situation algebraically as a system of equations and check whether the system so obtained is consistent or not. 2

**OR**

- (b) Solve for  $x$  and  $y$  :

$$\sqrt{2}x + \sqrt{3}y = 5 \text{ and}$$

$$\sqrt{3}x - \sqrt{8}y = -\sqrt{6}$$
2

22. The coordinates of the end points of the line segment AB are A(−2, −2) and B(2, −4). P is the point on AB such that  $BP = \frac{4}{7}AB$ . Find the coordinates of point P. 2

23. (a) It is given that  $\sin(A - B) = \sin A \cos B - \cos A \sin B$ . Use it to find the value of  $\sin 15^\circ$ . 2

**OR**

- (b) If  $\sin A = y$ , then express  $\cos A$  and  $\tan A$  in terms of  $y$ . 2

24. AD and PS are medians of triangles ABC and PQR respectively such that  $\triangle ABD \sim \triangle PQS$ . Prove that  $\triangle ABC \sim \triangle PQR$ . 2

25. While shuffling a pack of 52 cards, one card was accidentally dropped. Find the probability that the dropped card

(i) is not a face card.

(ii) is a black king. 2



## खण्ड – ग

इस खण्ड में 6 लघु-उत्तरीय प्रश्न हैं। प्रत्येक प्रश्न के 3 अंक हैं।

26. (a) सिद्ध कीजिए कि  $\sqrt{3}$  एक अपरिमेय संख्या है। 3
- अथवा**
- (b) नीचे दिए कथनों में, प्रत्येक के लिए सही अथवा गलत बताइए और अपने उत्तर की व्याख्या भी दीजिए : 3
- (i)  $2 \times 3 \times 5 \times 7 + 7$  एक भाज्य संख्या है।
- (ii)  $2 \times 3 \times 5 \times 7 + 1$  एक भाज्य संख्या है।
27. बहुपद  $7x^2 + 18x - 9$  के शून्यक ज्ञात कीजिए। अतः एक ऐसा बहुपद लिखिए जिसका प्रत्येक शून्यक, दिए गए शून्यकों के दुगुने के समान हो। 3
28. निम्न समीकरण निकाय का हल आलेखीय विधि से ज्ञात कीजिए : 3
- $$2x - y - 2 = 0$$
- $$-4x + y + 4 = 0$$
- ऊपर दिए समीकरणों से निरूपित रेखाएँ  $y$ -अक्ष को जिन-जिन बिंदुओं पर काटती हैं उन बिंदुओं की कोटियों का निरपेक्ष अंतर भी ज्ञात कीजिए।
29.  $x$  और  $y$  में एक ऐसा संबंध ज्ञात कीजिए कि बिंदु  $P(x, y)$  बिंदुओं  $A(3, 5)$  और  $B(7, 1)$  से समदूरस्थ हो। अतः  $x$ -अक्ष और  $y$ -अक्ष के उन बिंदुओं के निर्देशांक ज्ञात कीजिए जो बिंदुओं  $A$  तथा  $B$  से समदूरस्थ हैं। 3
30. (a) निम्न त्रिकोणमितीय सर्वसमिका को सिद्ध कीजिए : 3
- $$\frac{1 + \operatorname{cosec} A}{\operatorname{cosec} A} = \frac{\cos^2 A}{1 - \sin A}$$
- अथवा**
- (b) माना  $2A + B$  और  $A + 2B$  दोनों ही न्यूनकोण हैं जिनके लिए  $\sin(2A + B) = \frac{\sqrt{3}}{2}$  और  $\tan(A + 2B) = 1$  है।  $\cot(4A - 7B)$  का मान ज्ञात कीजिए। 3



## SECTION – C

This section has 6 short answer type questions of 3 marks each.

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

OR

- (b) State true or false for each of the following statements and justify in each case : 3

(i)  $2 \times 3 \times 5 \times 7 + 7$  is a composite number.

(ii)  $2 \times 3 \times 5 \times 7 + 1$  is a composite number.

27. Obtain the zeroes of the polynomial  $7x^2 + 18x - 9$ . Hence, write a polynomial each of whose zeroes is twice the zeroes of given polynomial. 3

28. Solve the following system of equations graphically : 3

$$2x - y - 2 = 0$$

$$-4x + y + 4 = 0$$

Also, find the absolute difference between the ordinates of the points where given lines cut y – axis.

29. Find a relation between  $x$  and  $y$  such that  $P(x, y)$  is equidistant from the points  $A(3, 5)$  and  $B(7, 1)$ . Hence, write the coordinates of the points on  $x$ -axis and  $y$ -axis which are equidistant from points  $A$  and  $B$ . 3

30. (a) Prove the following trigonometric identity : 3

$$\frac{1 + \operatorname{cosec} A}{\operatorname{cosec} A} = \frac{\cos^2 A}{1 - \sin A}$$

OR

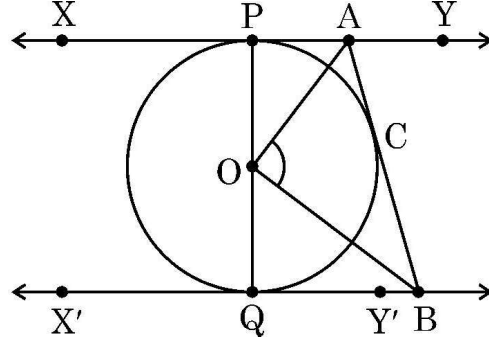
- (b) Let  $2A + B$  and  $A + 2B$  be acute angles such that  $\sin(2A + B) = \frac{\sqrt{3}}{2}$  and  $\tan(A + 2B) = 1$ . Find the value of  $\cot(4A - 7B)$ . 3



• • •

31. दी गई आकृति में,  $XY$  तथा  $X'Y'$ ,  $O$  केंद्र वाले किसी वृत्त पर दो समांतर स्पर्श-रेखाएँ हैं। स्पर्श बिंदु  $C$  पर स्पर्श-रेखा  $AB$ ,  $XY$  को  $A$  तथा  $X'Y'$  को  $B$  पर प्रतिच्छेद करती है। सिद्ध कीजिए कि  $AB$ , वृत्त के केंद्र पर एक समकोण बनाती है अथवा  $\angle AOB = 90^\circ$ ।

3



### खण्ड – घ

इस खण्ड में 4 दीर्घ-उत्तरीय प्रश्न हैं। प्रत्येक प्रश्न के 5 अंक हैं।

32. (a) एक 2-अंकीय संख्या अपने अंकों के योग से सात गुना है और अंकों के गुणनफल के पाँच गुने से 2 अधिक भी है। संख्या ज्ञात कीजिए।

5

अथवा

- (b)  $p$  का (के) मान ज्ञात कीजिए जिसके लिए द्विघात समीकरण  $(p + 4)x^2 - (p + 1)x + 1 = 0$  के मूल वास्तविक एवं बराबर हों। इस प्रकार प्राप्त द्विघात समीकरणों के मूल भी ज्ञात कीजिए।

5

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

साथ ही, ऊपरी कथन का विलोम भी लिखिए।

5

34. (a) 14 cm भुजा वाले एक ठोस लकड़ी के घन के एक फलक से 1.4 cm व्यास वाले अधिकतम गोलाधर्म निकाले जाते हैं। निकाले जा सकने वाले गोलाधर्मों की कुल संख्या ज्ञात कीजिए। बचे ठोस का कुल पृष्ठीय क्षेत्रफल भी ज्ञात कीजिए।

5

अथवा

- (b) 24 cm ऊँचाई और 5 cm त्रिज्या वाले एक ठोस बेलन से 12 cm ऊँचाई और 5 cm त्रिज्या के दो शंकु खोद कर निकाले जाते हैं। बचे ठोस का आयतन एवं पृष्ठीय क्षेत्रफल ज्ञात कीजिए।

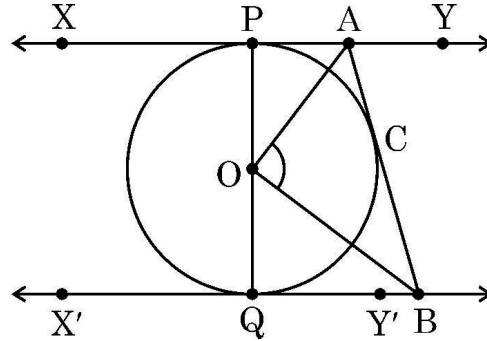
5



• • •

31. In the adjoining figure,  $XY$  and  $X'Y'$  are parallel tangents to a circle with centre  $O$ . Another tangent  $AB$  touches the circle at  $C$  intersecting  $XY$  at  $A$  and  $X'Y'$  at  $B$ . Prove that  $AB$  subtends right angle at the centre of the circle; or  $\angle AOB = 90^\circ$ .

3



### SECTION – D

**This section has 4 long answer questions of 5 marks each.**

32. (a) A 2-digit number is seven times the sum of its digits and two (2) more than 5 times the product of its digits. Find the number.

5

**OR**

- (b) Find the value(s) of  $p$  for which the quadratic equation given as  $(p + 4)x^2 - (p + 1)x + 1 = 0$  has real and equal roots. Also, find the roots of the equation(s) so obtained.

5

33. If a line is drawn parallel to one side of a triangle intersecting the other two sides in distinct points then it divides the two sides in the same ratio. Prove it.

Also, state the converse of the above statement.

5

34. (a) From one of the faces of a solid wooden cube of side 14 cm, maximum number of hemispheres of diameter 1.4 cm are scooped out. Find the total number of hemispheres that can be scooped out. Also, find the total surface area of the remaining solid.

5

**OR**

- (b) From a solid cylinder of height 24 cm and radius 5 cm, two cones of height 12 cm and radius 5 cm are hollowed out. Find the volume and surface area of the remaining solid.

