

Series : H4EFG



SET ~ 2

रोल नं.
Roll No.



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प्रश्न-पत्र कोड
Q.P. Code 30/4/2

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

नोट

- (I) कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ 15 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 यथास्थान 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 छात्र केवल प्रश्न-पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर-पुस्तिका पर कोई उत्तर नहीं लिखेंगे।

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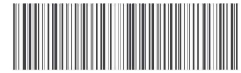
NOTE

- (I) Please check that this question paper contains 15 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 students 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



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सामान्य निर्देश :

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

- (i) इस प्रश्न-पत्र में 38 प्रश्न हैं। सभी प्रश्न अनिवार्य हैं।
- (ii) प्रश्न-पत्र पांच खण्डों में विभाजित है - 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 किया गया है।
- (ix) जहां आवश्यक हो, स्वच्छ आकृतियां बनाइए। यदि आवश्यक हो तो $\pi = \frac{22}{7}$ लीजिए, यदि अन्यथा न दिया गया हो।
- (x) कैलकुलेटर का उपयोग वर्जित है।

खण्ड - क

20×1 = 20

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

1. घात 3 के एक बहुपद $p(x)$ के लिए निम्न कथनों में से कौन-सा सही है? 1
 - (a) $p(x)$ के अधिक से अधिक दो भिन्न शून्यक हैं।
 - (b) $p(x)$ के कम से कम दो भिन्न शून्यक हैं।
 - (c) $p(x)$ के तीन भिन्न शून्यक हैं।
 - (d) $p(x)$ के अधिक से अधिक तीन भिन्न शून्यक हैं।
2. पासों का एक जोड़ा एक बार फेंका जाता है। उनकी ऊपरी सतहों पर आई संख्याओं का योग कम से कम 4 होने की प्रायिकता है : 1
 - (a) $\frac{1}{11}$
 - (b) $\frac{10}{11}$
 - (c) $\frac{5}{6}$
 - (d) $\frac{11}{12}$
3. यदि $x = ab^3$ और $y = a^3b$ हैं, जहाँ a और b अभाज्य संख्याएँ हैं, तो $[HCF(x, y) - LCM(x, y)]$ बराबर है : 1
 - (a) $1 - a^3b^3$
 - (b) $ab(1 - ab)$
 - (c) $ab - a^4b^4$
 - (d) $ab(1 - ab)(1 + ab)$
4. $(1 + \sqrt{3})^2 - (1 - \sqrt{3})^2$ एक : 1
 - (a) धनात्मक परिमेय संख्या है।
 - (b) ऋणात्मक पूर्णांक है।
 - (c) धनात्मक अपरिमेय संख्या है।
 - (d) ऋणात्मक अपरिमेय संख्या है।



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General Instructions :

Read the following instructions carefully and follow them :

- (i) This question paper contains **38** questions. **All** questions are **compulsory**.
- (ii) 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 question in each case-study.
- (viii) There is no overall choice. However, an internal choice has been provided in **2** questions in Section **B**, **2** questions in Section **C**, **2** questions in Section **D** and **3** questions of **2** marks in Section **E**.
- (ix) Draw neat diagrams wherever required. Take $\pi = \frac{22}{7}$ wherever required, if not stated.
- (x) Use of calculators is **NOT** allowed.

SECTION – A

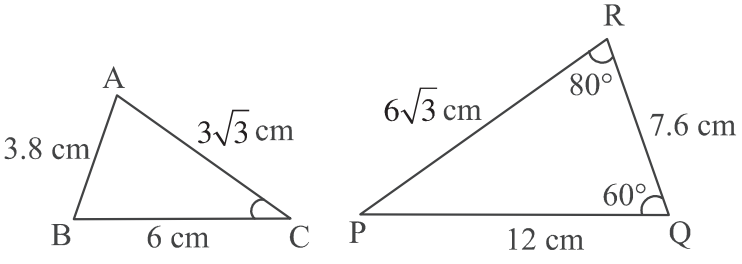
20×1 = 20

This section consists of 20 questions of 1 mark each.

1. Which of the following statements is true for a polynomial $p(x)$ of degree 3? **1**
 - (a) $p(x)$ has at most two distinct zeroes.
 - (b) $p(x)$ has at least two distinct zeroes.
 - (c) $p(x)$ has exactly three distinct zeroes.
 - (d) $p(x)$ has at most three distinct zeroes.
2. A pair of dice is thrown once. The probability that sum of numbers appearing on top faces is at least 4 is : **1**
 - (a) $\frac{1}{11}$ (b) $\frac{10}{11}$ (c) $\frac{5}{6}$ (d) $\frac{11}{12}$
3. If $x = ab^3$ and $y = a^3b$, where a and b are prime numbers, then $[\text{HCF}(x, y) - \text{LCM}(x, y)]$ is equal to : **1**
 - (a) $1 - a^3b^3$ (b) $ab(1 - ab)$
 - (c) $ab - a^4b^4$ (d) $ab(1 - ab)(1 + ab)$
4. $(1 + \sqrt{3})^2 - (1 - \sqrt{3})^2$ is : **1**
 - (a) a positive rational number. (b) a negative integer.
 - (c) a positive irrational number. (d) a negative irrational number.

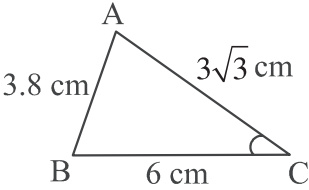


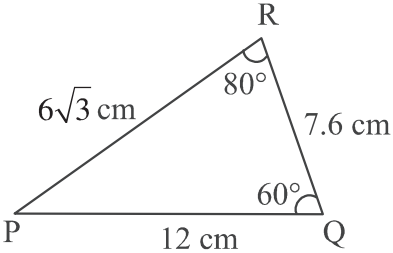
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5. 'a' का मान जिसके लिए $ax^2 + x + a = 0$ के मूल बराबर और धनात्मक हैं, है : 1
 (a) 2 (b) -2 (c) $\frac{1}{2}$ (d) $-\frac{1}{2}$
6. निम्न बिंदुओं में से किस बिंदु की, मूल बिंदु से दूरी 5 इकाई से कम है? 1
 (a) (3, 4) (b) (2, 6) (c) (-3, -4) (d) (1, 4)
7. एक थैले में लाल गेंदों की संख्या, काली गेंदों की संख्या से 10 अधिक है। यदि इस थैले से यादृच्छया एक लाल गेंद निकालने की प्रायिकता $\frac{3}{5}$ है, तो ज्ञात कीजिए कि थैले में कुल कितनी गेंदें हैं? 1
 (a) 50 (b) 60 (c) 80 (d) 40
8. 'p' का मान जिसके लिए निम्न समीकरणों के अपरिमित रूप से अनेक हल होंगे : 1
 $px + 3y = p - 3$, $12x + py = p$
 (a) केवल -6 (b) केवल 6
 (c) ± 6 (d) ± 6 को छोड़कर कोई भी वास्तविक संख्या
9. दी गई आकृतियों में, दो त्रिभुज ABC और PQR हैं। $\angle C$ की माप है : 1
 (a) 140°
 (b) 80°
 (c) 60°
 (d) 40°
- 
10. निम्न में से कौन-सी त्रिकोणमितीय सर्वसमिका है? 1
 (a) $\sin^2 \theta = 1 + \cos^2 \theta$ (b) $\operatorname{cosec}^2 \theta + \cot^2 \theta = 1$
 (c) $\sec^2 \theta = 1 + \tan^2 \theta$ (d) $\sin 2\theta = 2 \sin \theta$
11. निम्न में से कौन-सा कथन सही है? 1
 (a) $\sin 20^\circ > \sin 70^\circ$ (b) $\sin 20^\circ > \cos 20^\circ$
 (c) $\cos 20^\circ > \cos 70^\circ$ (d) $\tan 20^\circ > \tan 70^\circ$
12. एक 30 m लंबी रस्सी कसकर खींची गई और खंभे के शीर्ष से जमीन तक बांधी गई है। यदि रस्सी जमीन से 60° का कोण बनाती है, तो खंभे की ऊँचाई होगी : 1
 (a) $10\sqrt{3}$ m (b) $30\sqrt{3}$ m (c) 15 m (d) $15\sqrt{3}$ m
13. यदि किन्हीं आँकड़ों के समुच्चय का माध्य और बहुलक क्रमशः 10 और 13 हैं, तो इनके माध्यक का मान होगा : 1
 (a) 19 (b) 4 (c) 11 (d) 43



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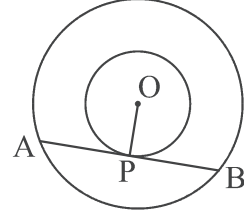
5. The value of 'a' for which $ax^2 + x + a = 0$ has equal and positive roots is : 1
(a) 2 (b) -2 (c) $\frac{1}{2}$ (d) $-\frac{1}{2}$
6. The distance of which of the following points from origin is less than 5 units ? 1
(a) (3, 4) (b) (2, 6) (c) (-3, -4) (d) (1, 4)
7. The number of red balls in a bag is 10 more than the number of black balls. If the probability of drawing a red ball at random from this bag is $\frac{3}{5}$, then the total number of balls in the bag is : 1
(a) 50 (b) 60 (c) 80 (d) 40
8. The value of 'p' for which the equations $px + 3y = p - 3$, $12x + py = p$ has infinitely many solutions is : 1
(a) -6 only (b) 6 only
(c) ± 6 (d) Any real number except ± 6
9. $\triangle ABC$ and $\triangle PQR$ are shown in the adjoining figures. The measure of $\angle C$ is : 1
(a) 140°
(b) 80°
(c) 60°
(d) 40°
- 


