Series : 5LMKN

SET ~ 3

रोल नं.

Roll No.

प्रश्न–पत्र कोड
Q.P. Code **30/5/3**

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

नोट/ NOTE :

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

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

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

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

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

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

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

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

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

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

गणित (मानक)

MATHEMATICS (Standard)

निर्धारित समय : 3 घण्टे *अधिकतम अंक : 80*

Time allowed : 3 hours *Maximum Marks : 80*

सामान्य निर्देश :

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

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

(ii) *यह प्रश्न-पत्र **पाँच** खण्डों में विभाजित है – **क, ख, ग, घ** 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****, questions number* ***1*** *to* ***18*** *are Multiple Choice Questions (MCQs) and questions number* ***19*** *and* ***20*** *are Assertion-Reason based questions of* ***1*** *mark each.*

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

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

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

(vii) *In Section–****E****, questions number* ***36*** *to* ***38*** *are Case Study based questions carrying* ***4*** *marks each. Internal choice is provided in* ***2*** *marks questions in each case-study.*

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

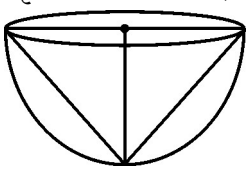
(ix) *Draw neat diagrams wherever required. Take* $\pi = \frac{22}{7}$ *wherever required, if not stated.*

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

खण्ड – क

प्रश्न संख्या 1 से 20 तक बहुविकल्पीय प्रश्न हैं । प्रत्येक प्रश्न 1 अंक का है ।

1. 10 cm त्रिज्या वाले, लकड़ी से बने एक ठोस अर्धगोले में से अधिकतम आयतन का एक शंकु काटकर निकाला जाता है । प्राप्त शंकु का वक्र पृष्ठीय क्षेत्रफल है : ($\pi = 3.14$ लीजिए)



(A) $314\sqrt{2}\ cm^2$ (B) $314\ cm^2$

(C) $\frac{3140}{3}\ cm^2$ (D) $3140\sqrt{2}\ cm^2$

2. यदि एक A.P. $-\frac{15}{4}, -\frac{10}{4}, -\frac{5}{4}$, ... का nवाँ पद a_n हो, तो $a_{16} - a_{12}$ का मान है

(A) 4 (B) $\frac{5}{4}$

(C) 5 (D) $\frac{25}{4}$

3. मीना ने हिसाब लगाया कि लॉटरी में उसके प्रथम पुरस्कार जीतने की प्रायिकता 0.08 है । यदि कुल 800 टिकट बिके हों, तो मीना द्वारा खरीदे गये टिकटों की संख्या है

(A) 64 (B) 640

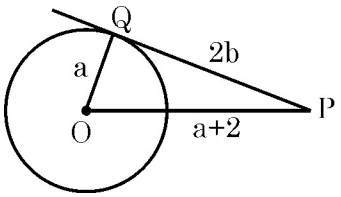
(C) 100 (D) 10

4. एक तंबू अर्धगोले के आकार का है । इसकी त्रिज्या 1.4 m है तथा इसमें दरवाजे के लिए 0.50 m^2 क्षेत्रफल वाली खुली जगह दी है । तंबू का बाहरी पृष्ठीय क्षेत्रफल है

(A) 11.78 m^2 (B) 12.32 m^2

(C) 11.82 m^2 (D) 12.86 m^2

5. केन्द्र O वाले वृत्त पर स्पर्श-रेखा PQ खींची गयी है । यदि OQ = a, OP = a + 2 तथा PQ = 2b है, तो a तथा b के बीच का सम्बन्ध है :



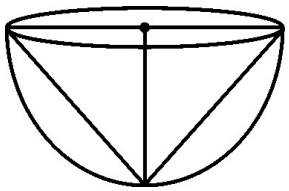
(A) $a^2 + (a + 2)^2 = (2b)^2$ (B) $b^2 = a + 4$

(C) $2a^2 + 1 = b^2$ (D) $b^2 = a + 1$

SECTION – A

Q. Number 1 to 20 are multiple choice questions of 1 mark each.

1. A conical cavity of maximum volume is carved out from a wooden solid hemisphere of radius 10 cm. Curved surface area of the cavity carved out is (use $\pi = 3.14$)



(A) $314\sqrt{2}$ cm^2 (B) 314 cm^2

(C) $\frac{3140}{3}$ cm^2 (D) $3140\sqrt{2}$ cm^2

2. If a_n represents n^{th} term of the A.P. $-\frac{15}{4}, -\frac{10}{4}, -\frac{5}{4}$, ... then value of $a_{16} - a_{12}$ is

(A) 4 (B) $\frac{5}{4}$

(C) 5 (D) $\frac{25}{4}$

3. Meena calculates that the probability of her winning the first prize in a lottery is 0.08. If total 800 tickets were sold, the number of tickets bought by her, is

(A) 64 (B) 640

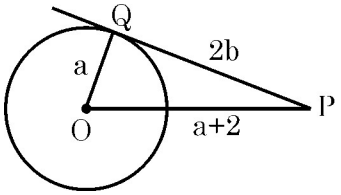
(C) 100 (D) 10

4. A camping tent in hemispherical shape of radius 1.4 m, has a door opening of area 0.50 m^2. Outer surface area of the tent is

(A) 11.78 m^2 (B) 12.32 m^2

(C) 11.82 m^2 (D) 12.86 m^2

5. PQ is tangent to a circle with centre O. If OQ = a, OP = a + 2 and PQ = 2b, then relation between a and b is



(A) $a^2 + (a + 2)^2 = (2b)^2$ (B) $b^2 = a + 4$

(C) $2a^2 + 1 = b^2$ (D) $b^2 = a + 1$

6. $\frac{\sec A}{\sqrt{\sec^2 A - 1}}$ का सरलतम रूप है

(A) sin A (B) tan A

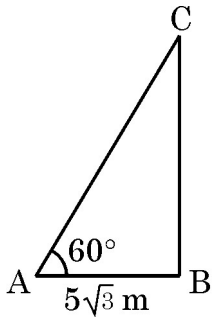
(C) cosec A (D) cos A

7. बिंदुओं P(–4, –2) तथा Q(10, 4) को जोड़ने वाले रेखाखंड को y-अक्ष निम्न अनुपात में विभाजित करती है

(A) 2 : 5 (B) 1 : 2

(C) 2 : 1 (D) 5 : 2

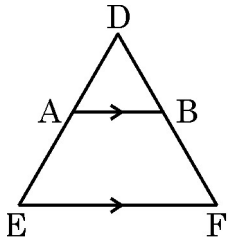
8. भूमि पर एक बिन्दु A से एक खम्भे BC के शिखर 60° का उन्नयन कोण बनाते हुए एक तार बाँधा गया है। यदि AB = $5\sqrt{3}$ m है, तो तार की लम्बाई है



(A) 10 m (B) $10\sqrt{3}$ m

(C) 15 m (D) $\frac{5}{2}\sqrt{3}$ m

9. दी गयी आकृति में AB || EF है। यदि AB = 24 cm, EF = 36 cm तथा DA = 7 cm है, तो AE बराबर है :



(A) 2.5 cm (B) 10.5 cm

(C) 3.5 cm (D) $\frac{14}{3}$ cm

6. Simplest form of $\frac{\sec A}{\sqrt{\sec^2 A - 1}}$ is

(A) sin A (B) tan A

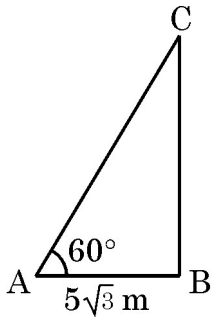
(C) cosec A (D) cos A

7. The line segment joining the points P(–4, –2) and Q(10, 4) is divided by y-axis in the ratio

(A) 2 : 5 (B) 1 : 2

(C) 2 : 1 (D) 5 : 2

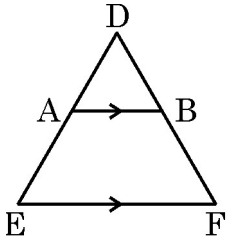
8. A wire is attached from a point A on the ground to the top of a pole BC, making an angle of elevation as 60°. If AB = $5\sqrt{3}$ m, then length of the wire is



(A) 10 m (B) $10\sqrt{3}$ m

(C) 15 m (D) $\frac{5}{2}\sqrt{3}$ m

9. In the given figure, AB || EF. If AB = 24 cm, EF = 36 cm and DA = 7 cm, then AE equals



(A) 2.5 cm (B) 10.5 cm

(C) 3.5 cm (D) $\frac{14}{3}$ cm

10. समरूपता की कसौटी SAS का प्रयोग करते हुए देवांश ने सिद्ध किया कि $\Delta ABC \sim \Delta PQR$ है । यदि $\angle C = \angle R$ है, तो निम्न में से कौन सा कथन सही पाया गया ?