5



• • •

35. एक कक्षा के 35 विद्यार्थियों की चिकित्सा जाँच करने पर उनके भार निम्न तालिका में दिए गए हैं :

5

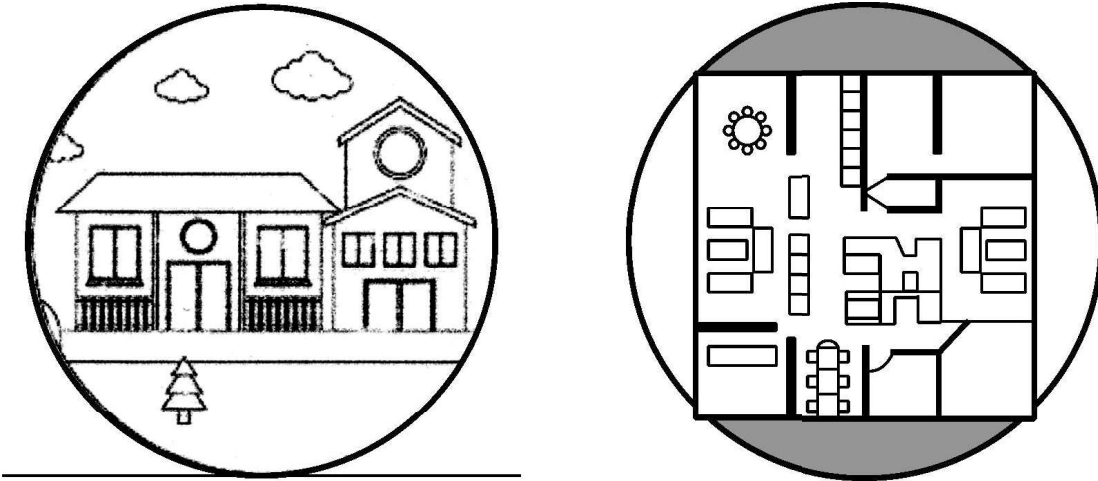
| भार (kg में)            | 38-40 | 40-42 | 42-44 | 44-46 | 46-48 | 48-50 | 50-52 |
|-------------------------|-------|-------|-------|-------|-------|-------|-------|
| विद्यार्थियों की संख्या | 3     | 2     | 4     | 5     | 14    | 4     | 3     |

माध्य भार और माध्यक भार के बीच का अंतर ज्ञात कीजिए ।

### खण्ड – ड

इस खण्ड में 3 प्रकरण अध्ययन आधारित प्रश्न हैं । प्रत्येक प्रश्न के 4 अंक हैं ।

36. एक किसान के पास एक वृत्ताकार भूमि का टुकड़ा है । वह इस पर बड़े-से-बड़े वर्गाकार हिस्से पर अपना मकान बनवाना चाहता है, जैसा नीचे चित्र में दिखाया गया है :



वृत्ताकार भूमि के टुकड़े की त्रिज्या 35 m है ।

उपरोक्त जानकारी के आधार पर निम्न प्रश्नों के उत्तर दीजिए :

- भूमि के पूरे टुकड़े पर बाड़ लगाने वाली तार की लंबाई ज्ञात कीजिए । 1
- जिस वर्गाकार भूमि के टुकड़े पर घर बनना है, उसकी एक भुजा की लंबाई ज्ञात कीजिए । 1
- (a) घर के चारों ओर छायांकित भाग पर यह किसान घास उगाना चाहता है । ₹ 50 प्रति वर्ग मीटर की दर से घास उगवाने का खर्च ज्ञात कीजिए । 2

### अथवा

- (b) भूमि के टुकड़े का क्षेत्रफल, जिस पर घर बनना है तथा बचे हुए वृत्ताकार भूमि के टुकड़े का क्षेत्रफल से अनुपात ज्ञात कीजिए । 2



• • •

35. Medical check-up was carried out for 35 students of a class and their weights were recorded as follows :

5

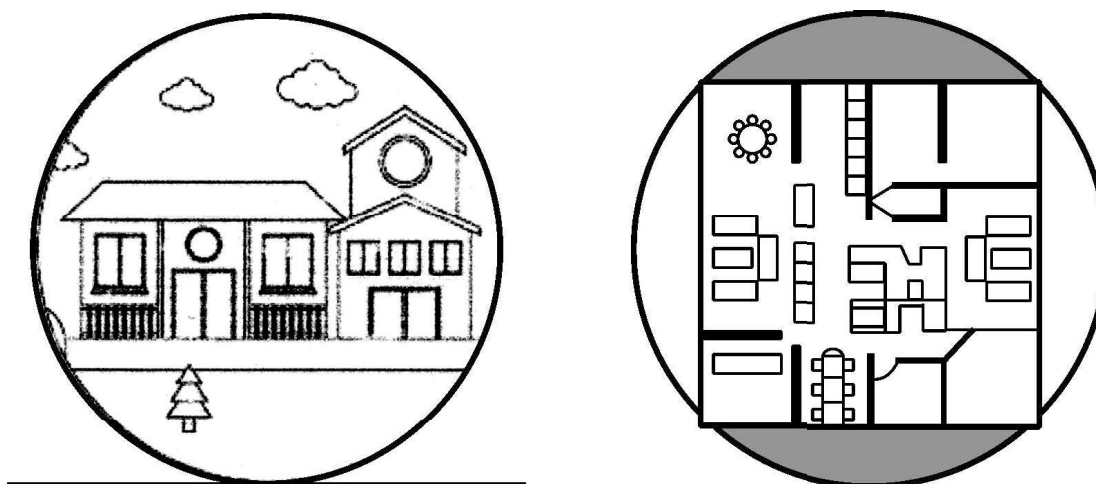
| Weight (in kg)     | 38-40 | 40-42 | 42-44 | 44-46 | 46-48 | 48-50 | 50-52 |
|--------------------|-------|-------|-------|-------|-------|-------|-------|
| Number of Students | 3     | 2     | 4     | 5     | 14    | 4     | 3     |

Find the difference between the mean weight and the median weight.

### SECTION – E

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

36. A farmer has a circular piece of land. He wishes to construct his house in the form of largest possible square within the land as shown below.



The radius of circular piece of land is 35 m.

Based on given information, answer the following questions :

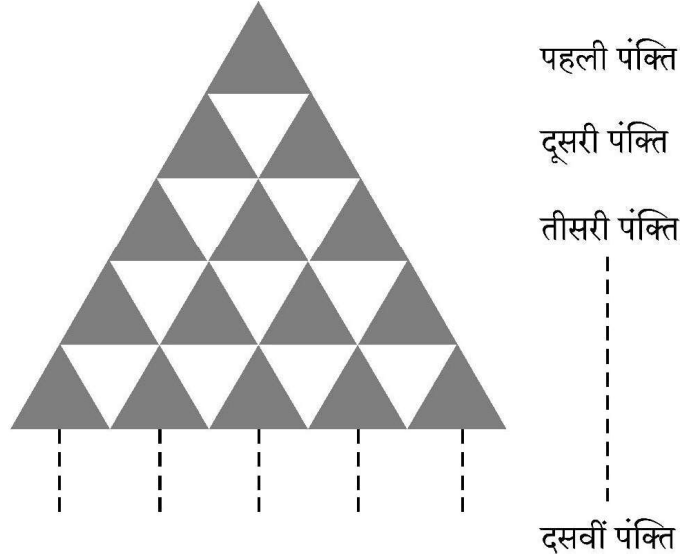
- (i) Find the length of wire needed to fence the entire land. 1
- (ii) Find the length of each side of the square land on which house will be constructed. 1
- (iii) (a) The farmer wishes to grow grass on the shaded region around the house. Find the cost of growing the grass at the rate of ₹ 50 per square metre. 2

OR

- (iii) (b) Find the ratio of area of land on which house is built to remaining area of circular piece of land. 2



- • •
37. 10 cm भुजा वाले एक समबाहु त्रिभुज में 1 cm भुजा वाले समबाहु त्रिभुज बनाए गए हैं, जैसा नीचे बने चित्र में दिखाया गया है। पहली पंक्ति में एक त्रिभुज, दूसरी पंक्ति में तीन त्रिभुज, तीसरी में पाँच त्रिभुज इत्यादि।



उपरोक्त जानकारी के आधार पर समांतर श्रेढ़ी का प्रयोग करते हुए निम्न प्रश्नों के उत्तर दीजिए :

- |                                                                              |   |
|------------------------------------------------------------------------------|---|
| (i) सबसे निचली पंक्ति में कुल कितने त्रिभुज बने हैं ?                        | 1 |
| (ii) नीचे से चौथी पंक्ति में कुल कितने त्रिभुज बने हैं ?                     | 1 |
| (iii) (a) 8वीं पंक्ति तक प्रत्येक 1 cm भुजा वाले कुल कितने त्रिभुज बने हैं ? | 2 |

**अथवा**

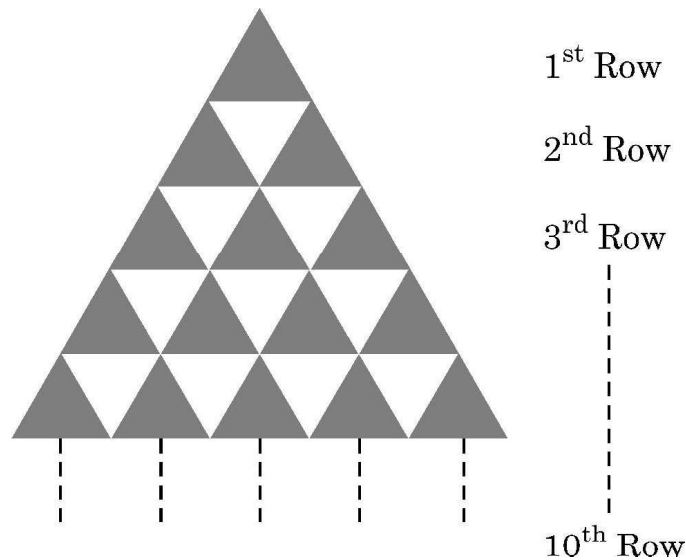
- |                                                                                                                                                     |   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|---|
| (iii) (b) 5वीं से 10वीं पंक्ति में बने त्रिभुजों की कुल संख्या, पहली 4 पंक्तियों में बने त्रिभुजों की कुल संख्या से कितनी अधिक है ? परिकलन दर्शाइए। | 2 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|---|

38. यात्री बोर्डिंग सीढ़ियाँ, जिन्हें कभी-कभी बोर्डिंग रैंप, सीढ़ी कार या विमान सीढ़ियाँ भी कहा जाता है, विमान के दरवाजे और जमीन के बीच यात्रा करने के लिए एक मोबाइल साधन प्रदान करती हैं। बड़े विमानों के दरवाजे की चौखट 5 से 20 फुट (1 फुट = 30 सेमी) तक ऊँची होती है। सीढ़ियाँ सुरक्षित रूप से चढ़ने और उतरने की सुविधा प्रदान करती हैं।



• • •

37. In an equilateral triangle of side 10 cm, equilateral triangles of side 1 cm are formed as shown in the figure below, such that there is one triangle in the first row, three triangles in the second row, five triangles in the third row and so on.