10. Which of the following is a trigonometric identity ? 1
(a) $\sin^2 \theta = 1 + \cos^2 \theta$ (b) $\operatorname{cosec}^2 \theta + \cot^2 \theta = 1$
(c) $\sec^2 \theta = 1 + \tan^2 \theta$ (d) $\sin 2\theta = 2 \sin \theta$
11. Which of the following statements is true ? 1
(a) $\sin 20^\circ > \sin 70^\circ$ (b) $\sin 20^\circ > \cos 20^\circ$
(c) $\cos 20^\circ > \cos 70^\circ$ (d) $\tan 20^\circ > \tan 70^\circ$
12. A 30 m long rope is tightly stretched and tied from the top of pole to the ground. If the rope makes an angle of 60° with the ground, the height of the pole is : 1
(a) $10\sqrt{3}$ m (b) $30\sqrt{3}$ m (c) 15 m (d) $15\sqrt{3}$ m
13. If mean and mode of given set of observations are 10 and 13 respectively, then the value of median is : 1
(a) 19 (b) 4 (c) 11 (d) 43



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14. दी गई आकृति में, बड़े वृत्त की जीवा AB, छोटे वृत्त को बिंदु P पर स्पर्श करती है।
यदि AB की लंबाई = छोटे वृत्त का व्यास = $2r$ है,
तो बड़े वृत्त का व्यास है :



- (a) $2r$ (b) $4r$
(c) $2\sqrt{2}r$ (d) $\sqrt{2}r$
15. 7 cm भुजा वाले एक घन की ऊपरी सतह से, लकड़ी को बाहर निकालकर त्रिज्या 0.35 cm के अर्धगोलाकार गड्ढे बनाए जाते हैं। ऐसे बनाए गए गड्ढों की अधिकतम संख्या है :
(a) 400 (b) 100 (c) 20 (d) 10
16. माध्यक की गणना के लिए संचयी बारंबारता किन सभी वर्गों की बारंबारताओं को जोड़कर प्राप्त की जाती है ?
(a) माध्यक वर्ग तक के वर्ग (b) माध्यक वर्ग के बाद के वर्ग
(c) माध्यक वर्ग से पहले के वर्ग (d) सभी वर्ग
17. एक वृत्त के परिगत एक समांतर चतुर्भुज की एक भुजा 5 cm लंबी है। इस समांतर चतुर्भुज का परिमाण है :
(a) 20 cm (b) 20 cm से कम
(c) 20 cm से अधिक परन्तु 40 cm से कम (d) 40 cm
18. त्रिभुज ABC की भुजाओं AB और AC पर दो बिंदु E और F इस प्रकार स्थित हैं कि $\frac{AE}{EB} = \frac{AF}{FC} = \frac{1}{2}$ है। निम्न में से कौन-सा संबंध सही है ?
(a) $EF = 2BC$ (b) $BC = 2EF$ (c) $EF = 3BC$ (d) $BC = 3EF$

निर्देश :

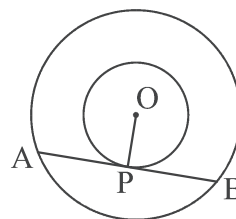
प्रश्न संख्या 19 तथा 20 प्रत्येक में एक अभिकथन (A) के पश्चात् एक तर्क (R) दिया है। निम्न में से सही विकल्प चुनिए :

- (a) दोनों, अभिकथन (A) तथा तर्क (R) सत्य हैं और तर्क (R), अभिकथन (A) की पूर्ण व्याख्या करता है।
(b) दोनों, अभिकथन (A) तथा तर्क (R) सत्य हैं और तर्क (R), अभिकथन (A) की 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) : वृत्त की स्पर्श रेखा के स्पर्श बिंदु से लम्बवत् रेखा, वृत्त के केन्द्र से होकर गुजरती है।
तर्क (R) : बाह्य बिंदु से वृत्त पर खींची गई स्पर्श रेखाओं की लंबाइयाँ बराबर होती हैं।
20. अभिकथन (A) : किसी प्राकृत संख्या n के लिए, संख्या 4^n अंक 0 पर समाप्त होती है।
तर्क (R) : प्राकृत संख्या ' x ', जिसके दो अभाज्य गुणखंड 2 और 5 हैं, के लिए x^n सदैव अंक 0 पर समाप्त होता है, जहाँ n एक प्राकृत संख्या है।



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14. In the adjoining figure, AB is the chord of larger circle which touches the smaller circle at P. If length of AB = diameter of inner circle = $2r$, then the diameter of larger circle is :



- (a) $2r$ (b) $4r$
 (c) $2\sqrt{2}r$ (d) $\sqrt{2}r$ 1
15. On the top face of the wooden cube of side 7 cm, hemispherical depressions of radius 0.35 cm are to be formed by taking out the wood. The maximum number of depressions that can be formed is : 1
 (a) 400 (b) 100 (c) 20 (d) 10
16. The cumulative frequency for calculating median is obtained by adding the frequencies of all the : 1
 (a) classes up to the median class
 (b) classes following the median class
 (c) classes preceding the median class
 (d) all classes
17. A parallelogram having one of its sides 5 cm circumscribes a circle. The perimeter of parallelogram is : 1
 (a) 20 cm (b) less than 20 cm
 (c) more than 20 cm but less than 40 cm (d) 40 cm
18. E and F are points on the sides AB and AC respectively of a ΔABC such that $\frac{AE}{EB} = \frac{AF}{FC} = \frac{1}{2}$. Which of the following relation is true ? 1
 (a) $EF = 2BC$ (b) $BC = 2EF$ (c) $EF = 3BC$ (d) $BC = 3EF$

Directions :

In question number 19 and 20, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option :

- (a) Both, Assertion (A) and Reason (R) are true and Reason (R) is correct explanation of Assertion (A).
 (b) Both, Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).
 (c) Assertion (A) is true but Reason (R) is false.
 (d) Assertion (A) is false but Reason (R) is true.
19. **Assertion (A) :** A line drawn perpendicular to the tangent at point of contact passes through the centre of the circle.
Reason (R) : Lengths of tangents drawn from external point to a circle are equal. 1
20. **Assertion (A) :** 4^n ends with digit 0 for some natural number n .
Reason (R) : For a number 'x' having 2 and 5 as its prime factors, x^n always ends with digit 0 for every natural number n . 1



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खण्ड – ख

इस खण्ड में 5 प्रश्न हैं, जिनमें प्रत्येक के 2 अंक हैं।

21. (A) x का मान ज्ञात कीजिए, जिसके लिए
 $(\sin A + \operatorname{cosec} A)^2 + (\cos A + \sec A)^2 = x + \tan^2 A + \cot^2 A$ 2
अथवा
(B) मान ज्ञात कीजिए : $\frac{3 \sin 30^\circ - 4 \sin^3 30^\circ}{2 \sin^2 50^\circ + 2 \cos^2 50^\circ}$ 2
22. साइमा और आर्या, वर्ष 2012 के जून महीने में पैदा हुई थीं। प्रायिकता ज्ञात कीजिए कि : 2
(i) उन दोनों की जन्म तिथि भिन्न हैं।
(ii) उन दोनों की जन्म तिथि एक ही है।
23. निम्न समीकरण निकाय को, बीजगणितीय विधि से हल कीजिए : 2
 $37x + 63y = 137$
 $63x + 37y = 163$
24. (A) 1.5 m लंबा एक लड़का 12 m ऊँचे लैंप-पोस्ट (lamp post) के पाद से 2.5 m/sec 2
की गति से दूर जा रहा है। 3 sec पश्चात् उसकी छाया की लंबाई ज्ञात कीजिए।
अथवा
(B) समांतर चतुर्भुज ABCD की भुजा AD को बिंदु E तक बढ़ाया जाता है और BE, CD 2
को F पर प्रतिच्छेदित करती है। सिद्ध कीजिए कि $\triangle ABE \sim \triangle CFB$
25. बिंदु C के निर्देशांक ज्ञात कीजिए जो बढ़ी हुई रेखा AB पर इस प्रकार स्थित है कि 2
 $AC = 2BC$, जहाँ A और B के निर्देशांक क्रमशः $(-1, 7)$ और $(4, -3)$ हैं।

खण्ड – ग

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

26. द्विघात समीकरण $x^2 - ax - b$ के शून्यक α और β हैं। एक द्विघात समीकरण बनाइए जिसके 3
शून्यक $3\alpha + 1$ और $3\beta + 1$ हों।
27. 10 cm त्रिज्या वाले एक वृत्त के परिगत एक आयत ABCD बनी है। सिद्ध कीजिए कि यह 3
आयत ABCD का वर्ग है। अतः ABCD का परिमाप ज्ञात कीजिए।
28. (A) सिद्ध कीजिए कि $\sqrt{2}$ एक अपरिमेय संख्या है। 3
अथवा
(B) माना x और y दो भिन्न अभाज्य संख्याएँ हैं और $p = x^2 y^3$, $q = xy^4$, $r = x^5 y^2$ हैं। 3
 p, q और r का HCF और LCM ज्ञात कीजिए। इसके अलावा यह भी जाँच कीजिए कि
क्या $\text{HCF}(p, q, r) \times \text{LCM}(p, q, r) = p \times q \times r$ है या नहीं।
29. एक समकोण त्रिभुज के दो कोणों (90° के अलावा) का अनुपात 2 : 3 है। दी गई स्थिति को 3
बीजगणितीय दो चरों वाले एक समीकरण निकाय के रूप में व्यक्त कीजिए। अतः इस निकाय को
हल कीजिए।



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SECTION – B

This section consists of 5 questions of 2 marks each.