(A) $\frac{AC}{AB} = \frac{PR}{PQ}$ (B) $\frac{BC}{AC} = \frac{PR}{QR}$

(C) $\frac{AC}{BC} = \frac{PR}{PQ}$ (D) $\frac{AC}{BC} = \frac{PR}{QR}$

11. एक वर्गीकृत बारम्बारता सारणी का माध्य ज्ञात करते हुए पग विचलन विधि का प्रयोग किया गया । $\left(\frac{x-a}{h} = u\right)$ यदि प्राप्त $\bar{x} = 64$, $h = 5$ तथा $a = 62.5$ है तो $\bar{u}$ का मान है :

(A) 0.5 (B) 1.5

(C) 0.3 (D) 7.5

12. न्यूनकोण θ के लिए, यदि $\sin\theta = \frac{1}{9}$ है, तो $\frac{9\ \text{cosec}\ \theta + 1}{9\ \text{cosec}\ \theta - 1}$ का मान है

(A) 0 (B) $\frac{80}{81}$

(C) 1 (D) $\frac{82}{80}$

13. निम्नलिखित में से कौन सी संख्या किसी घटना की प्रायिकता नहीं हो सकती ?

(A) $\frac{39}{100}$ (B) $\frac{0.001}{20}$

(C) $\frac{10}{0.2}$ (D) 10%

14. द्विघात समीकरण $3x^2 - 7x + m = 0$ के मूल वास्तविक तथा समान हैं । m का मान है

(A) 7 (B) $\frac{49}{12}$

(C) $\frac{49}{3}$ (D) 4

15. बहुपद $p(x)$ के शून्यक -3 तथा 8 हैं । बहुपद $p(x)$ है

(A) $x^2 + 5x - 4$ (B) $(x + 3)(-x + 8)$

(C) $a(x^2 + 5x - 24)$ (D) $x^2 - 24$

10. Devansh proved that $\Delta ABC \sim \Delta PQR$ using SAS similarity criteria. If he found $\angle C = \angle R$, then which of the following was proved true ?

(A) $\frac{AC}{AB} = \frac{PR}{PQ}$ (B) $\frac{BC}{AC} = \frac{PR}{QR}$

(C) $\frac{AC}{BC} = \frac{PR}{PQ}$ (D) $\frac{AC}{BC} = \frac{PR}{QR}$

11. While calculating mean of a grouped frequency distribution, step deviation method was used $\left(\frac{x-a}{h} = u\right)$. It was found that $\bar{x} = 64$, h = 5 and a = 62.5. The value of $\bar{u}$ is

(A) 0.5 (B) 1.5

(C) 0.3 (D) 7.5

12. For an acute angle θ, if $\sin\theta = \frac{1}{9}$, then value of $\frac{9\ \text{cosec}\ \theta + 1}{9\ \text{cosec}\ \theta - 1}$ is

(A) 0 (B) $\frac{80}{81}$

(C) 1 (D) $\frac{82}{80}$

13. Which of the following can not be the probability of an event ?

(A) $\frac{39}{100}$ (B) $\frac{0.001}{20}$

(C) $\frac{10}{0.2}$ (D) 10%

14. The value of m for which the quadratic equation $3x^2 - 7x + m = 0$ has real and equal roots, is

(A) 7 (B) $\frac{49}{12}$

(C) $\frac{49}{3}$ (D) 4

15. If the zeroes of a polynomial $p(x)$ are –3 and 8, then $p(x)$ equals

(A) $x^2 + 5x - 4$ (B) $(x + 3)(-x + 8)$

(C) $a(x^2 + 5x - 24)$ (D) $x^2 - 24$

16. द्विघात समीकरण $x^2 - px + 6 = 0$ के मूल परिमेय हैं । p का निम्न में से कौन सा मान है ?

(A) 1 (B) -5

(C) 25 (D) $\sqrt{5}$

17. 2.2 cm लम्बी एक चाप, 2.8 cm त्रिज्या वाले वृत्त के केन्द्र पर कोण θ अंतरित करती है । θ का मान है

(A) $50°$ (B) $60°$

(C) $45°$ (D) $30°$

18. दो पासे एक साथ फेंके जाते हैं । एक ऐसा परिणाम (x, y) जहाँ $x > y$ है, के आने की प्रायिकता है

(A) $\frac{5}{12}$ (B) $\frac{5}{6}$

(C) 1 (D) 0

(अभिकथन एवं तर्क आधारित प्रश्न)

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

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

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

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

(D) अभिकथन (A) गलत है जबकि तर्क (R) सही है ।

19. **अभिकथन (A)** : H.C.F. ($36\ m^2$, 18 m) = 18 m है, यहाँ m एक अभाज्य संख्या है ।

तर्क (R) : दो संख्याओं का H.C.F. हमेशा छोटी संख्या से कम या उसके बराबर होता है ।

20. **अभिकथन (A)** : रैखिक समीकरण युग्म $3x - 5y + 7 = 0$ तथा $-6x + 10y + 14 = 0$ असंगत है ।

तर्क (R) : जब दो रैखिक समीकरणों का अद्वितीय हल नहीं होता, वे हमेशा समांतर रेखायें निरूपित करती है ।

16. The value of p for which roots of the quadratic equation $x^2 - px + 6 = 0$ are rational, is

(A) 1 (B) –5

(C) 25 (D) $\sqrt{5}$

17. An arc of length 2.2 cm subtends an angle θ at the centre of the circle with radius 2.8 cm. The value of θ is

(A) 50° (B) 60°

(C) 45° (D) 30°

18. Two dice are rolled together. The probability of getting an outcome (x, y) where x > y, is

(A) $\frac{5}{12}$ (B) $\frac{5}{6}$

(C) 1 (D) 0

(Assertion and Reason Based Questions)

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

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

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

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

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

19. **Assertion (A) :** H.C.F. (36 m^2, 18 m) = 18 m, where m is a prime number.

Reason (R) : H.C.F. of two numbers is always less than or equal to the smaller number.

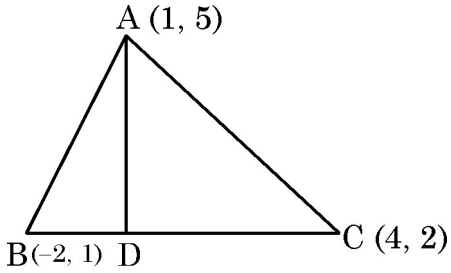
20. **Assertion (A) :** The system of linear equations $3x - 5y + 7 = 0$ and $-6x + 10y + 14 = 0$ is inconsistent.

Reason (R) : When two linear equations don't have unique solution, they always represent parallel lines.