Based on given information, answer the following questions using Arithmetic Progression.

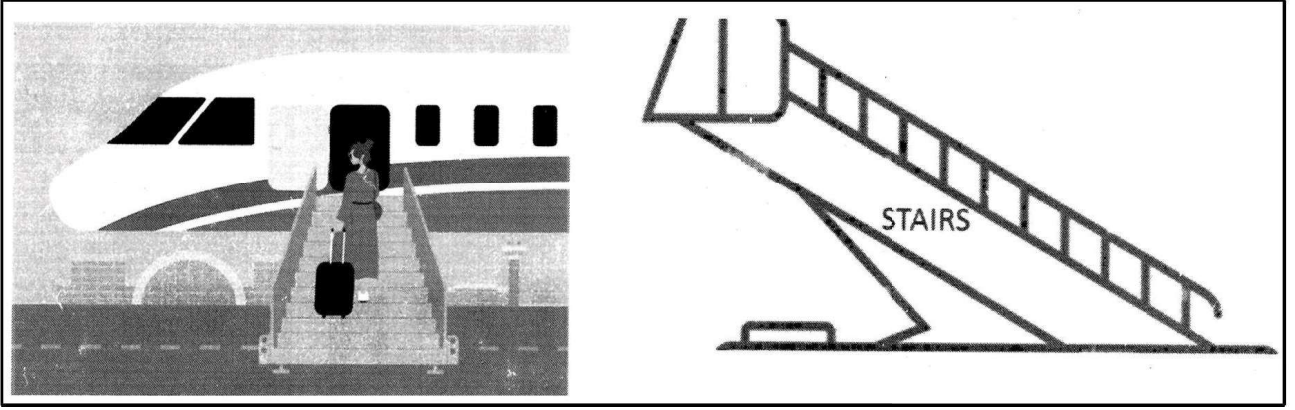
- (i) How many triangles will be there in bottom most row ? 1
- (ii) How many triangles will be there in fourth row from the bottom ? 1
- (iii) (a) Find the total number of triangles of side 1 cm each till 8<sup>th</sup> row. 2

**OR**

- (iii) (b) How many more number of triangles are there from 5<sup>th</sup> row to 10<sup>th</sup> row than in first 4 rows ? Show working. 2

38. Passenger boarding stairs, sometimes referred to as boarding ramps, stair cars or aircraft steps, provide a mobile means to travel between the aircraft doors and the ground. Larger aircraft have door sills 5 to 20 feet (1 foot = 30 cm) high. Stairs facilitate safe boarding and de-boarding.





एक विमान के दरवाजे की चौखट भूमि (समतल) से 15 फुट की ऊँचाई पर है। एक सीढ़ी कार को विमान से 15 फुट की क्षैतिज दूरी पर रखा गया है।

उपरोक्त जानकारी के आधार पर, निम्न प्रश्नों (i) और (ii) के उत्तर दीजिए :

(i) वह कोण ज्ञात कीजिए जिस पर सीढ़ियाँ जमीन से 15 फुट ऊपर दरवाजे की चौखट तक पहुँचने के लिए झुकी हुई हैं।

1

(ii) दरवाजे की चौखट तक पहुँचने के लिए उपयोग की जाने वाली सीढ़ियों की लंबाई ज्ञात कीजिए।

1

इसके अलावा, निम्नलिखित में से किसी एक का उत्तर दीजिए :

(iii) (a) यदि दरवाजे की चौखट तक पहुँचने के लिए 20 फुट लंबी सीढ़ियाँ  $60^\circ$  के कोण पर झुकी हों, तो दरवाजे की चौखट की, भूमि से ऊँचाई ज्ञात कीजिए। ( $\sqrt{3} = 1.732$  का प्रयोग करें।)

2

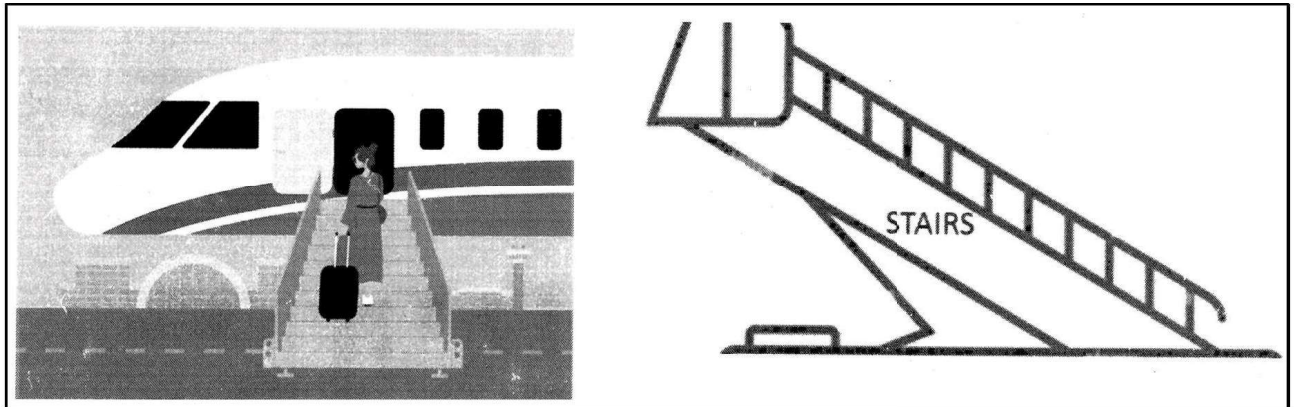
अथवा

(iii) (b) जमीन से 20 फीट ऊपर विमान के दरवाजे की चौखट तक पहुँचने के लिए सीढ़ियों की न्यूनतम संभव लंबाई क्या होनी चाहिए, यदि उन्नयन कोण  $30^\circ$  से अधिक नहीं हो सकता है ? इसके अलावा, विमान से सीढ़ी कार के आधार की क्षैतिज दूरी भी ज्ञात कीजिए।

2



• • •



An aircraft has a door sill at a height of 15 feet above the ground. A stair car is placed at a horizontal distance of 15 feet from the plane.

Based on given information, answer the questions given in part (i) and (ii).

- (i) Find the angle at which stairs are inclined to reach the door sill 15 feet high above the ground. 1
- (ii) Find the length of stairs used to reach the door sill. 1

Further, answer any **one** of the following questions :

- (iii) (a) If the 20 feet long stairs is inclined at an angle of  $60^\circ$  to reach the door sill, then find the height of the door sill above the ground. (use  $\sqrt{3} = 1.732$ ) 2

**OR**

- (iii) (b) What should be the shortest possible length of stairs to reach the door sill of the plane 20 feet above the ground, if the angle of elevation cannot exceed  $30^\circ$  ? Also, find the horizontal distance of base of stair car from the plane. 2



• • •



**Marking Scheme**  
**Strictly Confidential**  
**(For Internal and Restricted use only)**  
**Secondary School Examination, 2025**  
**MATHEMATICS (Standard) (Q.P. CODE 30/5/1)**

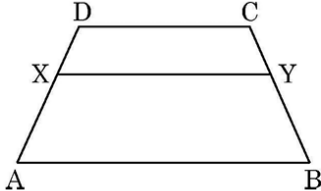
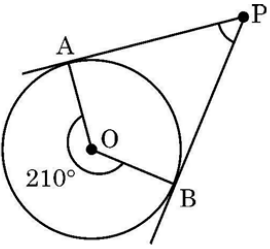
**General Instructions: -**

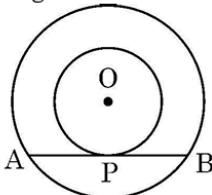
|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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. | <b>“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.”</b>                                                                                                                                                                                             |
| 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. <b>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 the 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.</b> |
| 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. <b>This is most common mistake which evaluators are committing.</b>                                                                                                                                                                                                                                                                                                                                                                                               |
| 7. | If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totalled up and written on the left-hand margin and encircled. This may be followed strictly.                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 8. | If a question does not have any parts, marks must be awarded on the left-hand margin and encircled. This may also be followed strictly.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9.  | 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 _____ 80 _____ (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. | <p>Ensure that you do not make the following common types of errors committed by the Examiner in the past:-</p> <ul style="list-style-type: none"> <li>• Leaving answer or part thereof unassessed in an answer book.</li> <li>• Giving more marks for an answer than assigned to it.</li> <li>• Wrong totalling of marks awarded to an answer.</li> <li>• Wrong transfer of marks from the inside pages of the answer book to the title page.</li> <li>• Wrong question wise totalling on the title page.</li> <li>• Wrong totalling of marks of the two columns on the title page.</li> <li>• Wrong grand total.</li> <li>• Marks in words and figures not tallying/not same.</li> <li>• Wrong transfer of marks from the answer book to online award list.</li> <li>• 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.)</li> </ul> <p>Half or a part of answer marked correct and the rest as wrong, but no marks awarded.</p> |
| 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 un assessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 16. | The Examiners should acquaint themselves with the guidelines given in the “ <b>Guidelines for spot Evaluation</b> ” 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 totalled 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.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