21. (A) Find the value of x for which
 $(\sin A + \operatorname{cosec} A)^2 + (\cos A + \sec A)^2 = x + \tan^2 A + \cot^2 A$ 2
- OR**
- (B) Evaluate the following : 2
- $$\frac{3 \sin 30^\circ - 4 \sin^3 30^\circ}{2 \sin^2 50^\circ + 2 \cos^2 50^\circ}$$
22. Saima and Aryaa were born in the month of June in the year 2012. Find the probability that : 2
- (i) they have different dates of birth.
(ii) they have same date of birth.
23. Solve the following system of equations algebraically : 2
- $$37x + 63y = 137$$
- $$63x + 37y = 163$$
24. (A) A 1.5 m tall boy is walking away from the base of a lamp post which is 12 m high, at the speed of 2.5 m/sec. Find the length of his shadow after 3 seconds. 2
- OR**
- (B) In parallelogram ABCD, side AD is produced to a point E and BE intersects CD at F. Prove that $\triangle ABE \sim \triangle CFB$ 2
25. Find the coordinates of the point C which lies on the line AB produced such that $AC = 2BC$, where coordinates of points A and B are $(-1, 7)$ and $(4, -3)$ respectively. 2

SECTION – C

This section consists of 6 questions of 3 marks each.

26. α and β are zeroes of a quadratic polynomial $x^2 - ax - b$. Obtain a quadratic polynomial whose zeroes are $3\alpha + 1$ and $3\beta + 1$. 3
27. Rectangle ABCD circumscribes the circle of radius 10 cm. Prove that ABCD is a square. Hence, find the perimeter of ABCD. 3
28. (A) Prove that $\sqrt{2}$ is an irrational number. 3
- OR**
- (B) Let x and y be two distinct prime numbers and $p = x^2 y^3$, $q = xy^4$, $r = x^5 y^2$. Find the HCF and LCM of p , q and r . Further check if $\text{HCF}(p, q, r) \times \text{LCM}(p, q, r) = p \times q \times r$ or not. 3
29. The two angles of a right angled triangle other than 90° are in the ratio 2:3. Express the given situation algebraically as a system of linear equations in two variables and hence solve it. 3



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- 30 एक समकोण त्रिभुज PQR, जिसमें समकोण बिंदु P पर है, के शीर्ष P (x, y), Q (-2, -3) और R (2, 3) हैं। x और y के बीच का संबंध ज्ञात कीजिए। अतः x के वे सभी सम्भव मान ज्ञात कीजिए जिनके लिए y = 2 है। 3

31. (A) सिद्ध कीजिए कि $\frac{\cos A + \sin A - 1}{\cos A - \sin A + 1} = \operatorname{cosec} A - \cot A$ 3

अथवा

- (B) यदि $\cot \theta + \cos \theta = p$ और $\cot \theta - \cos \theta = q$ हैं,
तो सिद्ध कीजिए कि $p^2 - q^2 = 4\sqrt{pq}$ 3

खण्ड - घ

इस खण्ड में 4 प्रश्न हैं, जिनमें प्रत्येक के 5 अंक हैं।

32. निम्न तालिका में, यातायात पुलिस ने अप्रैल के महीने में जितने चालान जारी किए थे, उनको दर्शाया गया है :

चालानों की संख्या	दिनों की संख्या
0-10	3
10-20	5
20-30	10
30-40	9
40-50	2
50-60	1
योग	30

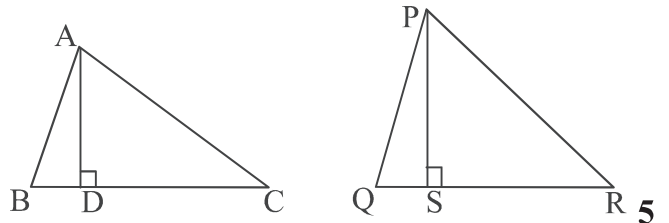
उपरोक्त आँकड़ों का 'माध्य' और 'बहुलक' ज्ञात कीजिए। 5

33. (A) एक समकोण त्रिभुज की भुजाएँ इस प्रकार हैं कि सबसे लंबी भुजा, सबसे छोटी भुजा से 4 m बड़ी है और तीसरी भुजा सबसे बड़ी भुजा से 2 m छोटी है। त्रिभुज की सभी भुजाओं की लंबाईयें ज्ञात कीजिए। दिए गए त्रिभुज के क्षेत्रफल और परिमाप के संख्यात्मक मानों के बीच का अंतर ज्ञात कीजिए। 5

अथवा

- (B) समीकरण $\frac{x-2}{x-3} + \frac{x-4}{x-5} = \frac{10}{3}$; ($x \neq 3, 5$) को एक द्विघात समीकरण के मानक रूप में व्यक्त कीजिए। अतः इस बनाए गए द्विघात समीकरण के मूल ज्ञात कीजिए। 5

34. (A) त्रिभुजों ABC और PQR की संगत भुजाएँ 3:5 के अनुपात में हैं। $AD \perp BC$ तथा $PS \perp QR$ जैसा कि दी गई आकृतियों में दिखाया गया है :



- (i) सिद्ध कीजिए कि $\triangle ADC \sim \triangle PSR$
(ii) यदि $AD = 4$ cm है, तो PS की लंबाई ज्ञात कीजिए।
(iii) (ii) के प्रयोग से $\ar(\triangle ABC) : \ar(\triangle PQR)$ ज्ञात कीजिए।



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30. P (x, y), Q (− 2, − 3) and R (2, 3) are the vertices of a right triangle PQR right angled at P. Find the relationship between x and y. Hence, find all possible values of x for which y = 2. 3

31. (A) Prove that $\frac{\cos A + \sin A - 1}{\cos A - \sin A + 1} = \operatorname{cosec} A - \cot A$ 3

OR

- (B) If $\cot \theta + \cos \theta = p$ and $\cot \theta - \cos \theta = q$,
prove that $p^2 - q^2 = 4\sqrt{pq}$ 3

SECTION – D

This section consists of 4 questions of 5 marks each.

32. The following table shows the number of traffic challans issued in the month of April by the traffic police :

Number of Challans	Number of Days
0-10	3
10-20	5
20-30	10
30-40	9
40-50	2
50-60	1
Total	30

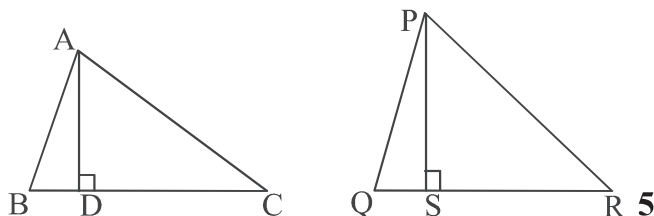
Find the ‘mean’ and ‘mode’ of the above data. 5

33. (A) The sides of a right triangle are such that the longest side is 4 m more than the shortest side and the third side is 2 m less than the longest side. Find the length of each side of the triangle. Also, find the difference between the numerical values of the area and the perimeter of the given triangle. 5

OR

- (B) Express the equation $\frac{x-2}{x-3} + \frac{x-4}{x-5} = \frac{10}{3}$; ($x \neq 3, 5$) as a quadratic equation in standard form. Hence, find the roots of the equation so formed. 5

34. (A) The corresponding sides of $\triangle ABC$ and $\triangle PQR$ are in the ratio 3 : 5. $AD \perp BC$ and $PS \perp QR$ as shown in the adjoining figures :



- (i) Prove that $\triangle ADC \sim \triangle PSR$
(ii) If $AD = 4$ cm, find the length of PS .
(iii) Using (ii) find $\text{ar}(\triangle ABC) : \text{ar}(\triangle PQR)$



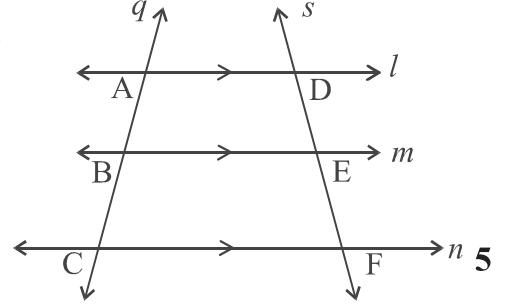
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अथवा

(B) आधारभूत समानुपातिकता प्रमेय बताइए। इस प्रमेय के उपयोग से निम्नलिखित को सिद्ध कीजिए :

यदि तीन समांतर रेखाएँ l, m, n तिर्यक रेखाओं q और s द्वारा प्रतिच्छेदित होती हैं, जैसा कि दी गई