खण्ड – ख

प्रश्न संख्या 21 से 25 तक अति लघु–उत्तरीय प्रश्न हैं । प्रत्येक प्रश्न 2 अंकों का है ।

21. दी गयी आकृति में, ΔABC की भुजा BC को बिंदु D 1 : 2 के अनुपात में विभाजित करता है । AD की लम्बाई ज्ञात कीजिए ।



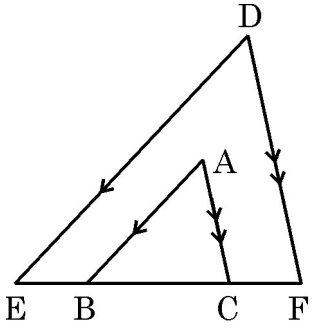
22. (a) मान ज्ञात कीजिए : $\frac{\sin^3 60° - \tan 30°}{\cos^2 45°}$

अथवा

(b) न्यून कोण A तथा B के लिए, यदि A + 2B तथा 2A + B न्यून कोण हैं, तथा $\tan (A + 2B) = \sqrt{3}$ तथा $\sin (2A + B) = \frac{1}{\sqrt{2}}$ है, तो कोण A तथा B का मान ज्ञात कीजिए ।

23. एक थैले में 25 गेंद हैं । उनमें से कुछ पीली तथा शेष हरी हैं । एक गेंद को यादृच्छया निकाला गया । यदि हरी गेंद के मिलने की प्रायिकता 3/5 है, तो पीली गेंदों की संख्या ज्ञात कीजिए ।

24. दी गयी आकृति में, AB || DE तथा AC || DF है । दर्शाइये कि $\Delta ABC \sim \Delta DEF$ है । यदि BC = 10 cm, EB = CF = 5 cm तथा AB = 7 cm है, तो DE की लम्बाई ज्ञात कीजिए ।

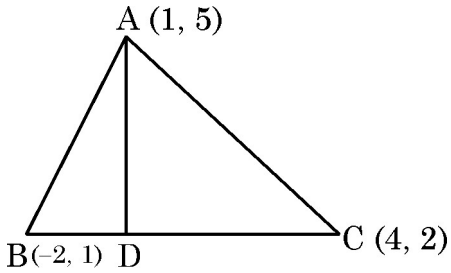


25. सिद्ध कीजिए कि $14 - 2\sqrt{3}$ एक अपरिमेय संख्या है । दिया गया है कि $\sqrt{3}$ एक अपरिमेय संख्या है ।

SECTION – B

Q. Numbers 21 to 25 are very short answer questions of 2 marks each.

21. In the given figure, point D divides the side BC of ΔABC in the ratio 1 : 2. Find length AD.



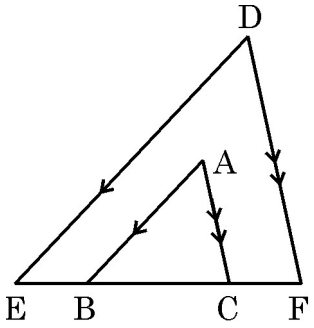
22. (a) Evaluate : $\frac{\sin^3 60° - \tan 30°}{\cos^2 45°}$

OR

(b) For acute angles A and B and A + 2B and 2A + B are acute if $\tan (A + 2B) = \sqrt{3}$ and $\sin (2A + B) = \frac{1}{\sqrt{2}}$, then find the measures of angles A and B.

23. A bag contains 25 balls. Some of them are yellow and others are green. One ball is drawn at random. If probability of getting a green ball is 3/5, then find the number of yellow balls.

24. In the given figure, AB || DE and AC || DF. Show that $\Delta ABC \sim \Delta DEF$. If BC = 10 cm, EB = CF = 5 cm and AB = 7 cm, then find the length DE.



25. Prove that $14 - 2\sqrt{3}$ is an irrational number, given that $\sqrt{3}$ is irrational.

खण्ड – ग

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

26. (a) बिंदु (2, 1) पर केन्द्रित वृत्त, बिंदुओं A(5, 6) तथा B(–3, K) से होकर गुजरता है । K का (के) मान ज्ञात कीजिए । अतः जीवा AB की लम्बाई ज्ञात कीजिए ।

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(b) सिद्ध कीजिए कि बिंदुओं A(–1, 7) तथा B(4, –3) को जोड़ने वाले रेखाखंड को 3 : 2 के अनुपात में विभाजित करने वाला बिंदु P रेखा $x - 3y = -1$ पर स्थित है । PA व PB की लम्बाई भी ज्ञात कीजिए ।

27. रैखिक समीकरण युग्म $x = -3$ तथा $5x - 2y = -5$ को ग्राफीय विधि से हल कीजिए ।

28. (a) एक A.P. में 15वाँ पद, 8वें पद से 21 अधिक है । यदि प्रथम 10 पदों का योग 55 है, तो A.P. लिखिए ।

अथवा

(b) एक A.P. के प्रथम n पदों का योग $2n^2 + 13n$ है । इसका nवाँ पद तथा फिर 10वाँ पद ज्ञात कीजिए ।

29. एक खिड़की की विमायें 156 cm × 216 cm हैं । अर्जुन खिड़की पर जाली लगाना चाहता है जो अधिकतम आकार के पूर्ण वर्गों से बनी हो । वर्ग की भुजा की लम्बाई ज्ञात कीजिए । बनाये गये वर्गों की संख्या भी बताइए ।

30. सिद्ध कीजिए :

$$\frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta} = 1 + \tan\theta + \cot\theta$$

31. 14 cm त्रिज्या वाले वृत्त की एक जीवा केन्द्र पर 60° का कोण अंतरित करती है । लघु त्रिज्यखंड का क्षेत्रफल तथा लघु वृतखंड का परिमाप ज्ञात कीजिए ।

SECTION – C

Q. Numbers 26 to 31 are short answer questions of 3 marks each :

26. (a) A circle centered at (2, 1) passes through the points A(5, 6) and B(–3, K). Find the value(s) of K. Hence find length of chord AB.

OR

(b) Prove that the point P dividing the line segment joining the points A(–1, 7) and B(4, –3) in the ratio 3 : 2, lies on the line $x - 3y = -1$. Also find length of PA and PB.

27. Use graphical method to solve the system of linear equations : $x = -3$ and $5x - 2y = -5$.

28. (a) In an A.P., 15^{th} term exceeds the 8^{th} term by 21. If sum of first 10 terms is 55, then form the A.P.

OR

(b) The sum of first n terms of an A.P. is $2n^2 + 13n$. Find its n^{th} term and hence 10^{th} term.

29. The dimensions of a window are 156 cm × 216 cm. Arjun wants to put grill on the window creating complete squares of maximum size. Determine the side length of the square and hence find the number of squares formed.

30. Prove that :

$$\frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta} = 1 + \tan\theta + \cot\theta.$$

31. A chord of a circle, of radius 14 cm, subtends an angle of 60° at the centre. Find the area of the smaller sector and perimeter of the smaller segment.