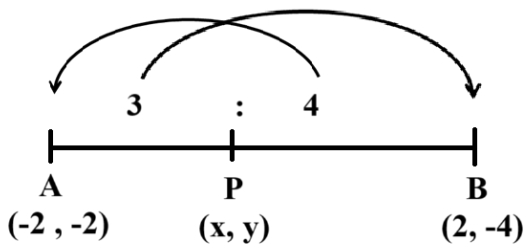
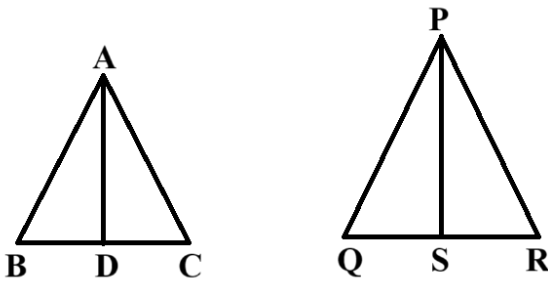
**MARKING SCHEME**  
**MATHEMATICS (Subject Code-041)**  
**(PAPER CODE: 30/5/1)**

| Q. No. | EXPECTED OUTCOMES/VALUE POINTS                                                                                                                                                                                                                                                                                                                                                   | Marks |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|        | <b>SECTION A</b>                                                                                                                                                                                                                                                                                                                                                                 |       |
|        | <b>This section consists of 20 multiple choice questions of 1 mark each.</b>                                                                                                                                                                                                                                                                                                     |       |
| 1.     | $(\sqrt{3}+2)^2 + (\sqrt{3}-2)^2$ is a/an<br>(A) positive rational number                      (B) negative rational number<br>(C) positive irrational number                      (D) negative irrational number                                                                                                                                                                |       |
| Sol.   | (A) positive rational number                                                                                                                                                                                                                                                                                                                                                     | 1     |
| 2.     | Let $x = a^2 b^3 c^n$ and $y = a^3 b^m c^2$ , where a, b, c are prime numbers. If LCM of x and y is $a^3 b^4 c^3$ , then the value of m + n is<br>(A) 10                                                      (B) 7<br>(C) 6                                                      (D) 5                                                                                          |       |
| Sol.   | (B) 7                                                                                                                                                                                                                                                                                                                                                                            | 1     |
| 3.     | For any prime number p, if p divides $a^2$ , where a is any real number then p also divides<br><br>(A) a                                                      (B) $a^{\frac{1}{2}}$<br>(C) $a^{\frac{3}{2}}$ (D) $a^{\frac{1}{8}}$                                                                                                                                               |       |
| Sol.   | (A) a                                                                                                                                                                                                                                                                                                                                                                            | 1     |
| 4.     | Which of the following equations is a quadratic equation ?<br>(A) $x^2 + 1 = (x - 1)^2$ (B) $(x + \sqrt{x})^2 = 2x\sqrt{x}$<br>(C) $x^3 + 3x^2 = (x + 1)^3$ (D) $(x + 1)(x - 1) = (x + 1)^2$                                                                                                                                                                                     |       |
| Sol.   | (B) $(x + \sqrt{x})^2 = 2x\sqrt{x}$                                                                                                                                                                                                                                                                                                                                              | 1     |
| 5.     | If $x^2 + bx + b = 0$ has two real and distinct roots, then the value of b can be<br>(A) 0                                                      (B) 4<br>(C) 3                                                      (D) -3                                                                                                                                                       |       |
| Sol.   | (D) -3                                                                                                                                                                                                                                                                                                                                                                           | 1     |
| 6.     | In the figure given below, points P, Q, R divides the line segment AB in four equal parts.<br><br>The point Q divides PB in the ratio<br>(A) 1 : 3                                                      (B) 2 : 3<br>(C) 1 : 2                                                      (D) 1 : 1 |       |
| Sol.   | (C) 1 : 2                                                                                                                                                                                                                                                                                                                                                                        | 1     |
| 7.     | A bag contains red balls and black balls in the ratio 3 : 7. A ball is drawn at random. The probability that ball so drawn is black in colour, is<br>(A) $\frac{3}{7}$ (B) 0.3<br>(C) 0.7                                                      (D) $\frac{1}{7}$                                                                                                                 |       |
| Sol.   | (C) 0.7                                                                                                                                                                                                                                                                                                                                                                          | 1     |

|             |                                                                                                                                                                                                                                                                                                                                                                                  |          |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <b>8.</b>   | Which of the following statements is false ?<br>(A) Two right triangles are always similar.<br>(B) Two squares are always similar.<br>(C) Two equilateral triangles are always similar.<br>(D) Two circles are always similar.                                                                                                                                                   |          |
| <b>Sol.</b> | (A) Two right triangles are always similar.                                                                                                                                                                                                                                                                                                                                      | <b>1</b> |
| <b>9.</b>   | In the adjoining figure, ABCD is a trapezium in which $XY \parallel AB \parallel CD$ . If $AX = \frac{2}{3} AD$ , then $CY : YB =$<br>                                                                                                                                                          |          |
|             | (A) 2 : 3<br>(C) 1 : 3<br>(B) 3 : 2<br>(D) 1 : 2                                                                                                                                                                                                                                                                                                                                 |          |
| <b>Sol.</b> | (D) 1 : 2                                                                                                                                                                                                                                                                                                                                                                        | <b>1</b> |
| <b>10.</b>  | Which of the following statements is false ?<br>(A) Infinite number of tangents can be drawn to a circle.<br>(B) Infinite number of tangents can be drawn to a circle from a point outside the circle.<br>(C) Infinite number of secants can be drawn to a circle from a point outside the circle.<br>(D) Angle between tangent and diameter at point of contact is $90^\circ$ . |          |
| <b>Sol.</b> | (B) Infinite number of tangents can be drawn to a circle from a point outside the circle.                                                                                                                                                                                                                                                                                        | <b>1</b> |
| <b>11.</b>  | In the adjoining figure, PA and PB are tangents to a circle with centre O. The measure of angle APB is<br>                                                                                                                                                                                    |          |
|             | (A) $210^\circ$<br>(C) $105^\circ$<br>(B) $150^\circ$<br>(D) $30^\circ$                                                                                                                                                                                                                                                                                                          |          |
| <b>Sol.</b> | (D) $30^\circ$                                                                                                                                                                                                                                                                                                                                                                   | <b>1</b> |
| <b>12.</b>  | $\frac{1 - \tan^2 30^\circ}{1 + \tan^2 30^\circ}$ is equal to<br>(A) $\sin 60^\circ$<br>(C) $\tan 60^\circ$<br>(B) $\cos 60^\circ$<br>(D) $\sec 60^\circ$                                                                                                                                                                                                                        |          |
| <b>Sol.</b> | (B) $\cos 60^\circ$                                                                                                                                                                                                                                                                                                                                                              | <b>1</b> |

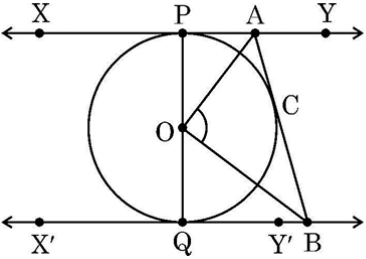
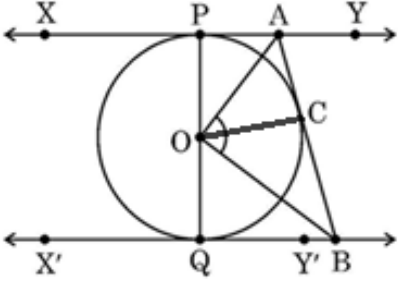
|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |    |    |    |    |    |    |    |    |                    |   |    |    |    |   |   |   |    |  |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----|----|----|----|----|----|----|----|--------------------|---|----|----|----|---|---|---|----|--|
| 13.                | An observer 1.8 m tall stands away from a chimney at a distance of 38.2 m along the ground. The angle of elevation of top of chimney from the eyes of observer is $45^\circ$ . The height of chimney above the ground is<br>(A) 38.2 m (B) 36.4 m<br>(C) 40 m (D) $(38.2)\sqrt{2}$ m                                                                                                                                                                                                                         |                |    |    |    |    |    |    |    |    |                    |   |    |    |    |   |   |   |    |  |
| Sol.               | (C) 40 m                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1              |    |    |    |    |    |    |    |    |                    |   |    |    |    |   |   |   |    |  |
| 14.                | In the adjoining figure, the sum of radii of two concentric circles is 16 cm. The length of chord AB which touches the inner circle at P is 16 cm. The difference of the radii of the given circles is<br><br>(A) 8 cm (B) 4 cm<br>(C) 2 cm (D) 3 cm                                                                                                                                                                        |                |    |    |    |    |    |    |    |    |                    |   |    |    |    |   |   |   |    |  |
| Sol.               | (B) 4 cm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1              |    |    |    |    |    |    |    |    |                    |   |    |    |    |   |   |   |    |  |
| 15.                | A cone of height 12 cm and slant height 13 cm is surmounted on a hemisphere having radius equal to that of cone. The entire height of the solid is<br>(A) 17 cm (B) 18 cm<br>(C) 22 cm (D) 23 cm                                                                                                                                                                                                                                                                                                             |                |    |    |    |    |    |    |    |    |                    |   |    |    |    |   |   |   |    |  |
| Sol.               | (A) 17 cm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1              |    |    |    |    |    |    |    |    |                    |   |    |    |    |   |   |   |    |  |
| 16.                | If $x$ median + $y$ mean = $z$ mode; is the empirical relationship between mean, median and mode, then the value of $x + y + z$ is<br>(A) 6 (B) 3<br>(C) 2 (D) 1                                                                                                                                                                                                                                                                                                                                             |                |    |    |    |    |    |    |    |    |                    |   |    |    |    |   |   |   |    |  |
| Sol.               | (C) 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1              |    |    |    |    |    |    |    |    |                    |   |    |    |    |   |   |   |    |  |
| 17.                | Following data shows the marks obtained by 100 students in a class test : <table border="1" data-bbox="250 1247 1150 1323"><tr><td>Marks obtained</td><td>20</td><td>29</td><td>28</td><td>33</td><td>42</td><td>38</td><td>43</td><td>25</td></tr><tr><td>Number of students</td><td>6</td><td>28</td><td>24</td><td>15</td><td>2</td><td>4</td><td>1</td><td>20</td></tr></table> The median will be the average of which two observations ?<br>(A) 29 and 33 (B) 25 and 28<br>(C) 28 and 29 (D) 33 and 38 | Marks obtained | 20 | 29 | 28 | 33 | 42 | 38 | 43 | 25 | Number of students | 6 | 28 | 24 | 15 | 2 | 4 | 1 | 20 |  |
| Marks obtained     | 20                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 29             | 28 | 33 | 42 | 38 | 43 | 25 |    |    |                    |   |    |    |    |   |   |   |    |  |
| Number of students | 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 28             | 24 | 15 | 2  | 4  | 1  | 20 |    |    |                    |   |    |    |    |   |   |   |    |  |
| Sol.               | (C) 28 and 29                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1              |    |    |    |    |    |    |    |    |                    |   |    |    |    |   |   |   |    |  |
| 18.                | The probability of getting a composite number greater than 3 on throwing a die is<br>(A) $\frac{1}{6}$ (B) $\frac{1}{3}$<br>(C) $\frac{1}{2}$ (D) $\frac{2}{3}$                                                                                                                                                                                                                                                                                                                                              |                |    |    |    |    |    |    |    |    |                    |   |    |    |    |   |   |   |    |  |
| Sol.               | (B) $\frac{1}{3}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1              |    |    |    |    |    |    |    |    |                    |   |    |    |    |   |   |   |    |  |