आकृति में दिखाया गया है, तो $\frac{AB}{BC} = \frac{DE}{EF}$ है।



35. बाढ़ पीड़ितों को आश्रय प्रदान करने के लिए, टिन शीट का उपयोग करके एक शेड का निर्माण किया गया था, जो नीचे दिखाए गए आधे सिलिण्डर (बेलन) द्वारा घिरे घनाभाकार के रूप में है।



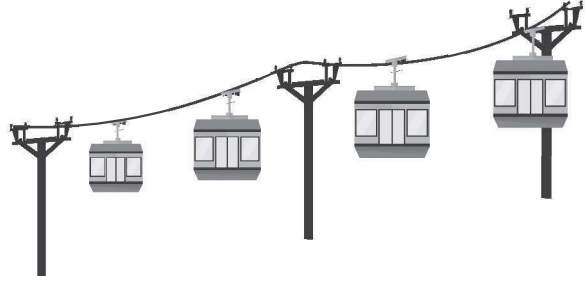
घनाभाकार भाग की लंबाई, चौड़ाई और ऊँचाई क्रमशः 10 m, 7 m और 3 m हैं। बेलनाकार भाग का व्यास 7 m है। शेड को बनाने के लिए आवश्यक टिन शीट की लागत ₹ 70 प्रति वर्गमीटर की दर से ज्ञात कीजिए। यह दिया गया है कि शेड सामने की तरफ से खुला है और पीछे की तरफ से बंद है।

5

खण्ड - ड

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

36. हिल स्टेशनों पर केबल कारें प्रमुख पर्यटक आकर्षणों में से एक हैं। एक हिल स्टेशन पर, पहाड़ी पर आधार बिंदु से शीर्षतम बिंदु तक केबल कार की सवारी की लंबाई 5000 m है। जिस केबल पर कार चलती है उसे सहारा देने के लिए रास्ते में समान अंतराल पर खंभे लगाए जाते हैं।



आधार बिंदु से पहले खंभे की दूरी 200 m है और बाद में खंभे 150 m के बराबर अंतराल पर स्थापित किए जाते हैं। इसके अलावा, शीर्ष से अंतिम खंभे की दूरी 300 m है।

उपरोक्त सूचना के आधार पर, समान्तर श्रेढ़ी का उपयोग करके निम्नलिखित प्रश्नों के उत्तर दीजिए :

- आधार बिंदु से 10वें खंभे की दूरी ज्ञात कीजिए। 1
- 15वें खंभे और 25वें खंभे के बीच की दूरी ज्ञात कीजिए। 1
- (a) यदि केबल कार 5 m/sec की गति से चल रही है और ऊपर से आ रही है, तो ऊपर से 15वें खंभे तक पहुंचने में केबल कार द्वारा लिया गया समय ज्ञात कीजिए। 2

अथवा

- (b) पूरी यात्रा के दौरान लगाए गए खंभों की कुल संख्या ज्ञात कीजिए। 2



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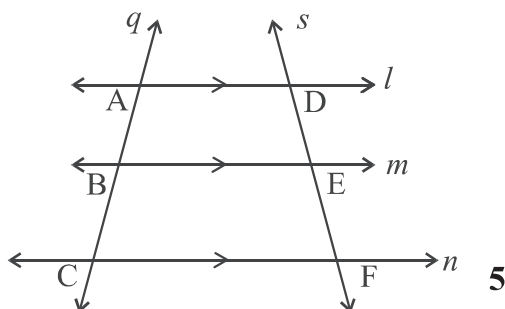
OR

(B) State basic proportionality theorem.

Use it to prove the following :

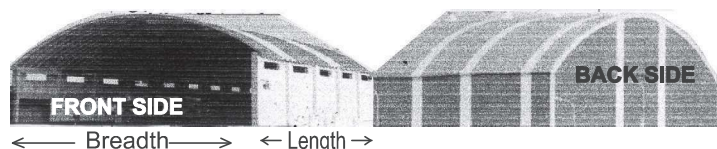
If three parallel lines l, m, n are intersected by transversals q and s as shown in the adjoining figure,

$$\text{then } \frac{AB}{BC} = \frac{DE}{EF}.$$



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35. In order to provide shelter to flood victims, a shed was constructed using tin sheets which is in the form of cuboid surmounted by a half cylinder as shown below :



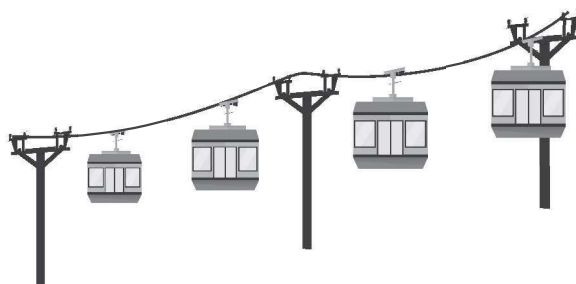
The length, breadth and height of cuboidal portion are 10 m, 7 m and 3 m respectively. The diameter of the cylindrical portion is 7 m. Find the cost of tin sheets required to make the shed at the rate of ₹ 70 per square metre, given that the shed is open from the front side and closed from the back side.

5

SECTION – E

This section consists of 3 Case-study based questions of 4 marks each.

36. Cable cars at hill stations are one of the major tourist attractions. On a hill station, the length of cable car ride from base point to top most point on the hill is 5000 m. Poles are installed at equal intervals on the way to provide support to the cables on which car moves.



The distance of first pole from base point is 200 m and subsequent poles are installed at equal interval of 150 m. Further, the distance of last pole from the top is 300 m.

Based on above information, answer the following questions using Arithmetic Progression :

- (i) Find the distance of 10th pole from the base. 1
- (ii) Find the distance between 15th pole and 25th pole. 1
- (iii) (a) Find the time taken by cable car to reach 15th pole from the top if it is moving at the speed of 5m/sec and coming from top. 2

OR

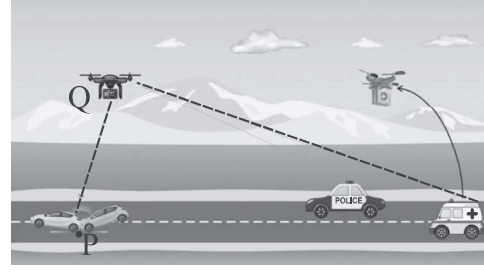
- (iii) (b) Find the total number of poles installed along the entire journey. 2



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37. जमीन पर एक बिंदु P पर, जहाँ दुर्घटना हुई थी, सीधे राजमार्ग पर एम्बुलेंस की आवाजाही को सुविधाजनक बनाने के लिए एक ड्रोन का उपयोग किया गया था।

एम्बुलेंस 60 km/h की रफ्तार से चल रही थी। ड्रोन बिंदु P से 100 m लंबवत् बिंदु Q पर रुका। एम्बुलेंस का अवनमन कोण एक विशेष क्षण पर 30° पाया गया।



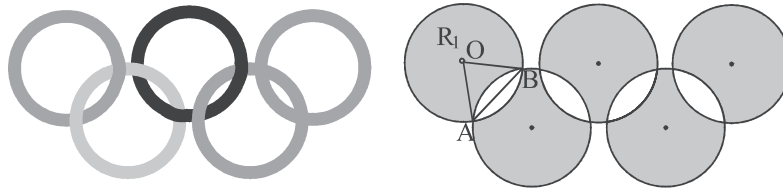
उपरोक्त सूचना के आधार पर, निम्नलिखित प्रश्नों के उत्तर दीजिए :

- (i) उपरोक्त स्थिति को एक चित्र की सहायता से निरूपित कीजिए। 1
- (ii) किसी विशेष क्षण में एम्बुलेंस और दुर्घटना स्थल (P) के बीच की दूरी ज्ञात कीजिए।
($\sqrt{3} = 1.73$ लीजिए) 1
- (iii) (a) समय (सैकण्ड में) ज्ञात कीजिए जिसके अंतर्गत अवनमन कोण 30° से 45° हो जाता है। 2

अथवा

- (iii) (b) राजमार्ग पर एक बिंदु T से बिंदु P तक पहुँचने में एम्बुलेंस को कितना समय (सैकण्ड में) लगेगा, जैसा कि T पर एम्बुलेंस का अवनमन कोण ड्रोन से 60° है? 2

38. पाँच इंटरलॉकिंग रिंगों वाला ओलंपिक प्रतीक दुनिया के पाँच महाद्वीपों के संघ और ओलंपिक में दुनियाभर के एथलिटों की बैठक का प्रतिनिधित्व करता है। ओलंपिक खेलों के बारे में जागरूकता फैलाने के लिए दसवीं कक्षा के छात्रों ने स्कूल द्वारा आयोजित विभिन्न गतिविधियों में भाग लिया। छात्रों के ऐसे ही एक समूह ने स्कूल के लॉन में रस्सियों की मदद से 5 गोलाकार छल्ले बनाए। प्रत्येक गोलाकार छल्ले को बनाने के लिए 44 m रस्सी की आवश्यकता थी। छायांकित भागों (जैसा चित्र में दिखाया गया है) में भी छात्रों ने विभिन्न खेलों का प्रदर्शन करते हुए रंगोली बनाई। यह दिया गया है कि त्रिभुज OAB एक समबाहु त्रिभुज है और सभी छायांकित क्षेत्र सर्वांगसम हैं।



उपरोक्त सूचना के आधार पर, निम्नलिखित प्रश्नों के उत्तर दीजिए :