खण्ड – घ

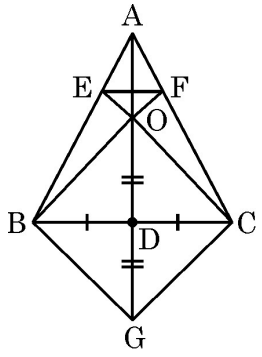
प्रश्न संख्या 32 से 35 तक दीर्घ–उत्तरीय प्रश्न हैं । प्रत्येक प्रश्न के 5 अंक हैं ।

32. (a) ΔABC की भुजा BC का मध्यबिंदु D है । BF तथा CE का प्रतिच्छेद बिंदु O, AD पर स्थित है । AD को बिंदु G तक इस प्रकार बढ़ाया गया कि OD = DG है । सिद्ध कीजिए ।

(i) OBGC एक समांतर चतुर्भुज है ।

(ii) EF || BC है ।

(iii) $\Delta AEF \sim \Delta ABC$



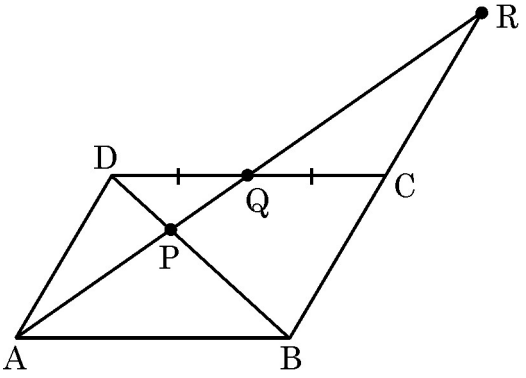
अथवा

(b) एक समांतर चतुर्भुज ABCD की भुजा CD के मध्यबिंदु Q से होकर जाती हुई रेखा AR खींची गयी है जो BD को बिंदु P तथा बढ़ाई गयी भुजा BC को बिंदु R पर काटती है । सिद्ध कीजिए ।

(i) AQ = QR

(ii) AP = 2PQ

(iii) PR = 2AP



33. (a) निम्नलिखित वितरण का माध्य 53 है । लुप्त बारंबारता p का मान ज्ञात कीजिए ।

वर्ग अंतराल	:	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100
बारंबारता	:	12	15	p	28	13

अतः वितरण का बहुलक ज्ञात कीजिए ।

अथवा

SECTION – D

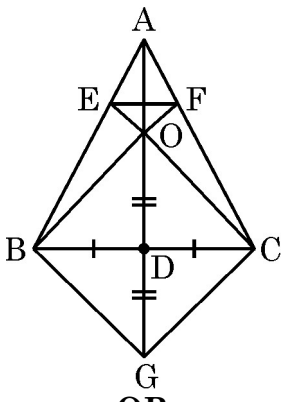
Q. numbers 32 to 35 are long answer questions of 5 marks each.

32. (a) D is the mid-point of side BC of ΔABC. CE and BF intersect at O, a point on AD. AD is produced to G such that OD = DG. Prove that

(i) OBGC is a parallelogram.

(ii) EF || BC

(iii) $\Delta AEF \sim \Delta ABC$



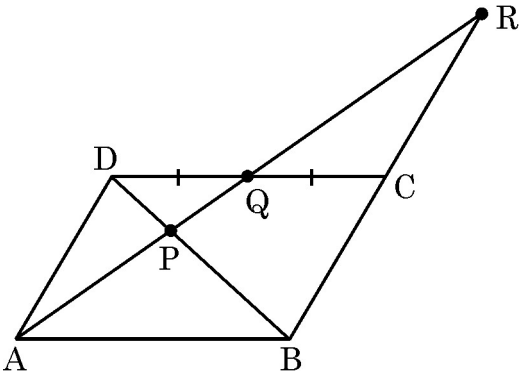
OR

(b) Through the mid-point Q of side CD of a parallelogram ABCD, the line AR is drawn which intersects BD at P and produced BC at R. Prove that

(i) AQ = QR

(ii) AP = 2PQ

(iii) PR = 2AP



33. (a) The mean of the following distribution is 53. Find the missing frequency p.

Class Interval :	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100
Frequency :	12	15	p	28	13

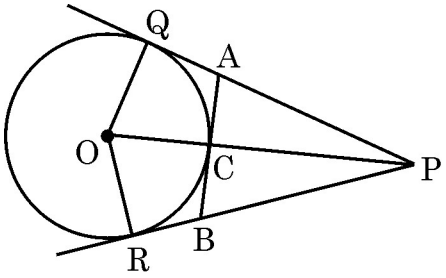
Hence, find mode of the distribution.

OR

(b) निम्न आँकड़ों का माध्यक ज्ञात कीजिए :

मध्य मान	:	115	125	135	145	155	165	175
बारंबारता	:	12	15	20	16	10	16	11

34. 5 cm त्रिज्या तथा केन्द्र O वाले वृत्त की दो स्पर्श रेखायें PQ तथा PR हैं । OP वृत्त को बिंदु C पर काटती है जिस पर एक अन्य स्पर्श रेखा AB खींची गयी है । यदि OP = 13 cm है, तो AB तथा PA की लम्बाई ज्ञात कीजिए ।



35. दो पानी के नल एक साथ एक हौज को $8\frac{8}{9}$ घंटों में भर सकते हैं । बड़े व्यास बाला नल, हौज को भरने में, कम व्यास वाले नल से 4 घंटे कम समय लेता है । प्रत्येक द्वारा अलग से हौज को भरने का समय ज्ञात कीजिए ।

खण्ड – ङ

प्रश्न संख्या 36 से 38 तक प्रकरण अध्ययन आधारित 3 प्रश्न है । प्रत्येक प्रश्न के 4 अंक हैं ।

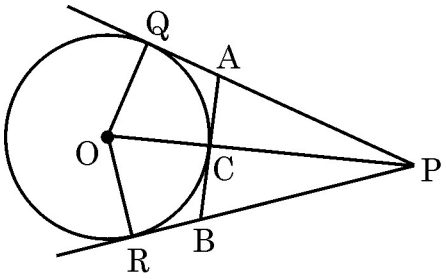
36.



(b) Compute median of the following data :

Mid-value :	115	125	135	145	155	165	175
Frequency :	12	15	20	16	10	16	11

34. PQ and PR are two tangents to a circle with centre O and radius 5 cm. AB is another tangent to the circle at C which lies on OP. If OP = 13 cm, then find the length AB and PA.



35. Two water taps together can fill a tank in $8\frac{8}{9}$ hours. The tap of larger diameter takes 4 hours less than the smaller one to fill the tank separately. Find the time in which each tap can separately fill the tank.

SECTION – E

This section (Q. 36 to 38) has 3 case study based questions of 4 marks each.

36.



पानी संगृहीत करने व आस-पास की कॉलोनियों में उपलब्ध कराने के लिये पानी की ऊँची टंकियों का प्रयोग किया जाता है ।

ऊपरी दी गयी आकृति में, AB पानी की एक ऊँची टंकी है तथा इससे 54 मीटर की दूरी पर स्थित CD एक बहुमंजिला भवन है ।

भवन की एक खिड़की (W) से टंकी के शिखर का उन्नयन कोण 45° है तथा इसके पाद का अवनमन कोण 30° है ।

(i) d (खिड़की की ऊँचाई) तथा y के बीच के संबंध को लिखिए । **1**

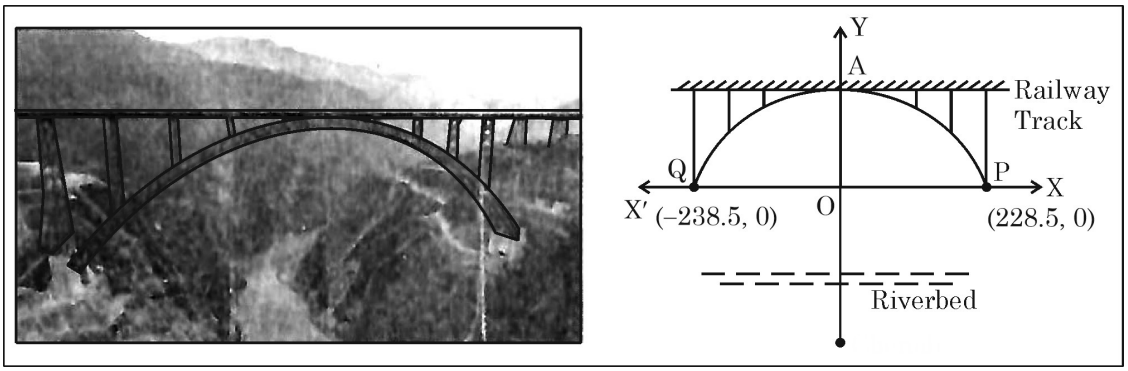
(ii) h का मान ज्ञात कीजिए । **1**

(iii) (a) पानी की टंकी की ऊँचाई ज्ञात कीजिए । **2**

अथवा

(iii) (b) x का मान तथा खिड़की की धरातल से ऊँचाई ज्ञात कीजिए । **2**

37.