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                  |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
|               | <p><b>Directions :</b> In Question Numbers <b>19</b> and <b>20</b>, a statement of <b>Assertion (A)</b> is followed by a statement of <b>Reason (R)</b>. Choose the correct option from following :</p> <p>(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).</p> <p>(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of (A).</p> <p>(C) Assertion (A) is true, but Reason (R) is false.</p> <p>(D) Assertion (A) is false, but Reason (R) is true.</p> |                                                                  |
| <b>19.</b>    | <p><b>Assertion (A) :</b> For an acute angle <math>\theta</math>, <math>\sin \theta = \frac{3}{5} \Rightarrow \cos \theta = -\frac{4}{5}</math>.</p> <p><b>Reason (R) :</b> For any value of <math>\theta</math>, (<math>0^\circ \leq \theta \leq 90^\circ</math>)<br/> <math>\sin^2 \theta + \cos^2 \theta = 1</math>.</p>                                                                                                                                                                                                                                  |                                                                  |
| <b>Sol.</b>   | (D) Assertion (A) is false, but Reason (R) is true.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>1</b>                                                         |
| <b>20</b>     | <p><b>Assertion (A) :</b> For an A.P., 3, 6, 9, ..., 198, 10<sup>th</sup> term from the end is 168.</p> <p><b>Reason (R) :</b> If 'a' and 'l' are the first term and last term of an A.P. with common difference 'd', then n<sup>th</sup> term from the end of the given A.P. is <math>l - (n - 1) d</math>.</p>                                                                                                                                                                                                                                             |                                                                  |
| <b>Sol.</b>   | (D) Assertion (A) is false, but Reason (R) is true.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>1</b>                                                         |
|               | <b>SECTION B</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                  |
|               | <b>This section has 5 very short answer type questions of 2 marks each.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                  |
| <b>21 (a)</b> | <p>The cost of 2 kg apples and 1 kg of grapes on a day was found to be ₹ 320. The cost of 4 kg apples and 2 kg grapes was found to be ₹ 600. If cost of 1 kg of apples and 1 kg of grapes is ₹ x and ₹ y respectively, represent the given situation algebraically as a system of equations and check whether the system so obtained is consistent or not.</p>                                                                                                                                                                                               |                                                                  |
| <b>Sol.</b>   | $2x + y = 320$<br>$4x + 2y = 600$<br>Here, $\frac{a_1}{a_2} = \frac{2}{4} = \frac{1}{2}$ , $\frac{b_1}{b_2} = \frac{1}{2}$ , $\frac{c_1}{c_2} = \frac{320}{600} = \frac{8}{15}$<br>As $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2} \therefore$ System of equations is not consistent.                                                                                                                                                                                                                                                             | $\frac{1}{2}$<br>$\frac{1}{2}$<br>$\frac{1}{2}$<br>$\frac{1}{2}$ |
|               | <b>OR</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                  |
| <b>21 (b)</b> | <p>Solve for x and y :</p> $\sqrt{2}x + \sqrt{3}y = 5$ and<br>$\sqrt{3}x - \sqrt{8}y = -\sqrt{6}$                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                  |
| <b>Sol.</b>   | $(\sqrt{2}x + \sqrt{3}y = 5) \times \sqrt{3} \Rightarrow \sqrt{6}x + 3y = 5\sqrt{3}$<br>$(\sqrt{3}x - \sqrt{8}y = -\sqrt{6}) \times \sqrt{2} \Rightarrow \sqrt{6}x - 4y = -2\sqrt{3}$<br>Solving the equations, we get<br>$x = \sqrt{2}$ and $y = \sqrt{3}$                                                                                                                                                                                                                                                                                                  | $\frac{1}{2}$<br>$\frac{1}{2}$<br>$\frac{1}{2} + \frac{1}{2}$    |

|           |                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                  |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| 22.       | The coordinates of the end points of the line segment AB are A(-2, -2) and B(2, -4). P is the point on AB such that $BP = \frac{4}{7} AB$ . Find the coordinates of point P.                                                                                                                                                                                                                     |                                                                  |
| Sol.      |  <p>P (x, y) divides AB in the ratio 3: 4</p> $x = \frac{3 \times 2 + 4 \times (-2)}{4+3} \Rightarrow x = -\frac{2}{7}$ $y = \frac{3 \times (-4) + 4 \times (-2)}{4+3} \Rightarrow y = -\frac{20}{7}$ <p><math>\therefore</math> Coordinates of P are <math>\left(-\frac{2}{7}, -\frac{20}{7}\right)</math></p> | $\frac{1}{2}$<br>$\frac{1}{2}$<br>$\frac{1}{2}$<br>$\frac{1}{2}$ |
| 23 (a)    | It is given that $\sin (A - B) = \sin A \cos B - \cos A \sin B$ . Use it to find the value of $\sin 15^\circ$ .                                                                                                                                                                                                                                                                                  |                                                                  |
| Sol.      | $\begin{aligned} \sin 15^\circ &= \sin (45^\circ - 30^\circ) \\ &= \sin 45^\circ \cos 30^\circ - \cos 45^\circ \sin 30^\circ \\ &= \frac{1}{\sqrt{2}} \times \frac{\sqrt{3}}{2} - \frac{1}{\sqrt{2}} \times \frac{1}{2} \\ &= \frac{\sqrt{3}-1}{2\sqrt{2}} \text{ or } \frac{\sqrt{6}-\sqrt{2}}{4} \end{aligned}$                                                                                | $\frac{1}{2}$<br><br><br><b>1</b><br>$\frac{1}{2}$               |
| <b>OR</b> |                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                  |
| 23 (b)    | If $\sin A = y$ , then express $\cos A$ and $\tan A$ in terms of $y$ .                                                                                                                                                                                                                                                                                                                           |                                                                  |
| Sol.      | $\cos A = \sqrt{1 - \sin^2 A} = \sqrt{1 - y^2}$ $\tan A = \frac{\sin A}{\cos A} = \frac{y}{\sqrt{1-y^2}}$                                                                                                                                                                                                                                                                                        | <b>1</b><br><b>1</b>                                             |
| 24.       | AD and PS are medians of triangles ABC and PQR respectively such that $\triangle ABD \sim \triangle PQS$ . Prove that $\triangle ABC \sim \triangle PQR$ .                                                                                                                                                                                                                                       |                                                                  |
| Sol.      |  <p>Since <math>\triangle ABD \sim \triangle PQS</math></p> $\therefore \frac{AB}{PQ} = \frac{BD}{QS} \text{ or } \frac{AB}{PQ} = \frac{2BD}{2QS}$                                                                                                                                                            | Correct figure<br>$\frac{1}{2}$                                  |