- (i) प्रत्येक गोलाकार छल्ले की त्रिज्या ज्ञात कीजिए। 1
- (ii) $\angle AOB$ की माप क्या है? 1
- (iii) (a) छायांकित क्षेत्र R_1 का क्षेत्रफल ज्ञात कीजिए। 2

अथवा

- (iii) (b) अछायांकित क्षेत्रों के चारों ओर लगने वाली रस्सी की लंबाई ज्ञात कीजिए। 2



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Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2025
MATHEMATICS (Standard) (Q.P. CODE 30/4/2)

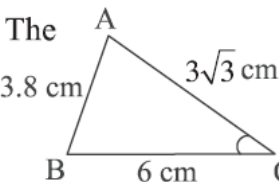
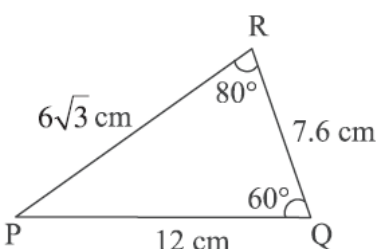
General Instructions: -

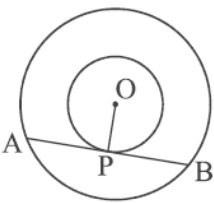
1.	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested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

9.	If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note “Extra Question”.
10.	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
11.	A full scale of marks _____ (example 0 to 80/70/60/50/40/30 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.
12.	Every examiner has to necessarily do evaluation work for full working hours i.e., 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines). This is in view of the reduced syllabus and number of questions in question paper.
13.	<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"> ● Leaving answer or part thereof unassessed in an answer book. ● Giving more marks for an answer than assigned to it. ● Wrong totalling of marks awarded to an answer. ● Wrong transfer of marks from the inside pages of the answer book to the title page. ● Wrong question wise totalling on the title page. ● Wrong totalling of marks of the two columns on the title page. ● Wrong grand total. ● Marks in words and figures not tallying/not same. ● Wrong transfer of marks from the answer book to online award list. ● Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.) <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 “ Guidelines for spot Evaluation ” before starting the actual evaluation.
17.	Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly 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.

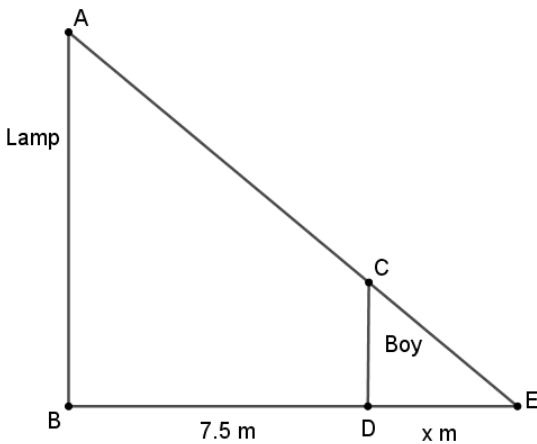
MARKING SCHEME
MATHEMATICS (Subject Code-041)
(PAPER CODE: 30/4/2)

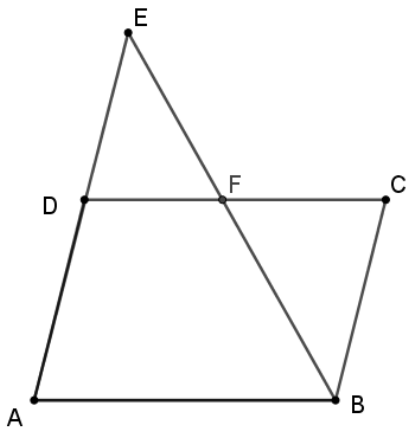
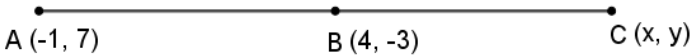
Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Marks
	SECTION - A This section consists of 20 questions of 1 mark each.	
1.	Which of the following statements is true for a polynomial $p(x)$ of degree 3? (a) $p(x)$ has at most two distinct zeroes. (b) $p(x)$ has at least two distinct zeroes. (c) $p(x)$ has exactly three distinct zeroes. (d) $p(x)$ has at most three distinct zeroes.	
Sol.	(d) $p(x)$ has at most three distinct zeroes.	1
2.	A pair of dice is thrown once. The probability that sum of numbers appearing on top faces is at least 4 is : (a) $\frac{1}{11}$ (b) $\frac{10}{11}$ (c) $\frac{5}{6}$ (d) $\frac{11}{12}$	
Sol.	(d) $\frac{11}{12}$	1
3.	If $x = ab^3$ and $y = a^3b$, where a and b are prime numbers, then [HCF (x, y) – LCM (x, y)] is equal to : (a) $1 - a^3b^3$ (b) $ab(1 - ab)$ (c) $ab - a^4b^4$ (d) $ab(1 - ab)(1 + ab)$	
Sol.	(d) $ab(1 - ab)(1 + ab)$	1
4.	$(1 + \sqrt{3})^2 - (1 - \sqrt{3})^2$ is : (a) a positive rational number. (b) a negative integer. (c) a positive irrational number. (d) a negative irrational number.	
Sol.	(c) a positive irrational number	1
5.	The value of 'a' for which $ax^2 + x + a = 0$ has equal and positive roots is : (a) 2 (b) -2 (c) $\frac{1}{2}$ (d) $-\frac{1}{2}$	
Sol.	(d) $-\frac{1}{2}$	1
6.	The distance of which of the following points from origin is less than 5 units ? (a) (3, 4) (b) (2, 6) (c) (-3, -4) (d) (1, 4)	
Sol.	(d) (1,4)	1

7.	The number of red balls in a bag is 10 more than the number of black balls. If the probability of drawing a red ball at random from this bag is $\frac{3}{5}$, then the total number of balls in the bag is : (a) 50 (b) 60 (c) 80 (d) 40	
Sol.	(a) 50	1
8.	The value of 'p' for which the equations $px + 3y = p - 3$, $12x + py = p$ has infinitely many solutions is : (a) -6 only (b) 6 only (c) ± 6 (d) Any real number except ± 6	
Sol.	(b) 6 only	1
9.	<p>ΔABC and ΔPQR are shown in the adjoining figures. The measure of $\angle C$ is :</p> <div style="display: flex; align-items: center; justify-content: space-around;"> <div style="text-align: center;">  <p>Triangle ABC: AB = 3.8 cm, AC = $3\sqrt{3}$ cm, BC = 6 cm.</p> </div> <div style="text-align: center;">  <p>Triangle PQR: PR = $6\sqrt{3}$ cm, PQ = 12 cm, RQ = 7.6 cm, $\angle R = 80^\circ$, $\angle Q = 60^\circ$.</p> </div> </div> <p>(a) 140° (b) 80° (c) 60° (d) 40°</p>	
Sol.	(d) 40°	1
10.	Which of the following is a trigonometric identity ? (a) $\sin^2 \theta = 1 + \cos^2 \theta$ (b) $\operatorname{cosec}^2 \theta + \cot^2 \theta = 1$ (c) $\sec^2 \theta = 1 + \tan^2 \theta$ (d) $\sin 2\theta = 2 \sin \theta$	
Sol.	(c) $\sec^2 \theta = 1 + \tan^2 \theta$	1
11.	Which of the following statements is true ? (a) $\sin 20^\circ > \sin 70^\circ$ (b) $\sin 20^\circ > \cos 20^\circ$ (c) $\cos 20^\circ > \cos 70^\circ$ (d) $\tan 20^\circ > \tan 70^\circ$	
Sol.	(c) $\cos 20^\circ > \cos 70^\circ$	1
12.	A 30 m long rope is tightly stretched and tied from the top of pole to the ground. If the rope makes an angle of 60° with the ground, the height of the pole is : (a) $10\sqrt{3}$ m (b) $30\sqrt{3}$ m (c) 15 m (d) $15\sqrt{3}$ m	
Sol.	(d) $15\sqrt{3}$ m	1
13.	If mean and mode of given set of observations are 10 and 13 respectively, then the value of median is : (a) 19 (b) 4 (c) 11 (d) 43	
Sol.	(c) 11	1

14.	<p>In the adjoining figure, AB is the chord of larger circle which touches the smaller circle at P. If length of AB = diameter of inner circle = $2r$, then the diameter of larger circle is :</p> <p>(a) $2r$ (b) $4r$ (c) $2\sqrt{2}r$ (d) $\sqrt{2}r$</p>		
Sol.	(c) $2\sqrt{2}r$		1
15.	<p>On the top face of the wooden cube of side 7 cm, hemispherical depressions of radius 0.35 cm are to be formed by taking out the wood. The maximum number of depressions that can be formed is :</p> <p>(a) 400 (b) 100 (c) 20 (d) 10</p>		
Sol.	(b) 100		1
16.	<p>The cumulative frequency for calculating median is obtained by adding the frequencies of all the :</p> <p>(a) classes up to the median class (b) classes following the median class (c) classes preceding the median class (d) all classes</p>		
Sol.	(c) classes preceding the median class		1
17.	<p>A parallelogram having one of its sides 5 cm circumscribes a circle. The perimeter of parallelogram is :</p> <p>(a) 20 cm (b) less than 20 cm (c) more than 20 cm but less than 40 cm (d) 40 cm</p>		
Sol.	(a) 20 cm		1
18.	<p>E and F are points on the sides AB and AC respectively of a $\triangle ABC$ such that $\frac{AE}{EB} = \frac{AF}{FC} = \frac{1}{2}$. Which of the following relation is true ?</p> <p>(a) $EF = 2BC$ (b) $BC = 2EF$ (c) $EF = 3BC$ (d) $BC = 3EF$</p>		
Sol.	(d) $BC = 3EF$		1
	<p>Directions : In question number 19 and 20, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option :</p> <p>(a) Both, Assertion (A) and Reason (R) are true and Reason (R) is correct explanation of Assertion (A). (b) Both, Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A). (c) Assertion (A) is true but Reason (R) is false. (d) Assertion (A) is false but Reason (R) is true.</p>		
19.	<p>Assertion (A) : A line drawn perpendicular to the tangent at point of contact passes through the centre of the circle. Reason (R) : Lengths of tangents drawn from external point to a circle are equal.</p>		