ऊपर दी गयी आकृति में, चेनाब नदी के ऊपर बने एक रेलवे पुल की मेहराब (arch) को दिखाया गया है । यह एक परवलयाकार मेहराब है जो दो पहाड़ियों को बिंदु P तथा Q पर जोड़ती है । यदि वक्र परवलय को निरूपित करने वाला बहुपद $p(x) = -0.0025x^2 - 0.025x + 136$ है ।

ऊपरी दी गयी आकृति तथा सूचना के आधार पर निम्न प्रश्नों के उत्तर दीजिए :

(i) बिंदु A के निर्देशांक लिखिए । **1**

(ii) मेहराब का विस्तार (span) ज्ञात कीजिए । **1**

(iii) (a) दी गयी आकृति की सहायता से बहुपद $p(x)$ के शून्यक लिखिए । इन शून्यकों तथा बहुपदों के गुणांकों के बीच के संबंध की सत्यता की जाँच कीजिए । **2**

अथवा

(iii) (b) $x = 100$ तथा $x = -100$ पर बहुपद $p(x)$ का मान ज्ञात कीजिए । क्या यह दोनों मान समान हैं ? **2**

Elevated water storage tanks are built to store and supply water to nearby colonies. In the diagram given above, AB is an elevated water tank and CD is a nearby multistorey building. The building is 54 metres away from the water tank.

From a window (W) of the building, the angle of elevation of top of the tank is 45° and angle of depression of its foot is 30°.

(i) Write a relation between d (the height of window) and y. **1**

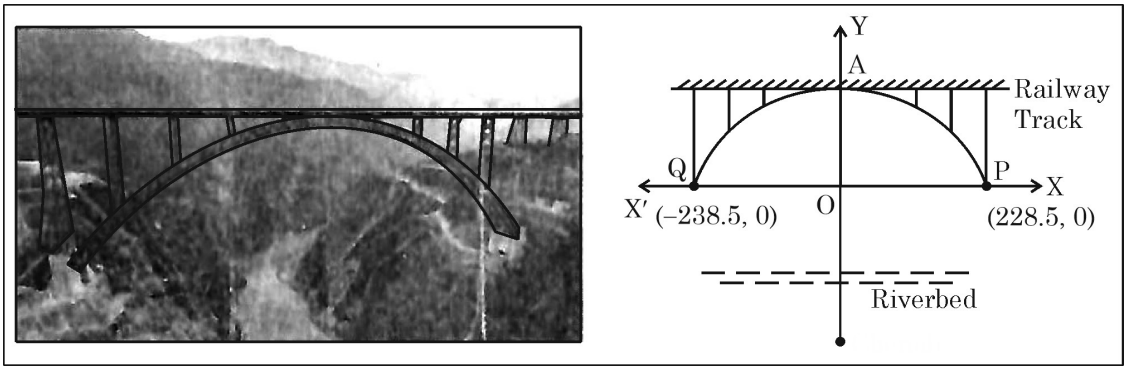
(ii) Determine the value of h. **1**

(iii) (a) Determine height of the water tank. **2**

OR

(iii) (b) Find the value of x and height of the window above ground level. **2**

37.



An arch of a railway bridge, built on Chenab riverbed, is shown in the above diagram. It is a parabolic arch connecting two hills at P and Q. If the parabolic curve is represented by the polynomial

$p(x) = -0.0025x^2 - 0.025x + 136$.

Observe the diagram and based on above information, answer the following questions :

(i) Write the co-ordinates of point A. **1**

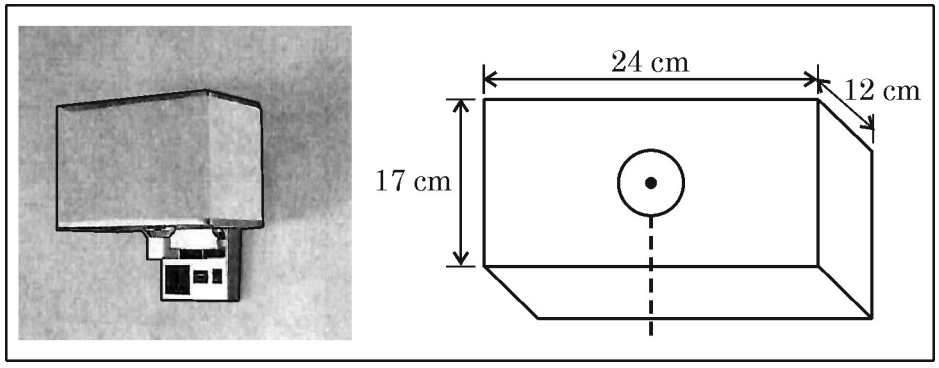
(ii) Find the span of the arch. **1**

(iii) (a) Write the zeroes of the polynomial using diagram and verify the relationship between sum of zeroes and polynomials. **2**

OR

(iii) (b) Find the values of $p(x)$ at $x = 100$ and $x = -100$. Are they same ? **2**

38. दीवार पर घनाभ के आकार का एक लैंप लगा है जो कपड़े से बना है । यह ऊपर तथा नीचे से खुला है । लैंप के अंदर 7 cm व्यास वाला एक गोलाकार बल्ब है जो एक पतली छड़ी पर टिका है । (कार्य करते समय छड़ी को अनदेखा करें)



घनाभ की विमायें 24 cm × 12 cm × 17 cm हैं ।

(i) बल्ब का पृष्ठीय क्षेत्रफल ज्ञात कीजिए । **1**

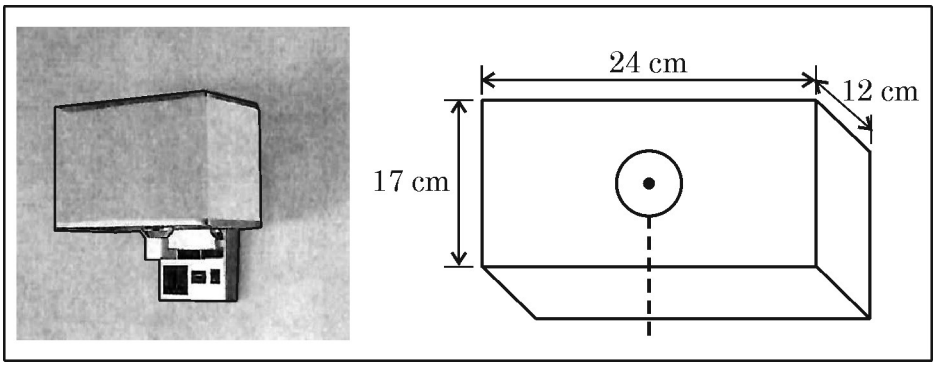
(ii) यदि हर तरफ से कम से कम 1 cm जगह छोड़नी जरूरी हो तो बल्ब का अधिकतम व्यास क्या हो सकता है ? **1**

(iii) (a) कपड़ा लगाते समय ऊपर तथा नीचे के किनारों पर 2 cm कपड़ा अंदर की तरफ मोड़ा गया है । प्रयुक्त कपड़े का क्षेत्रफल ज्ञात कीजिए । **2**

अथवा

(iii) (b) लैंप के अंदर उपलब्ध रिक्त स्थान ज्ञात कीजिए । **2**

38. A wall mounted lamp, made of fabric, is shown below. Lamp has cuboidal shape, open from top and bottom. A spherical bulb of diameter 7 cm is latched with a very thin rod. (Ignore the rod while making calculations.)



Dimensions of the cuboid are 24 cm × 12 cm × 17 cm.