|        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                    |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|        | $\Rightarrow \frac{AB}{PQ} = \frac{BC}{QR}$ $\angle B = \angle Q$ $\therefore \Delta ABC \sim \Delta PQR$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | $\frac{1}{2}$<br><br>$\frac{1}{2}$<br><br>$\frac{1}{2}$                                                                                                            |
| 25.    | <p>While shuffling a pack of 52 cards, one card was accidentally dropped. Find the probability that the dropped card</p> <p>(i) is not a face card.</p> <p>(ii) is a black king.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                    |
| Sol.   | <p>(i) <math>P(\text{not a face card}) = \frac{40}{52} \text{ or } \frac{10}{13}</math></p> <p>(ii) <math>P(\text{black king}) = \frac{2}{52} \text{ or } \frac{1}{26}</math></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>1</b><br><br><b>1</b>                                                                                                                                           |
|        | <b>SECTION C</b><br><b>This section has 6 short answer type questions of 3 marks each.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                    |
| 26 (a) | Prove that $\sqrt{3}$ is an irrational number.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                    |
| Sol.   | <p>Let <math>\sqrt{3}</math> be a rational number.</p> <p><math>\therefore \sqrt{3} = \frac{p}{q}</math>, where <math>q \neq 0</math> and let <math>p</math> &amp; <math>q</math> be coprimes.</p> <p><math>\Rightarrow 3q^2 = p^2</math></p> <p><math>\Rightarrow p^2</math> is divisible by 3.</p> <p><math>\Rightarrow p</math> is divisible by 3. ----- ①</p> <p>Let <math>p = 3a</math>, where 'a' is some integer</p> <p><math>\therefore 9a^2 = 3q^2</math></p> <p><math>\Rightarrow q^2 = 3a^2</math></p> <p><math>\Rightarrow q^2</math> is divisible by 3</p> <p><math>\Rightarrow q</math> is divisible by 3 ----- ②</p> <p><math>\therefore 3</math> divides both <math>p</math> &amp; <math>q</math>.</p> <p>① and ② leads to contradiction as <math>p</math> and <math>q</math> are coprimes.</p> <p>Hence, <math>\sqrt{3}</math> is an irrational number.</p> | $\frac{1}{2}$<br><br><br><br><br><br><br><br><br><br><b>1</b><br><br><br><br><br><br><br><br><br><br><b>1</b><br><br><br><br><br><br><br><br><br><br>$\frac{1}{2}$ |
|        | <b>OR</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                    |
| 26 (b) | <p>State true or false for each of the following statements and justify in each case :</p> <p>(i) <math>2 \times 3 \times 5 \times 7 + 7</math> is a composite number.</p> <p>(ii) <math>2 \times 3 \times 5 \times 7 + 1</math> is a composite number.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                    |
| Sol.   | <p>(i) True,</p> <p><math>\because 2 \times 3 \times 5 \times 7 + 7 = 7 \times (2 \times 3 \times 5 + 1)</math> has more than two factors.</p> <p>(ii) False,</p> <p><math>\because 2 \times 3 \times 5 \times 7 + 1 = 211</math> has only two factors.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>1</b><br><br>$\frac{1}{2}$<br><br><b>1</b><br><br>$\frac{1}{2}$                                                                                                 |
| 27.    | Obtain the zeroes of the polynomial $7x^2 + 18x - 9$ . Hence, write a polynomial each of whose zeroes is twice the zeroes of given polynomial.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                    |
| Sol.   | $7x^2 + 18x - 9$ $= (7x - 3)(x + 3)$ <p><math>\therefore</math> Zeroes are <math>-3, \frac{3}{7}</math></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>1</b>                                                                                                                                                           |

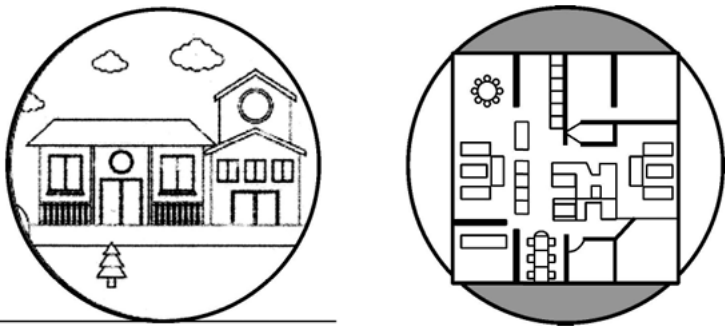
|      |                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                 |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
|      | <p>New zeroes are <math>-6, \frac{6}{7}</math></p> <p>Sum of new zeroes <math>= (-6) + \frac{6}{7} = -\frac{36}{7}</math></p> <p>Product of new zeroes <math>= (-6) \times \frac{6}{7} = -\frac{36}{7}</math></p> <p><math>\therefore</math> Required polynomial is <math>x^2 + \frac{36}{7}x - \frac{36}{7}</math> or <math>7x^2 + 36x - 36</math></p> | <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p>                 |
| 28.  | <p>Solve the following system of equations graphically :</p> $2x - y - 2 = 0$ $-4x + y + 4 = 0$ <p>Also, find the absolute difference between the ordinates of the points where given lines cut y – axis.</p>                                                                                                                                           |                                                                                                                                                 |
| Sol. | <p style="text-align: right;">Correct graph</p> <p>Solution is <math>(1, 0)</math> or <math>x = 1, y = 0</math></p> <p>Absolute difference = 2 (consider <math>-2</math> also)</p>                                                                                                                                                                      | <p>2</p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p>                                                                        |
| 29.  | <p>Find a relation between <math>x</math> and <math>y</math> such that <math>P(x, y)</math> is equidistant from the points <math>A(3, 5)</math> and <math>B(7, 1)</math>. Hence, write the coordinates of the points on <math>x</math>-axis and <math>y</math>-axis which are equidistant from points <math>A</math> and <math>B</math>.</p>            |                                                                                                                                                 |
| Sol. | <p><math>PA = PB \Rightarrow PA^2 = PB^2</math></p> $(x - 3)^2 + (y - 5)^2 = (x - 7)^2 + (y - 1)^2$ $\Rightarrow x - y = 2$ <p><math>\therefore</math> Required point on <math>x</math>-axis is <math>(2, 0)</math></p> <p>&amp; required point on <math>y</math>-axis is <math>(0, -2)</math></p>                                                      | <p><math>\frac{1}{2}</math></p> <p><b>1</b></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> |

|               |                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                 |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| <b>30 (a)</b> | Prove the following trigonometric identity :<br>$\frac{1 + \operatorname{cosec} A}{\operatorname{cosec} A} = \frac{\cos^2 A}{1 - \sin A}$                                                                                                                                                                                                                              |                                                                                                 |
| <b>Sol.</b>   | $\begin{aligned} \text{LHS} &= \frac{1 + \frac{1}{\sin A}}{\frac{1}{\sin A}} \\ &= \sin A + 1 \\ &= \frac{(\sin A + 1)(1 - \sin A)}{1 - \sin A} \\ &= \frac{1 - \sin^2 A}{1 - \sin A} \\ &= \frac{\cos^2 A}{1 - \sin A} = \text{RHS} \end{aligned}$                                                                                                                    | $\frac{1}{2}$<br><br><b>1</b><br>$\frac{1}{2}$<br>$\frac{1}{2}$<br>$\frac{1}{2}$                |
| <b>OR</b>     |                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                 |
| <b>30 (b)</b> | Let $2A + B$ and $A + 2B$ be acute angles such that $\sin(2A + B) = \frac{\sqrt{3}}{2}$ and $\tan(A + 2B) = 1$ . Find the value of $\cot(4A - 7B)$ .                                                                                                                                                                                                                   |                                                                                                 |
| <b>Sol.</b>   | $\begin{aligned} \sin(2A + B) &= \frac{\sqrt{3}}{2} \Rightarrow 2A + B = 60^\circ \quad \text{--- (1)} \\ \tan(A + 2B) &= 1 \Rightarrow A + 2B = 45^\circ \quad \text{--- (2)} \\ \text{Solving (1) \& (2), we get } A &= 25^\circ \text{ and } B = 10^\circ \\ \cot(4A - 7B) &= \cot 30^\circ \\ &= \sqrt{3} \end{aligned}$                                           | $\frac{1}{2}$<br>$\frac{1}{2}$<br>$\frac{1}{2} + \frac{1}{2}$<br>$\frac{1}{2}$<br>$\frac{1}{2}$ |
| <b>31.</b>    | <p>In the adjoining figure, XY and X'Y' are parallel tangents to a circle with centre O. Another tangent AB touches the circle at C intersecting XY at A and X'Y' at B. Prove that AB subtends right angle at the centre of the circle; or <math>\angle AOB = 90^\circ</math>.</p>  |                                                                                                 |
| <b>Sol.</b>   | <p>Join OC.</p>  <p> <math>\triangle POA \cong \triangle COA</math><br/> <math>\angle POA = \angle COA</math><br/> Similarly, <math>\angle QOB = \angle COB</math><br/> <math>\angle POA + \angle QOB + \angle COA + \angle COB = 180^\circ</math> </p>                             | $\frac{1}{2}$<br><br>$\frac{1}{2}$<br>$\frac{1}{2}$<br>$\frac{1}{2}$                            |

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                            |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
|               | $\Rightarrow 2(\angle COA + \angle COB) = 180^\circ$<br>$\Rightarrow \angle COA + \angle COB = 90^\circ$<br>$\therefore \angle AOB = 90^\circ$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | $\frac{1}{2}$                                                                                                                                              |
|               | <b>SECTION D</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                            |
|               | <b>This section has 4 long answer questions of 5 marks each.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                            |
| <b>32 (a)</b> | A 2-digit number is seven times the sum of its digits and two (2) more than 5 times the product of its digits. Find the number.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                            |
| <b>Sol.</b>   | <p>Let digit at unit place be x<br/> and digit at tens place be y<br/> <math>\therefore</math> number = <math>10y + x</math></p> <p>ATQ</p> $10y + x = 7(x + y)$ $\Rightarrow 3y = 6x \text{ or } y = 2x \quad \text{--- (1)}$ <p>Also, <math>10y + x = 5xy + 2 \quad \text{--- (2)}</math><br/> from (1) and (2), we get</p> $10x^2 - 21x + 2 = 0$ $\Rightarrow (x - 2)(10x - 1) = 0$ $\therefore x = 2$ <p>So, <math>y = 4</math><br/> <math>\therefore</math> Required number is 42.</p>                                                                                                                                                        | <p>1</p> <p>1</p> <p><math>\frac{1}{2}</math></p> <p>1</p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> |
|               | <b>OR</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                            |
| <b>32 (b)</b> | Find the value(s) of p for which the quadratic equation given as $(p + 4)x^2 - (p + 1)x + 1 = 0$ has real and equal roots. Also, find the roots of the equation(s) so obtained.                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                            |
| <b>Sol.</b>   | <p>For real and equal roots, <math>D = 0</math><br/> <math>\therefore [-(p + 1)]^2 - 4(p + 4) = 0</math><br/> <math>\Rightarrow p^2 - 2p - 15 = 0</math><br/> <math>\Rightarrow (p - 5)(p + 3) = 0</math><br/> <math>\therefore p = 5, -3</math></p> <p>For <math>p = 5</math>,</p> $9x^2 - 6x + 1 = 0$ $\Rightarrow (3x - 1)(3x - 1) = 0$ $\therefore x = \frac{1}{3}, \frac{1}{3}$ <p>For <math>p = -3</math>,</p> $x^2 + 2x + 1 = 0$ $\Rightarrow (x + 1)(x + 1) = 0$ $\therefore x = -1, -1$ <p>Hence roots are <math>\frac{1}{3}, \frac{1}{3}</math> and <math>-1, -1</math> for <math>p = 5</math> and <math>p = -3</math> respectively.</p> | <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>                                                        |