Sol.	(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).	1
20	Assertion (A) : 4^n ends with digit 0 for some natural number n . Reason (R) : For a number ' x ' having 2 and 5 as its prime factors, x^n always ends with digit 0 for every natural number n .	
Sol.	(d) Assertion (A) is false but Reason (R) is true.	1
	SECTION - B This section consists of 5 questions of 2 marks each.	
21 (A).	Find the value of x for which $(\sin A + \operatorname{cosec} A)^2 + (\cos A + \sec A)^2 = x + \tan^2 A + \cot^2 A$	
Sol.	$(\sin A + \operatorname{cosec} A)^2 + (\cos A + \sec A)^2 = x + \tan^2 A + \cot^2 A$ $\Rightarrow \sin^2 A + \operatorname{cosec}^2 A + 2 + \cos^2 A + \sec^2 A + 2 = x + \tan^2 A + \cot^2 A$ $\Rightarrow 1 + 2 + 2 + 1 + \cot^2 A + 1 + \tan^2 A = x + \tan^2 A + \cot^2 A$ $\therefore x = 7$	$\frac{1}{2}$ 1 $\frac{1}{2}$
	OR	
21 (B).	Evaluate the following : $\frac{3 \sin 30^\circ - 4 \sin^3 30^\circ}{2 \sin^2 50^\circ + 2 \cos^2 50^\circ}$	
Sol.	$\frac{3 \sin 30^\circ - 4 \sin^3 30^\circ}{2 \sin^2 50^\circ + 2 \cos^2 50^\circ}$ $= \frac{3 \times \frac{1}{2} - 4 \times \frac{1}{8}}{2 (\sin^2 50^\circ + \cos^2 50^\circ)}$ $= \frac{\frac{3}{2} - \frac{1}{2}}{2 \times 1}$ $= \frac{1}{2}$	1 $\frac{1}{2}$ $\frac{1}{2}$
22.	Saima and Aryaa were born in the month of June in the year 2012. Find the probability that : (i) they have different dates of birth. (ii) they have same date of birth.	
Sol.	Number of days in June 2012 = 30 (i) $P(\text{different dates of birth}) = \frac{29}{30}$ (ii) $P(\text{same date of birth}) = \frac{1}{30}$	1 1

23.	Solve the following system of equations algebraically : $37x + 63y = 137$ $63x + 37y = 163$	
Sol.	Adding and subtracting the given equations, we get $x + y = 3 \quad \dots (i)$ and $x - y = 1 \quad \dots (ii)$ Solving (i) and (ii), we get $x = 2, y = 1$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2} + \frac{1}{2}$
24 (A).	A 1.5 m tall boy is walking away from the base of a lamp post which is 12 m high, at the speed of 2.5 m/sec. Find the length of his shadow after 3 seconds.	
Sol.	<p>Let AB be the lamp post and CD be the boy 1.5 m tall.</p>  <p>For correct figure</p> <p>Let the length of shadow be x m Speed of boy = 2.5 m/sec \therefore Distance covered in 3 seconds = 7.5 m Now, $\Delta ABE \sim \Delta CDE$ $\Rightarrow \frac{CD}{AB} = \frac{DE}{BE}$ $\Rightarrow \frac{1.5}{12} = \frac{x}{7.5+x}$ Solving, we get $x = \frac{15}{14}$ or 1.07 approx. Hence length of shadow is 1.07 m</p>	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$
	OR	

24 (B).	In parallelogram ABCD, side AD is produced to a point E and BE intersects CD at F. Prove that $\triangle ABE \sim \triangle CFB$	
Sol.	 <p>For correct figure</p> <p>In $\triangle ABE$ and $\triangle CFB$,</p> <p>$\angle AEB = \angle CBF$</p> <p>$\angle A = \angle C$</p> <p>$\therefore \triangle ABE \sim \triangle CFB$</p>	<p>$\frac{1}{2}$</p> <p>1</p> <p>$\frac{1}{2}$</p>
25.	Find the coordinates of the point C which lies on the line AB produced such that $AC = 2BC$, where coordinates of points A and B are $(-1, 7)$ and $(4, -3)$ respectively.	
Sol.	 <p>Let coordinates of point C be (x, y)</p> <p>$AC = 2 BC$</p> <p>$\Rightarrow B$ is mid-point of AC</p> <p>$\Rightarrow \frac{-1+x}{2} = 4 \Rightarrow x = 9$</p> <p>$\frac{7+y}{2} = -3 \Rightarrow y = -13$</p> <p>$\therefore$ Coordinates of C are $(9, -13)$</p>	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p>
	SECTION - C	
	This section consists of 6 questions of 3 marks each.	
26.	α and β are zeroes of a quadratic polynomial $x^2 - ax - b$. Obtain a quadratic polynomial whose zeroes are $3\alpha + 1$ and $3\beta + 1$.	
Sol.	<p>$\alpha + \beta = a, \alpha\beta = -b$</p> <p>Sum of zeroes of required polynomial</p> <p>$= (3\alpha + 1) + (3\beta + 1)$</p>	$\frac{1}{2}$

28 (A).	Prove that $\sqrt{2}$ is an irrational number.	
Sol.	<p>Let $\sqrt{2}$ be a rational number.</p> <p>$\therefore \sqrt{2} = \frac{p}{q}$, where $q \neq 0$ and let p & q be co-primes.</p> <p>$2q^2 = p^2 \Rightarrow p^2$ is divisible by 2 $\Rightarrow p$ is divisible by 2 ----- (i)</p> <p>$\Rightarrow p = 2a$, where 'a' is some integer</p> <p>$4a^2 = 2q^2 \Rightarrow q^2 = 2a^2 \Rightarrow q^2$ is divisible by 2 $\Rightarrow q$ is divisible by 2 ----- (ii)</p> <p>(i) and (ii) leads to contradiction as 'p' and 'q' are co-primes.</p> <p>$\therefore \sqrt{2}$ is an irrational number.</p>	<p>$\frac{1}{2}$</p> <p>1</p> <p>1</p> <p>$\frac{1}{2}$</p>
	OR	
28 (B).	Let x and y be two distinct prime numbers and $p = x^2 y^3$, $q = xy^4$, $r = x^5 y^2$. Find the HCF and LCM of p , q and r . Further check if $\text{HCF}(p, q, r) \times \text{LCM}(p, q, r) = p \times q \times r$ or not.	
Sol.	<p>$p = x^2 y^3, q = xy^4, r = x^5 y^2$</p> <p>$\text{HCF}(p, q, r) = xy^2$</p> <p>$\text{LCM}(p, q, r) = x^5 y^4$</p> <p>$\text{HCF} \times \text{LCM} = x^6 y^6$</p> <p>$p \times q \times r = x^8 y^9$</p> <p>$\Rightarrow \text{HCF}(p, q, r) \times \text{LCM}(p, q, r) \neq p \times q \times r$</p>	<p>1</p> <p>1</p> <p>1</p>
29.	The two angles of a right angled triangle other than 90° are in the ratio 2 : 3. Express the given situation algebraically as a system of linear equations in two variables and hence solve it.	
Sol.	<p>Let the measures of two angles be x and y</p> <p>ATQ</p> <p>$x + y = 90^\circ \dots (i)$</p> <p>and $\frac{x}{y} = \frac{2}{3} \Rightarrow 3x - 2y = 0 \dots (ii)$</p> <p>Solving (i) and (ii), we get $x = 36^\circ, y = 54^\circ$</p>	<p>1</p> <p>1</p> <p>$\frac{1}{2} + \frac{1}{2}$</p>
30.	P (x, y), Q ($-2, -3$) and R ($2, 3$) are the vertices of a right triangle PQR right angled at P. Find the relationship between x and y . Hence, find all possible values of x for which $y = 2$.	
Sol.	<p>In $\Delta PQR, \angle P = 90^\circ$</p> <p>$PQ^2 + PR^2 = QR^2$</p>	