(i) Find the surface area of the bulb. **1**

(ii) What could be the maximum diameter of the bulb if at least 1 cm space is left from each side ? **1**

(iii) (a) Find the area of the fabric used if there is a fold of 2 cm on top and bottom edges. **2**

OR

(iii) (b) Find the space available inside the lamp. **2**



Marking Scheme

Strictly Confidential

(For Internal and Restricted use only)

Secondary School Examination, 2026

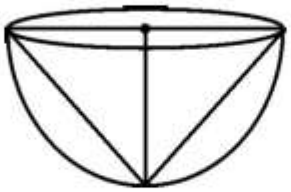
MATHEMATICS (STANDARD) (041) (PAPER CODE 30/5/3)

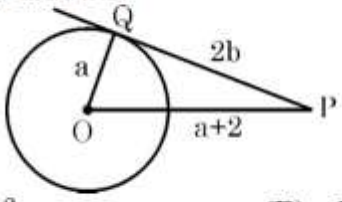
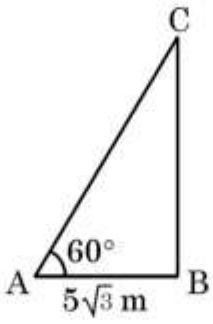
General Instructions: -

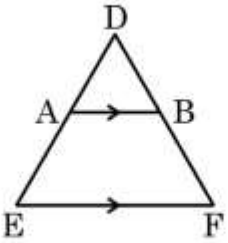
1.	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the Spot Evaluation Guidelines carefully.
2.	**"Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, Evaluation done and several other aspects. 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 BNS."**
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 0 to 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.	Ensure that you do not make the following common types of errors committed by the Examiner in the past: - ● Leaving answer or part thereof unassessed in an answer book. ● Giving more marks for an answer than assigned to it. ● Wrong 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.) Half or a part of answer marked correct and the rest as wrong, but no marks awarded.
14.	While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0) Marks.
15.	Any 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.

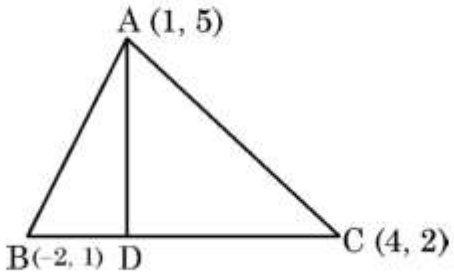
MARKING SCHEME
MATHEMATICS (Subject Code–041)
(PAPER CODE: 30/5/3)

Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Steps	Marks
	SECTION A Q. Number 1 to 20 are multiple choice questions of 1 mark each.		
1.	A conical cavity of maximum volume is carved out from a wooden solid hemisphere of radius 10 cm. Curved surface area of the cavity carved out is (use $\pi = 3.14$)  (A) $314\sqrt{2}\ cm^2$ (B) $314\ cm^2$ (C) $\frac{3140}{3}\ cm^2$ (D) $3140\sqrt{2}\ cm^2$		
Sol.	(A) $314\sqrt{2}\ cm^2$		1
2.	If a_n represents n^{th} term of the A.P. $-\frac{15}{4}, -\frac{10}{4}, -\frac{5}{4}$, ... then value of $a_{16} - a_{12}$ is (A) 4 (B) $\frac{5}{4}$ (C) 5 (D) $\frac{25}{4}$		
Sol.	(C) 5		1
3.	Meena calculates that the probability of her winning the first prize in a lottery is 0.08. If total 800 tickets were sold, the number of tickets bought by her, is (A) 64 (B) 640 (C) 100 (D) 10		
Sol.	(A) 64		1

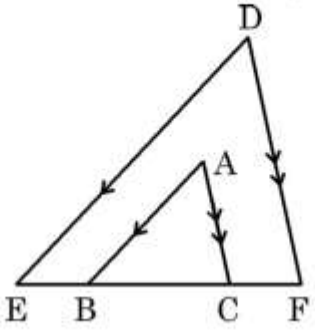
4.	A camping tent in hemispherical shape of radius 1.4 m, has a door opening of area 0.50 m^2. Outer surface area of the tent is (A) 11.78 m^2 (B) 12.32 m^2 (C) 11.82 m^2 (D) 12.86 m^2		
Sol.	(C) 11.82 m^2		1
5.	PQ is tangent to a circle with centre O. If OQ = a, OP = a + 2 and PQ = 2b, then relation between a and b is  (A) $a^2 + (a + 2)^2 = (2b)^2$ (B) $b^2 = a + 4$ (C) $2a^2 + 1 = b^2$ (D) $b^2 = a + 1$		
Sol.	(D) $b^2 = a + 1$		1
6.	Simplest form of $\frac{\sec A}{\sqrt{\sec^2 A - 1}}$ is (A) sin A (B) tan A (C) cosec A (D) cos A		
Sol.	(C) cosec A		1
7.	The line segment joining the points P(–4, –2) and Q(10, 4) is divided by y-axis in the ratio (A) 2 : 5 (B) 1 : 2 (C) 2 : 1 (D) 5 : 2		
Sol.	(A) 2:5		1
8.	A wire is attached from a point A on the ground to the top of a pole BC, making an angle of elevation as 60°. If AB = $5\sqrt{3}$ m, then length of the wire is  (A) 10 m (B) $10\sqrt{3}$ m (C) 15 m (D) $\frac{5}{2}\sqrt{3}$ m		

Sol.	(B) $10\sqrt{3}\ m$		1
9.	In the given figure, AB $\parallel$ EF. If AB = 24 cm, EF = 36 cm and DA = 7 cm, then AE equals  (A) 2.5 cm (B) 10.5 cm (C) 3.5 cm (D) $\frac{14}{3}$ cm		
Sol.	(C) 3.5 cm		1
10.	Devansh proved that $\Delta ABC \sim \Delta PQR$ using SAS similarity criteria. If he found $\angle C = \angle R$, then which of the following was proved true ? (A) $\frac{AC}{AB} = \frac{PR}{PQ}$ (B) $\frac{BC}{AC} = \frac{PR}{QR}$ (C) $\frac{AC}{BC} = \frac{PR}{PQ}$ (D) $\frac{AC}{BC} = \frac{PR}{QR}$		
Sol.	(D) $\frac{AC}{BC} = \frac{PR}{QR}$		1
11.	While calculating mean of a grouped frequency distribution, step deviation method was used $\left(\frac{x-a}{h} = u\right)$. It was found that $\bar{x} = 64$, h = 5 and a = 62.5. The value of $\bar{u}$ is (A) 0.5 (B) 1.5 (C) 0.3 (D) 7.5		
Sol.	(C) 0.3		1
12.	For an acute angle θ, if $\sin\theta = \frac{1}{9}$, then value of $\frac{9\ \text{cosec}\ \theta + 1}{9\ \text{cosec}\ \theta - 1}$ is (A) 0 (B) $\frac{80}{81}$ (C) 1 (D) $\frac{82}{80}$		
Sol.	(D) $\frac{82}{80}$		1