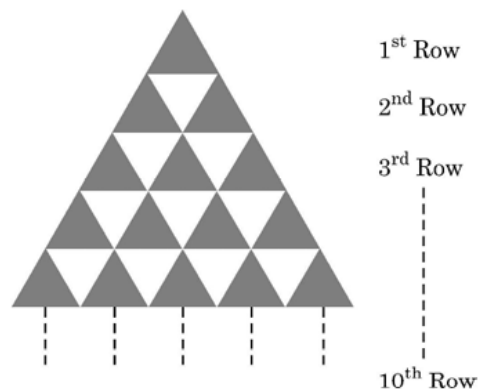
|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                           |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| <b>33.</b>    | If a line is drawn parallel to one side of a triangle intersecting the other two sides in distinct points then it divides the two sides in the same ratio. Prove it.<br>Also, state the converse of the above statement.                                                                                                                                                                                                                                                                                                                                |                           |
| <b>Sol.</b>   | Correct figure, given, to prove, construction<br>Correct proof<br>Correct statement of converse of given statement                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2<br>2<br>1               |
| <b>34 (a)</b> | From one of the faces of a solid wooden cube of side 14 cm, maximum number of hemispheres of diameter 1.4 cm are scooped out. Find the total number of hemispheres that can be scooped out. Also, find the total surface area of the remaining solid.                                                                                                                                                                                                                                                                                                   |                           |
| <b>Sol.</b>   | Total number of hemispheres = $\frac{14 \times 14}{1.4 \times 1.4}$<br>= 100<br>Total Surface Area of remaining solid = Surface Area of Cube + Curved Surface Area of 100 hemispheres – Area of 100 circles<br>= $6 \times 14 \times 14 + 100 \times 2 \times \frac{22}{7} \times 0.7 \times 0.7 - 100 \times \frac{22}{7} \times 0.7 \times 0.7$<br>= 1330<br>$\therefore$ Total surface area of remaining solid is 1330 cm <sup>2</sup> .                                                                                                             | 1<br>1<br><br>2<br>1      |
|               | <b>OR</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                           |
| <b>34 (b)</b> | From a solid cylinder of height 24 cm and radius 5 cm, two cones of height 12 cm and radius 5 cm are hollowed out. Find the volume and surface area of the remaining solid.                                                                                                                                                                                                                                                                                                                                                                             |                           |
| <b>Sol.</b>   | Volume of remaining solid = Volume of cylinder – Volume of two cones<br>= $\frac{22}{7} \times 5 \times 5 \times 24 - 2 \times \frac{1}{3} \times \frac{22}{7} \times 5 \times 5 \times 12$<br>= $\frac{8800}{7}$ or 1257.14 cm <sup>3</sup> approx.<br>$l = \sqrt{(12)^2 + (5)^2} = 13$ cm<br>Surface Area of remaining solid = Curved Surface Area of cylinder + Curved Surface Area of two cones<br>= $2 \times \frac{22}{7} \times 5 \times 24 + 2 \times \frac{22}{7} \times 5 \times 13$<br>= $\frac{8140}{7}$ or 1162.85 cm <sup>2</sup> approx. | 1<br>1<br>1<br><br>1<br>1 |

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |                              |           |                            |           |       |         |       |                    |     |     |   |         |    |    |     |     |   |         |   |    |     |     |   |         |   |        |   |   |    |         |    |    |   |    |    |         |   |    |   |   |    |         |   |    |   |   |    |       |    |  |  |    |  |                                                                 |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|------------------------------|-----------|----------------------------|-----------|-------|---------|-------|--------------------|-----|-----|---|---------|----|----|-----|-----|---|---------|---|----|-----|-----|---|---------|---|--------|---|---|----|---------|----|----|---|----|----|---------|---|----|---|---|----|---------|---|----|---|---|----|-------|----|--|--|----|--|-----------------------------------------------------------------|
| 35.                | <p>Medical check-up was carried out for 35 students of a class and their weights were recorded as follows :</p> <table><tr><td>Weight (in kg)</td><td>38-40</td><td>40-42</td><td>42-44</td><td>44-46</td><td>46-48</td><td>48-50</td><td>50-52</td></tr><tr><td>Number of Students</td><td>3</td><td>2</td><td>4</td><td>5</td><td>14</td><td>4</td><td>3</td></tr></table> <p>Find the difference between the mean weight and the median weight.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Weight (in kg) | 38-40                        | 40-42     | 42-44                      | 44-46     | 46-48 | 48-50   | 50-52 | Number of Students | 3   | 2   | 4 | 5       | 14 | 4  | 3   |     |   |         |   |    |     |     |   |         |   |        |   |   |    |         |    |    |   |    |    |         |   |    |   |   |    |         |   |    |   |   |    |       |    |  |  |    |  |                                                                 |
| Weight (in kg)     | 38-40                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 40-42          | 42-44                        | 44-46     | 46-48                      | 48-50     | 50-52 |         |       |                    |     |     |   |         |    |    |     |     |   |         |   |    |     |     |   |         |   |        |   |   |    |         |    |    |   |    |    |         |   |    |   |   |    |         |   |    |   |   |    |       |    |  |  |    |  |                                                                 |
| Number of Students | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 2              | 4                            | 5         | 14                         | 4         | 3     |         |       |                    |     |     |   |         |    |    |     |     |   |         |   |    |     |     |   |         |   |        |   |   |    |         |    |    |   |    |    |         |   |    |   |   |    |         |   |    |   |   |    |       |    |  |  |    |  |                                                                 |
| Sol.               | <table><tr><td>Weight (in kg)</td><td>Number of Students (<math>f_i</math>)</td><td><math>x_i</math></td><td><math>u_i = \frac{x_i - 45}{2}</math></td><td><math>f_i u_i</math></td><td><math>cf</math></td></tr><tr><td>38 – 40</td><td>3</td><td>39</td><td>– 3</td><td>– 9</td><td>3</td></tr><tr><td>40 – 42</td><td>2</td><td>41</td><td>– 2</td><td>– 4</td><td>5</td></tr><tr><td>42 – 44</td><td>4</td><td>43</td><td>– 1</td><td>– 4</td><td>9</td></tr><tr><td>44 – 46</td><td>5</td><td>45 = a</td><td>0</td><td>0</td><td>14</td></tr><tr><td>46 – 48</td><td>14</td><td>47</td><td>1</td><td>14</td><td>28</td></tr><tr><td>48 – 50</td><td>4</td><td>49</td><td>2</td><td>8</td><td>32</td></tr><tr><td>50 – 52</td><td>3</td><td>51</td><td>3</td><td>9</td><td>35</td></tr><tr><td>Total</td><td>35</td><td></td><td></td><td>14</td><td></td></tr></table> <p style="text-align: right;">Correct table</p> <p>Mean = <math>45 + \frac{14}{35} \times 2</math><br/>= 45.8</p> <p>∴ Mean weight is 45.8 kg</p> <p>Median Class is 46 – 48</p> <p>Median = <math>46 + \frac{\frac{35}{2} - 14}{14} \times 2</math><br/>= 46.5</p> <p>∴ Median weight is 46.5 kg</p> <p>Difference of mean weight and median weight = <math>46.5 - 45.8 = 0.7</math> kg</p> | Weight (in kg) | Number of Students ( $f_i$ ) | $x_i$     | $u_i = \frac{x_i - 45}{2}$ | $f_i u_i$ | $cf$  | 38 – 40 | 3     | 39                 | – 3 | – 9 | 3 | 40 – 42 | 2  | 41 | – 2 | – 4 | 5 | 42 – 44 | 4 | 43 | – 1 | – 4 | 9 | 44 – 46 | 5 | 45 = a | 0 | 0 | 14 | 46 – 48 | 14 | 47 | 1 | 14 | 28 | 48 – 50 | 4 | 49 | 2 | 8 | 32 | 50 – 52 | 3 | 51 | 3 | 9 | 35 | Total | 35 |  |  | 14 |  | <p>1½</p> <p>1</p> <p>½</p> <p>½</p> <p>½</p> <p>½</p> <p>½</p> |
| Weight (in kg)     | Number of Students ( $f_i$ )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | $x_i$          | $u_i = \frac{x_i - 45}{2}$   | $f_i u_i$ | $cf$                       |           |       |         |       |                    |     |     |   |         |    |    |     |     |   |         |   |    |     |     |   |         |   |        |   |   |    |         |    |    |   |    |    |         |   |    |   |   |    |         |   |    |   |   |    |       |    |  |  |    |  |                                                                 |
| 38 – 40            | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 39             | – 3                          | – 9       | 3                          |           |       |         |       |                    |     |     |   |         |    |    |     |     |   |         |   |    |     |     |   |         |   |        |   |   |    |         |    |    |   |    |    |         |   |    |   |   |    |         |   |    |   |   |    |       |    |  |  |    |  |                                                                 |
| 40 – 42            | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 41             | – 2                          | – 4       | 5                          |           |       |         |       |                    |     |     |   |         |    |    |     |     |   |         |   |    |     |     |   |         |   |        |   |   |    |         |    |    |   |    |    |         |   |    |   |   |    |         |   |    |   |   |    |       |    |  |  |    |  |                                                                 |
| 42 – 44            | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 43             | – 1                          | – 4       | 9                          |           |       |         |       |                    |     |     |   |         |    |    |     |     |   |         |   |    |     |     |   |         |   |        |   |   |    |         |    |    |   |    |    |         |   |    |   |   |    |         |   |    |   |   |    |       |    |  |  |    |  |                                                                 |
| 44 – 46            | 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 45 = a         | 0                            | 0         | 14                         |           |       |         |       |                    |     |     |   |         |    |    |     |     |   |         |   |    |     |     |   |         |   |        |   |   |    |         |    |    |   |    |    |         |   |    |   |   |    |         |   |    |   |   |    |       |    |  |  |    |  |                                                                 |
| 46 – 48            | 14                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 47             | 1                            | 14        | 28                         |           |       |         |       |                    |     |     |   |         |    |    |     |     |   |         |   |    |     |     |   |         |   |        |   |   |    |         |    |    |   |    |    |         |   |    |   |   |    |         |   |    |   |   |    |       |    |  |  |    |  |                                                                 |
| 48 – 50            | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 49             | 2                            | 8         | 32                         |           |       |         |       |                    |     |     |   |         |    |    |     |     |   |         |   |    |     |     |   |         |   |        |   |   |    |         |    |    |   |    |    |         |   |    |   |   |    |         |   |    |   |   |    |       |    |  |  |    |  |                                                                 |
| 50 – 52            | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 51             | 3                            | 9         | 35                         |           |       |         |       |                    |     |     |   |         |    |    |     |     |   |         |   |    |     |     |   |         |   |        |   |   |    |         |    |    |   |    |    |         |   |    |   |   |    |         |   |    |   |   |    |       |    |  |  |    |  |                                                                 |
| Total              | 35                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                |                              | 14        |                            |           |       |         |       |                    |     |     |   |         |    |    |     |     |   |         |   |    |     |     |   |         |   |        |   |   |    |         |    |    |   |    |    |         |   |    |   |   |    |         |   |    |   |   |    |       |    |  |  |    |  |                                                                 |