	$\Rightarrow (x+2)^2 + (y+3)^2 + (x-2)^2 + (y-3)^2 = 4^2 + 6^2$ $\Rightarrow x^2 + 4x + 4 + y^2 + 6y + 9 + x^2 - 4x + 4 + y^2 - 6y + 9 = 52$ <p>gives, $x^2 + y^2 = 13$</p> <p>Now for $y = 2, x = \pm 3$</p>	<p>1</p> <p>1</p> <p>1</p>
31 (A).	Prove that $\frac{\cos A + \sin A - 1}{\cos A - \sin A + 1} = \operatorname{cosec} A - \cot A$	
Sol.	$\text{LHS} = \frac{\cos A + \sin A - 1}{\cos A - \sin A + 1}$ $= \frac{\cot A + 1 - \operatorname{cosec} A}{\cot A - 1 + \operatorname{cosec} A}$ $= \frac{\cot A - \operatorname{cosec} A + \operatorname{cosec}^2 A - \cot^2 A}{\cot A - 1 + \operatorname{cosec} A}$ $= \frac{(\operatorname{cosec} A - \cot A)(-1 + \operatorname{cosec} A + \cot A)}{\cot A - 1 + \operatorname{cosec} A}$ $= \operatorname{cosec} A - \cot A = \text{RHS}$	<p>1</p> <p>1</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p>
	OR	
31 (B).	If $\cot \theta + \cos \theta = p$ and $\cot \theta - \cos \theta = q$, prove that $p^2 - q^2 = 4\sqrt{pq}$	
Sol.	$\text{LHS} = p^2 - q^2$ $= (\cot \theta + \cos \theta)^2 - (\cot \theta - \cos \theta)^2$ $= [(\cot \theta + \cos \theta) + (\cot \theta - \cos \theta)][(\cot \theta + \cos \theta) - (\cot \theta - \cos \theta)]$ $= 2 \cot \theta \times 2 \cos \theta = 4 \cot \theta \cos \theta$ $\text{RHS} = 4\sqrt{pq}$ $= 4\sqrt{(\cot \theta + \cos \theta)(\cot \theta - \cos \theta)}$ $= 4\sqrt{\cot^2 \theta - \cos^2 \theta}$ $= 4\sqrt{\cos^2 \theta (\operatorname{cosec}^2 \theta - 1)}$ $= 4\sqrt{\cos^2 \theta \times \cot^2 \theta}$ $= 4 \cot \theta \cos \theta$ $\therefore \text{LHS} = \text{RHS}$	<p>1</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p>

SECTION - D

This section consists of 4 questions of 5 marks each.

Number of Challans	Number of Days
0-10	3
10-20	5
20-30	10
30-40	9
40-50	2
50-60	1
Total	30

Find the ‘mean’ and ‘mode’ of the above data.

Number of Challans	Number of Days
0-10	3
10-20	5
20-30	10
30-40	9
40-50	2
50-60	1
Total	30

Find the ‘mean’ and ‘mode’ of the above data.

Number of Challans	Number of days (f_i)	Class Mark (x_i)	$f_i x_i$
0-10	3	5	15
10-20	5	15	75
20-30	10	25	250
30-40	9	35	315
40-50	2	45	90
50-60	1	55	55
Total	$\Sigma f_i = 30$		$\Sigma f_i x_i = 800$

Mean = $\frac{800}{30}$

= $\frac{80}{3}$ or 26.67 or 27 (approx.)

Modal class is 20-30

Mode = $20 + \frac{10-5}{2 \times 10-5-9} \times 10$

= $\frac{85}{3}$ or 28.3 or 28 (approx.)

Number of Challans	Number of days (f_i)	Class Mark (x_i)	$f_i x_i$
0-10	3	5	15
10-20	5	15	75
20-30	10	25	250
30-40	9	35	315
40-50	2	45	90
50-60	1	55	55
Total	$\Sigma f_i = 30$		$\Sigma f_i x_i = 800$

Mean = $\frac{800}{30}$

= $\frac{80}{3}$ or 26.67 or 27 (approx.)

Modal class is 20-30

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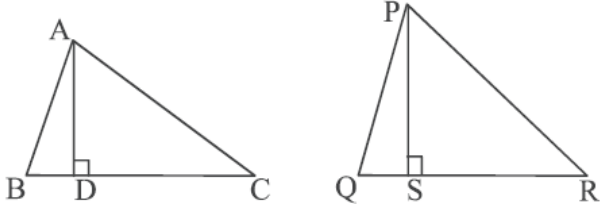
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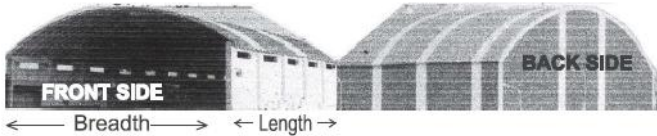
The sides of a right triangle are such that the longest side is 4 m more than the shortest side and the third side is 2 m less than the longest side. Find the length of each side of the triangle. Also, find the difference between the numerical values of the area and the perimeter of the given triangle.

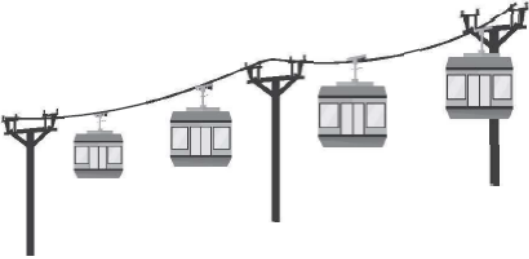
The sides of a right triangle are such that the longest side is 4 m more than the shortest side and the third side is 2 m less than the longest side. Find the length of each side of the triangle. Also, find the difference between the numerical values of the area and the perimeter of the given triangle.

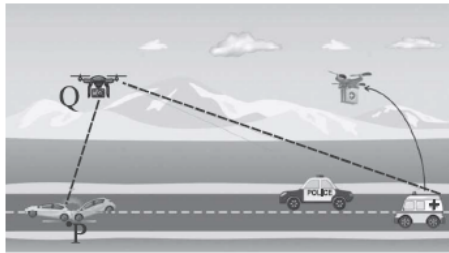
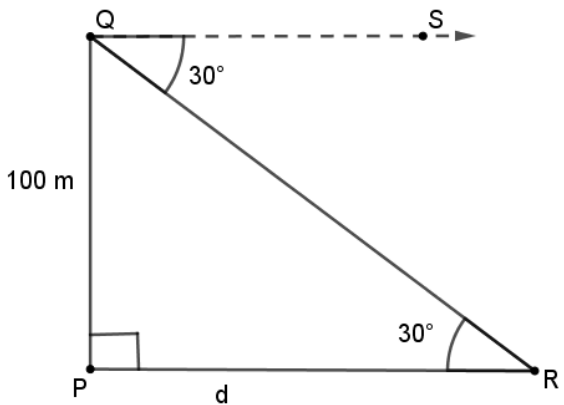
Let the length of shortest side be x m

Let the length of shortest side be x m

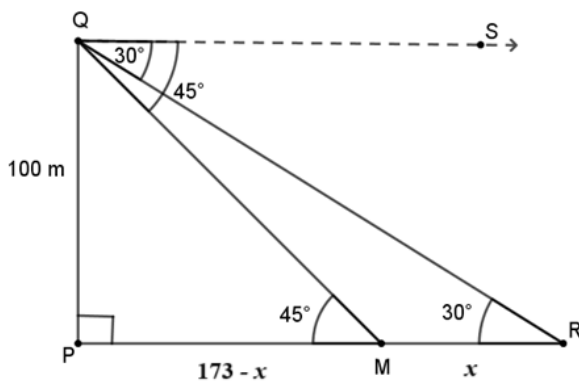
	\therefore length of longest side = $(x + 4)$ m and length of third side = $(x + 2)$ m Now, $(x + 4)^2 = x^2 + (x + 2)^2$ $\Rightarrow x^2 - 4x - 12 = 0$ $\Rightarrow (x - 6)(x + 2) = 0$ $\Rightarrow x = 6$ \therefore sides are 6 m, 8 m and 10 m Area = $\frac{1}{2} \times 6 \times 8 = 24 \text{ m}^2$ Perimeter = $6 + 8 + 10 = 24 \text{ m}$ Difference = 0	1 1 1 $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$
	OR	
33 (B).	Express the equation $\frac{x-2}{x-3} + \frac{x-4}{x-5} = \frac{10}{3}$; $(x \neq 3, 5)$ as a quadratic equation in standard form. Hence, find the roots of the equation so formed.	
Sol.	$\frac{x-2}{x-3} + \frac{x-4}{x-5} = \frac{10}{3}$ $\Rightarrow \frac{(x-2)(x-5) + (x-4)(x-3)}{(x-3)(x-5)} = \frac{10}{3}$ Simplifying, we get $2x^2 - 19x + 42 = 0$ $\Rightarrow (x - 6)(2x - 7) = 0$ $\Rightarrow x = 6$ or $x = \frac{7}{2}$	$1\frac{1}{2}$ $1\frac{1}{2}$ 1 1
34 (A).	The corresponding sides of $\triangle ABC$ and $\triangle PQR$ are in the ratio 3 : 5. $AD \perp BC$ and $PS \perp QR$ as shown in the following figures : <div style="text-align: center;">  </div> (i) Prove that $\triangle ADC \sim \triangle PSR$ (ii) If $AD = 4 \text{ cm}$, find the length of PS . (iii) Using (ii) find $\text{ar}(\triangle ABC) : \text{ar}(\triangle PQR)$	
Sol.	As, $\frac{AB}{PQ} = \frac{BC}{QR} = \frac{AC}{PR} = \frac{3}{5}$	