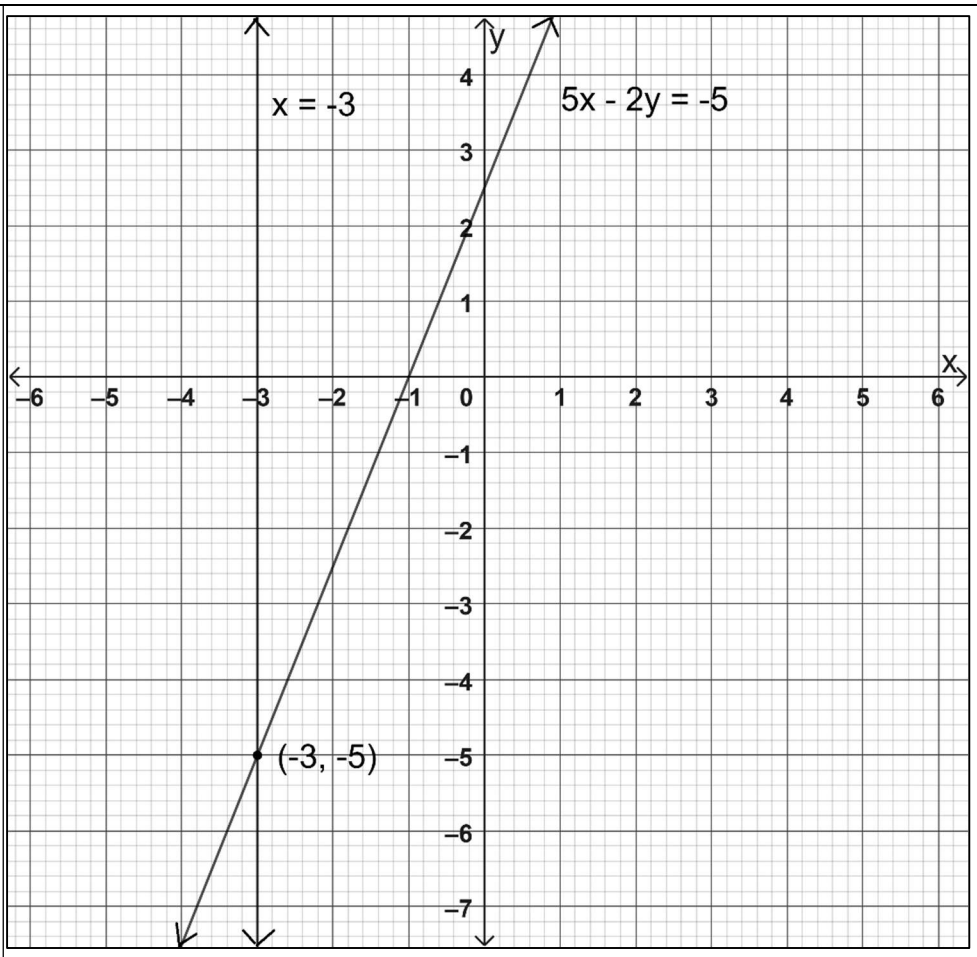
13.	Which of the following can not be the probability of an event ? (A) $\frac{39}{100}$ (B) $\frac{0.001}{20}$ (C) $\frac{10}{0.2}$ (D) 10%		
Sol.	(C) $\frac{10}{0.2}$		1
14.	The value of m for which the quadratic equation $3x^2 - 7x + m = 0$ has real and equal roots, is (A) 7 (B) $\frac{49}{12}$ (C) $\frac{49}{3}$ (D) 4		
Sol.	(B) $\frac{49}{12}$		1
15.	If the zeroes of a polynomial p(x) are –3 and 8, then p(x) equals (A) $x^2 + 5x - 4$ (B) $(x + 3)(-x + 8)$ (C) $a(x^2 + 5x - 24)$ (D) $x^2 - 24$		
Sol.	(B) $(x + 3)(-x + 8)$		1
16.	The value of p for which roots of the quadratic equation $x^2 - px + 6 = 0$ are rational, is (A) 1 (B) –5 (C) 25 (D) $\sqrt{5}$		
Sol.	(B) -5		1
17.	An arc of length 2.2 cm subtends an angle θ at the centre of the circle with radius 2.8 cm. The value of θ is (A) 50° (B) 60° (C) 45° (D) 30°		
Sol.	(C) 45°		1
18.	Two dice are rolled together. The probability of getting an outcome (x, y) where $x >$ y, is (A) $\frac{5}{12}$ (B) $\frac{5}{6}$ (C) 1 (D) 0		
sol.	(A) $\frac{5}{12}$		1

	(Assertion and Reason Based Questions) **Directions :** Questions number **19** and **20** are Assertion and Reason based questions. Two statements are given, one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer from the codes (A), (B), (C) and (D) as given below : (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A). (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A). (C) Assertion (A) is true, but Reason (R) is false. (D) Assertion (A) is false, but Reason (R) is true.		
19.	**Assertion (A) :** H.C.F. (36 m^2, 18 m) = 18 m, where m is a prime number. **Reason (R) :** H.C.F. of two numbers is always less than or equal to the smaller number.		
Sol.	(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).		1
20.	**Assertion (A) :** The system of linear equations $3x - 5y + 7 = 0$ and $-6x + 10y + 14 = 0$ is inconsistent. **Reason (R) :** When two linear equations don't have unique solution, they always represent parallel lines.		
Sol.	(C) Assertion (A) is true, but Reason (R) is false.		1
	SECTION B Q. Numbers 21 to 25 are very short answer questions of 2 marks each.		
21.	In the given figure, point D divides the side BC of ΔABC in the ratio 1 : 2. Find length AD. 		
Sol.	Coordinates of point D $= \left(\frac{4-4}{3}, \frac{2+2}{3}\right)$ i. e. $\left(0, \frac{4}{3}\right)$	I	1

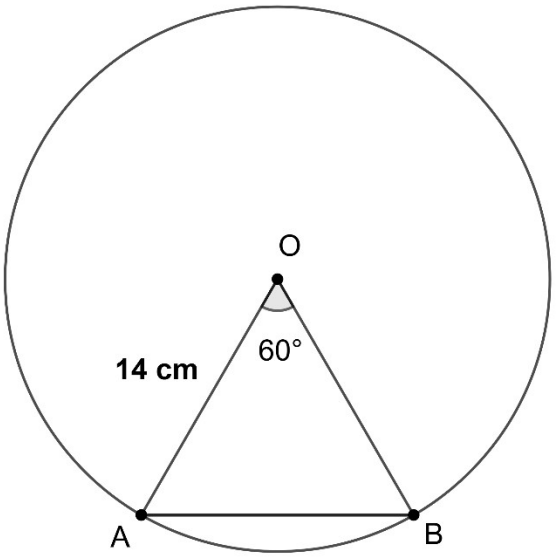
	$AD = \sqrt{(1-0)^2 + (5-\frac{4}{3})^2} = \frac{\sqrt{130}}{3}$ units	II	1
22. (a)	Evaluate : $\frac{\sin^3 60° - \tan 30°}{\cos^2 45°}$		
Sol.	$\frac{\sin^3 60° - \tan 30°}{\cos^2 45°} = \frac{\left(\frac{\sqrt{3}}{2}\right)^3 - \frac{1}{\sqrt{3}}}{\left(\frac{1}{\sqrt{2}}\right)^2}$	I	1½
	$= \frac{1}{4\sqrt{3}}$ *or* $\frac{\sqrt{3}}{12}$	II	½
	OR		
22. (b)	For acute angles A and B and A + 2B and 2A + B are acute if $\tan(A + 2B) = \sqrt{3}$ and $\sin(2A + B) = \frac{1}{\sqrt{2}}$, then find the measures of angles A and B.		
Sol.	$\tan(A + 2B) = \sqrt{3} \Rightarrow A + 2B = 60°$	I	½
	$\sin(2A + B) = \frac{1}{\sqrt{2}} \Rightarrow 2A + B = 45°$	II	½
	On solving above equations, $A = 10°, B = 25°$	III	½+½
23.	A bag contains 25 balls. Some of them are yellow and others are green. One ball is drawn at random. If probability of getting a green ball is 3/5, then find the number of yellow balls.		
Sol.	$P(\text{getting a yellow ball}) = 1 - P(\text{getting a green ball})$		
	$\Rightarrow \frac{\text{Number of yellow balls}}{25} = 1 - \frac{3}{5} = \frac{2}{5}$	I	1
	$\Rightarrow$ Number of yellow balls $= 25 \times \frac{2}{5} = 10$	II	1