|      | SECTION E<br>This section has 3 case study based questions of 4 marks each.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                  |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 36.  | <p>A farmer has a circular piece of land. He wishes to construct his house in the form of largest possible square within the land as shown below.</p>  <p>The radius of circular piece of land is 35 m.</p> <p>Based on given information, answer the following questions :</p> <p>(i) Find the length of wire needed to fence the entire land.</p> <p>(ii) Find the length of each side of the square land on which house will be constructed.</p> <p>(iii) (a) The farmer wishes to grow grass on the shaded region around the house. Find the cost of growing the grass at the rate of ₹ 50 per square metre.</p> <p style="text-align: center;"><b>OR</b></p> <p>(iii) (b) Find the ratio of area of land on which house is built to remaining area of circular piece of land.</p>                                                                   |                                                                                                                                                                                                                                                                  |
| Sol. | <p>(i) Length of wire = <math>2 \times \frac{22}{7} \times 35</math><br/>= 220 m</p> <p>(ii) Diagonal of square = 70 m<br/>Length of each side of the square land = <math>\frac{70}{\sqrt{2}}</math> or <math>35\sqrt{2}</math> m</p> <p>(iii) (a) Area on which grass is grown = Area of two segments<br/>= <math>2 \times \left[ \frac{90}{360} \times \frac{22}{7} \times 35 \times 35 - \frac{1}{2} \times 35 \times 35 \right]</math><br/>= 700 m<sup>2</sup><br/>Cost of growing the grass = <math>700 \times 50 = ₹ 35000</math></p> <p style="text-align: center;"><b>OR</b></p> <p>(iii) (b) Required ratio = <math>\frac{\text{area of square}}{\text{area of circle} - \text{area of square}}</math><br/>= <math>\frac{35\sqrt{2} \times 35\sqrt{2}}{\frac{22}{7} \times 35 \times 35 - 35\sqrt{2} \times 35\sqrt{2}}</math><br/>= <math>\frac{2450}{1400}</math> or <math>\frac{7}{4}</math><br/>∴ Required ratio is 7 : 4</p> | <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><b>1</b></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><b>1½</b></p> <p><math>\frac{1}{2}</math></p> |

**37.**

In an equilateral triangle of side 10 cm, equilateral triangles of side 1 cm are formed as shown in the figure below, such that there is one triangle in the first row, three triangles in the second row, five triangles in the third row and so on.



Based on given information, answer the following questions using Arithmetic Progression.

- How many triangles will be there in bottom most row ?
- How many triangles will be there in fourth row from the bottom ?
- (a) Find the total number of triangles of side 1 cm each till 8<sup>th</sup> row.

**OR**

- (iii) (b) How many more number of triangles are there from 5<sup>th</sup> row to 10<sup>th</sup> row than in first 4 rows ? Show working.

**Sol.**

Given A.P. is 1, 3, 5, ...

(i)  $a_{10} = 1 + 9 \times 2 = 19$

(ii)  $a_4$  (from bottom)  $= 19 + 3 \times (-2) = 13$

$$\text{(iii) (a) } S_8 = \frac{8}{2} \times [2 \times 1 + 7 \times 2]$$
$$= 64$$

**OR**

(iii) (b) Number of triangles from 5<sup>th</sup> row to 10<sup>th</sup> row =  $S_{10} - S_4$   
 $= \frac{10}{2} \times [2 \times 1 + 9 \times 2] - \frac{4}{2} \times [2 \times 1 + 3 \times 2]$   
 $= 84$

Number of triangles in first 4 rows,  $S_4 = \frac{4}{2} \times [2 \times 1 + 3 \times 2]$   
 $= 16$

Required number of triangles =  $84 - 16 = 68$

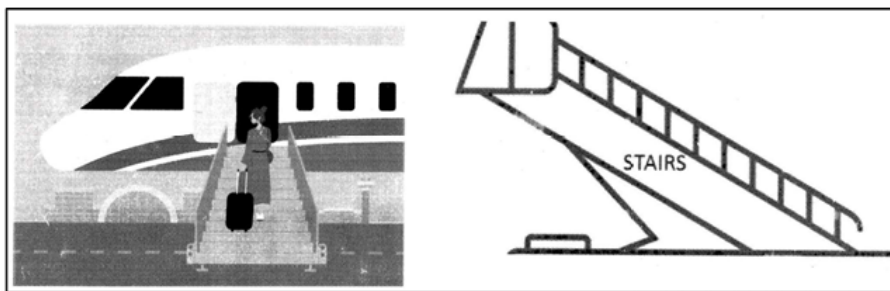
**1**  
**1**  
**1**  
**1**

**1**

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

38.

Passenger boarding stairs, sometimes referred to as boarding ramps, stair cars or aircraft steps, provide a mobile means to travel between the aircraft doors and the ground. Larger aircraft have door sills 5 to 20 feet (1 foot = 30 cm) high. Stairs facilitate safe boarding and de-boarding.



An aircraft has a door sill at a height of 15 feet above the ground. A stair car is placed at a horizontal distance of 15 feet from the plane.

Based on given information, answer the questions given in part (i) and (ii).

- (i) Find the angle at which stairs are inclined to reach the door sill 15 feet high above the ground.
- (ii) Find the length of stairs used to reach the door sill.

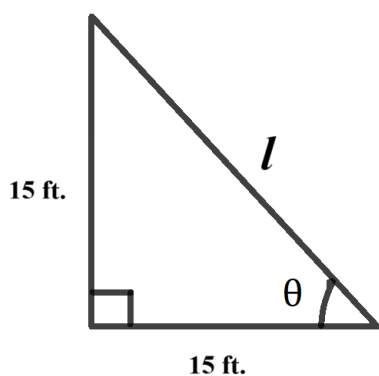
Further, answer any **one** of the following questions :

- (iii) (a) If the 20 feet long stairs is inclined at an angle of  $60^\circ$  to reach the door sill, then find the height of the door sill above the ground. (use  $\sqrt{3} = 1.732$ )

**OR**

- (iii) (b) What should be the shortest possible length of stairs to reach the door sill of the plane 20 feet above the ground, if the angle of elevation cannot exceed  $30^\circ$  ? Also, find the horizontal distance of base of stair car from the plane.

Sol.



$$(i) \quad \tan \theta = \frac{15}{15} = 1$$

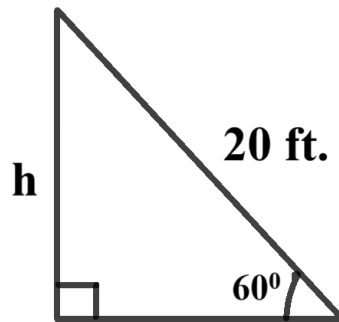
$$\Rightarrow \theta = 45^\circ$$

$$(ii) \quad \frac{15}{l} = \sin 45^\circ$$

$$\Rightarrow l = 15\sqrt{2} \text{ ft. or } 21.21 \text{ ft. approx.}$$

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

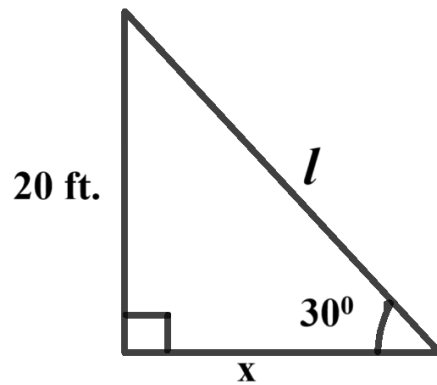
(iii) (a)



$$\begin{aligned}\frac{h}{20} &= \sin 60^\circ = \frac{\sqrt{3}}{2} \\ \Rightarrow h &= 10\sqrt{3} \\ &= 10 \times 1.732 \\ &= 17.32 \text{ ft.}\end{aligned}$$

OR

(iii) (b)



$$\begin{aligned}\frac{20}{l} &= \sin 30^\circ = \frac{1}{2} \\ \Rightarrow l &= 40 \text{ ft.} \\ \frac{20}{x} &= \tan 30^\circ = \frac{1}{\sqrt{3}} \\ \Rightarrow x &= 20\sqrt{3} \text{ ft. or } 34.64 \text{ ft. approx.}\end{aligned}$$

1

$\frac{1}{2}$

$\frac{1}{2}$

$\frac{1}{2}$

$\frac{1}{2}$

$\frac{1}{2}$

$\frac{1}{2}$