	<p>Join AF intersecting line m at G</p> <p>In ΔACF, $BG \parallel CF$</p> $\Rightarrow \frac{AB}{BC} = \frac{AG}{GF} \dots (i)$ <p>In ΔFDA, $GE \parallel AD$</p> $\Rightarrow \frac{EF}{DE} = \frac{GF}{AG} \text{ or } \frac{DE}{EF} = \frac{AG}{GF} \dots (ii)$ <p>From, (i) and (ii), we get $\frac{AB}{BC} = \frac{DE}{EF}$</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>
35.	<p>In order to provide shelter to flood victims, a shed was constructed using tin sheets which is in the form of cuboid surmounted by a half cylinder as shown below :</p>  <p>The length, breadth and height of cuboidal portion are 10 m, 7 m and 3 m respectively. The diameter of the cylindrical portion is 7 m. Find the cost of tin sheets required to make the shed at the rate of ₹ 70 per square metre, given that the shed is open from the front side and closed from the back side.</p>	
Sol.	<p>Area of the sheet required for the shed</p> $= (\text{lateral surface area of the cuboid} - \text{front area}) + \frac{1}{2} \text{ CSA of cylinder} + \text{area of semicircle}$ $= [2 \times (10 + 7) \times 3 - 7 \times 3] + \frac{1}{2} \times 2 \times \frac{22}{7} \times \frac{7}{2} \times 10 + \frac{1}{2} \times \frac{22}{7} \times \left(\frac{7}{2}\right)^2$ $= \frac{841}{4} m^2$ <p>Cost of sheet = $\frac{841}{4} \times 70 = ₹ 14717.50$</p>	<p>1+1+1</p> <p>1</p> <p>1</p>

	SECTION - E This section consists of 3 case-study based questions of 4 marks each.	
36.	<p>Cable cars at hill stations are one of the major tourist attractions. On a hill station, the length of cable car ride from base point to top most point on the hill is 5000 m. Poles are installed at equal intervals on the way to provide support to the cables on which car moves.</p>  <p>The distance of first pole from base point is 200 m and subsequent poles are installed at equal interval of 150 m. Further, the distance of last pole from the top is 300 m.</p> <p>Based on above information, answer the following questions using Arithmetic Progression :</p> <p>(i) Find the distance of 10th pole from the base. (ii) Find the distance between 15th pole and 25th pole. (iii) (a) Find the time taken by cable car to reach 15th pole from the top if it is moving at the speed of 5m/sec and coming from top.</p> <p style="text-align: center;">OR</p> <p>(iii) (b) Find the total number of poles installed along the entire journey.</p>	
Sol.	<p>AP formed is 200, 350, 500, ...</p> <p>(i) Distance of 10th pole from base = a_{10} $= 200 + 9 \times 150$ $= 1550 \text{ m}$</p> <p>(ii) Distance between 15th pole and 25th pole = $a_{25} - a_{15}$ $= 10 \times 150 = 1500 \text{ m}$</p> <p>(iii) (a) Distance of 15th pole from the top = $300 + 14 \times 150$ $= 2400 \text{ m}$ Time taken by cable car = $\frac{2400}{5} = 480$ seconds or 8 minutes</p> <p style="text-align: center;">OR</p> <p>(iii) (b) Distance of last pole from the base = $(5000 - 300) \text{ m} = 4700 \text{ m}$ $\therefore a_n = 4700$ $\Rightarrow 200 + (n - 1)150 = 4700$ Solving, we get $n = 31$</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1/2</p> <p>1</p> <p>1/2</p>

37.	<p>A drone was used to facilitate movement of an ambulance on the straight highway to a point P on the ground where there was an accident. The ambulance was travelling at the speed of 60 km/h. The drone stopped at a point Q, 100 m vertically above the point P. The angle of depression of the ambulance was found to be 30° at a particular instant.</p>  <p>Based on above information, answer the following questions :</p> <p>(i) Represent the above situation with the help of a diagram.</p> <p>(ii) Find the distance between the ambulance and the site of accident (P) at the particular instant. (Use $\sqrt{3} = 1.73$)</p> <p>(iii) (a) Find the time (in seconds) in which the angle of depression changes from 30° to 45°.</p> <p style="text-align: center;">OR</p> <p>(iii) (b) How long (in seconds) will the ambulance take to reach point P from a point T on the highway such that angle of depression of the ambulance at T is 60° from the drone ?</p>	
Sol.	<p>(i)</p>  <p style="text-align: right;">For correct figure</p> <p>(ii) In ΔPQR, $\frac{100}{d} = \tan 30^\circ = \frac{1}{\sqrt{3}}$</p> <p>$\Rightarrow d = 100\sqrt{3} = 173 \text{ m}$</p>	<p style="text-align: center;">1</p> <p style="text-align: center;">$\frac{1}{2}$</p> <p style="text-align: center;">$\frac{1}{2}$</p>

(iii) (a)



For correct figure

$\frac{1}{2}$

$$\text{In } \Delta PQM, \frac{100}{173-x} = \tan 45^\circ = 1$$

$$\Rightarrow x = 73 \text{ m}$$

$$\text{Time taken} = \frac{73 \times 18}{60 \times 5} = \frac{219}{50} \text{ or } 4.4 \text{ seconds (approx.)}$$

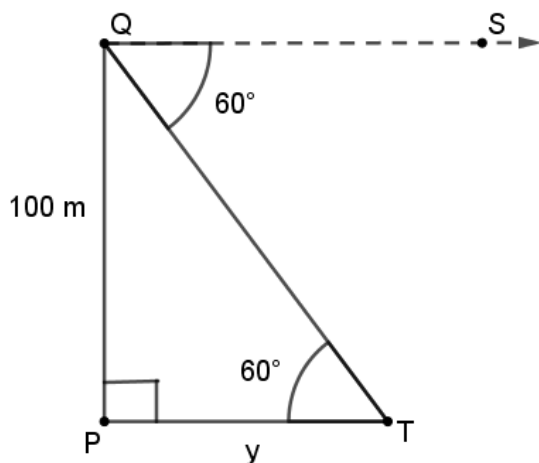
$\frac{1}{2}$

$\frac{1}{2}$

$\frac{1}{2}$

OR

(iii) (b)



For correct figure

$\frac{1}{2}$

$$\text{In } \Delta PQT, \frac{100}{y} = \tan 60^\circ = \sqrt{3}$$

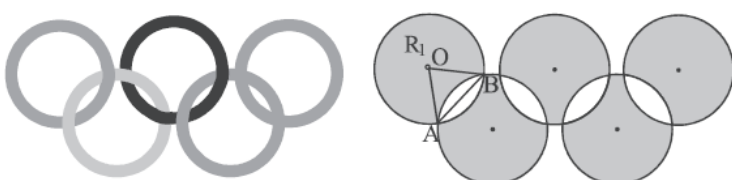
$$\Rightarrow y = \frac{100}{\sqrt{3}} = \frac{100\sqrt{3}}{3} \text{ or } \frac{173}{3} \text{ m}$$

$$\text{Time taken} = \frac{100\sqrt{3} \times 18}{3 \times 60 \times 5} = 2\sqrt{3} \text{ or } 3.5 \text{ seconds (approx.)}$$

$\frac{1}{2}$

$\frac{1}{2}$

$\frac{1}{2}$

38.	<p>The Olympic symbol comprising five interlocking rings represents the union of the five continents of the world and the meeting of athletes from all over the world at the Olympic games. In order to spread awareness about Olympic games, students of Class-X took part in various activities organised by the school. One such group of students made 5 circular rings in the school lawn with the help of ropes. Each circular ring required 44 m of rope.</p> <p>Also, in the shaded regions as shown in the figure, students made rangoli showcasing various sports and games. It is given that $\triangle OAB$ is an equilateral triangle and all unshaded regions are congruent.</p>  <p>Based on above information, answer the following questions :</p> <p>(i) Find the radius of each circular ring.</p> <p>(ii) What is the measure of $\angle AOB$?</p> <p>(iii) (a) Find the area of shaded region R_1.</p> <p style="text-align: center;">OR</p> <p>(iii) (b) Find the length of rope around the unshaded regions.</p>	
Sol.	<p>(i) $2 \times \frac{22}{7} \times r = 44$</p> <p>$\Rightarrow r = 7 \text{ m}$</p> <p>(ii) $\angle AOB = 60^\circ$</p> <p>(iii) (a) Area of shaded region $R_1 = \text{area of circle} - \text{area of 2 segments}$</p> $= \frac{22}{7} \times 7 \times 7 - 2 \times \left(\frac{60}{360} \times \frac{22}{7} \times 7 \times 7 - \frac{\sqrt{3}}{4} \times 7 \times 7 \right)$ $= \left(\frac{308}{3} + \frac{49\sqrt{3}}{2} \right) \text{ m}^2 \text{ or } 145.05 \text{ m}^2 \text{ (approx.)}$ <p style="text-align: center;">OR</p> <p>(iii) (b) Length of rope around unshaded regions</p> <p>$= 8 \times \text{length of arc}$</p> $= 8 \times 2 \times \frac{60}{360} \times \frac{22}{7} \times 7$ $= \frac{176}{3} \text{ m or } 58.66 \text{ m (approx.)}$	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>1</p> <p>1</p> <p>1</p> <p>$\frac{1}{2}$</p> <p>1</p> <p>$\frac{1}{2}$</p>