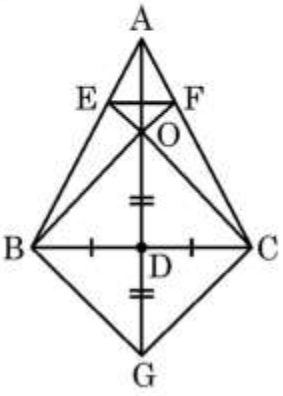
24.	In the given figure, AB ‖ DE and AC ‖ DF. Show that ΔABC ~ ΔDEF. If BC = 10 cm, EB = CF = 5 cm and AB = 7 cm, then find the length DE.  		
Sol.	$AB \parallel DE \Rightarrow \angle DEF = \angle ABC$ $AC \parallel DF \Rightarrow \angle DFE = \angle ACB$ Hence $\Delta ABC \sim \Delta DEF$ $\frac{BC}{EF} = \frac{AB}{DE} \Rightarrow \frac{10}{20} = \frac{7}{DE}$ $DE = 14$ cm	I II III	1 ½ ½
25.	Prove that $14 - 2\sqrt{3}$ is an irrational number, given that $\sqrt{3}$ is irrational.		
Sol.	Let $14 - 2\sqrt{3}$ be a rational number. $\therefore 14 - 2\sqrt{3} = \frac{a}{b}$ where a and b are integers and $b \neq 0$. $\sqrt{3} = \frac{14b - a}{2b}$ RHS is rational but LHS is an irrational which is a contradiction to our supposition. Hence $14 - 2\sqrt{3}$ is an irrational number.	I II III	½ ½ 1
	SECTION C Q. Numbers 26 to 31 are short answer questions of 3 marks each.		
26. (a)	A circle centered at (2, 1) passes through the points A(5, 6) and B(–3, K). Find the value(s) of K. Hence find length of chord AB.		
Sol.	Let centre be $O(2,1) \Rightarrow OA = OB$ $\sqrt{(5-2)^2 + (6-1)^2} = \sqrt{(-3-2)^2 + (K-1)^2}$ $\Rightarrow 9 = (K-1)^2$ $\Rightarrow K = -2, 4$	I II	1 1

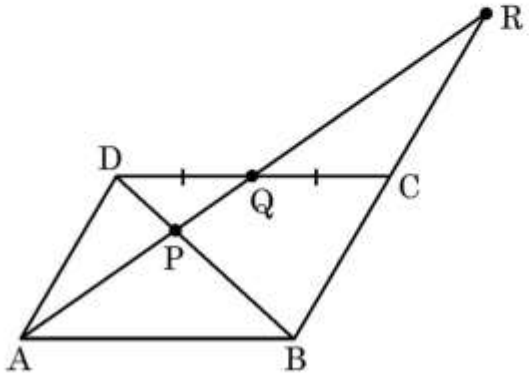
	For K $= -2$, AB $= \sqrt{128}$ or $8\sqrt{2}$ For K $= 4$, AB $= \sqrt{68}$ or $2\sqrt{17}$	III IV	½ ½
	OR		
26. (b)	Prove that the point P dividing the line segment joining the points A(–1, 7) and B(4, –3) in the ratio 3 : 2, lies on the line $x - 3y = -1$. Also find length of PA and PB.		
Sol.	**3 : 2** **A (–1, 7) P B (4, -3)** AP: PB $= 3:2$ Coordinates of P $= \left(\frac{12-2}{5}, \frac{-9+14}{5}\right) = (2,1)$ Substituting x $= 2$ and y $= 1$ in the given equation L. H. S. $=$ x $- 3$y $= 2 - 3(1)$ $= -1 =$ R. H. S. ∴ P lies on the given line PA $= \sqrt{(2+1)^2 + (1-7)^2} = \sqrt{45}$ or $3\sqrt{5}$ PB $= \sqrt{(2-4)^2 + (1+3)^2} = \sqrt{20}$ or $2\sqrt{5}$	I II III IV	1 1 ½ ½
27.	Use graphical method to solve the system of linear equations : $x = -3$ and $5x - 2y = -5$.		

Sol.			
	Correct graph of $5x - 2y = -5$	I	1½
	Correct graph of $x = -3$	II	½
	Solution: $x = -3, y = -5$	III	½ + ½
28. (a)	In an A.P., 15th term exceeds the 8th term by 21. If sum of first 10 terms is 55, then form the A.P.		
Sol.	Let first term = a and common difference = d		
	$(a + 14d) = (a + 7d) + 21$	I	1
	$\Rightarrow d = 3$	II	½
	Also, $S_{10} = 55 = \frac{10}{2}[2a + 9 \times 3]$	III	½
	$\Rightarrow a = -8$	IV	½
	$\therefore$ A. P. is $-8, -5, -2, \ldots$	V	½
	OR		

28. (b)	The sum of first n terms of an A.P. is $2n^2 + 13n$. Find its n^{th} term and hence 10^{th} term.		
Sol.	$S_n = 2n^2 + 13n$		
	$S_1 = a_1 = 15$	I	½
	$S_2 = a_1 + a_2 = 34 \Rightarrow a_2 = 19$	II	½
	$\Rightarrow d = 19 - 15 = 4$	III	½
	$\therefore a_n = 15 + (n-1) \times 4 = 4n + 11$	IV	1
	Hence $a_{10} = 4 \times 10 + 11 = 51$	V	½
29.	The dimensions of a window are 156 cm × 216 cm. Arjun wants to put grill on the window creating complete squares of maximum size. Determine the side length of the square and hence find the number of squares formed.		
Sol.	$156 = 2 \times 2 \times 3 \times 13 = 2^2 \times 3 \times 13$	I	½
	$216 = 2 \times 2 \times 2 \times 3 \times 3 \times 3 = 2^3 \times 3^3$	II	½
	$\therefore$ required side length of the square $= HCF(156,216) = 12$ cm	III	1
	Number of squares formed $= \frac{156 \times 216}{12 \times 12} = 234$	IV	1
30.	Prove that : $\frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta} = 1 + \tan\theta + \cot\theta.$		
Sol.	$LHS = \left(\frac{\frac{\sin\theta}{\cos\theta}}{1-\frac{\cos\theta}{\sin\theta}}\right) + \left(\frac{\frac{\cos\theta}{\sin\theta}}{1-\frac{\sin\theta}{\cos\theta}}\right)$	I	½
	$= \frac{\sin^2\theta}{\cos\theta(\sin\theta - \cos\theta)} + \frac{\cos^2\theta}{\sin\theta(\cos\theta - \sin\theta)}$	II	½
	$= \frac{\sin^3\theta - \cos^3\theta}{\sin\theta\cos\theta(\sin\theta - \cos\theta)}$	III	½
	$= \frac{(\sin\theta - \cos\theta)(\sin^2\theta + \cos^2\theta + \sin\theta\cos\theta)}{\sin\theta\cos\theta(\sin\theta - \cos\theta)}$	IV	½
	$= \frac{\sin^2\theta}{\sin\theta\cos\theta} + \frac{\cos^2\theta}{\sin\theta\cos\theta} + \frac{\sin\theta\cos\theta}{\sin\theta\cos\theta}$	V	½

	$= \tan\theta + \cot\theta + 1 = \text{RHS}$	VI	½
31.	A chord of a circle, of radius 14 cm, subtends an angle of 60° at the centre. Find the area of the smaller sector and perimeter of the smaller segment.		
Sol.			
	$\therefore \Delta OAB$ is an equilateral triangle.		
	$\Longrightarrow AB = 14\ cm$	I	½
	Area of smaller sector $= \frac{60}{360} \times \frac{22}{7} \times 14 \times 14$	II	½
	$= \frac{308}{3}\ cm^2$ or $102.6\ cm^2$ (approx.)	III	½
	Perimeter of smaller segment $= 14 + \frac{60}{360} \times 2 \times \frac{22}{7} \times 14$	IV	1
	$= \frac{86}{3}\ cm$ or $28.6\ cm$ (approx.)	V	½

	SECTION D Q. Numbers 32 to 35 are long answer questions of 5 marks each.		
32. (a)	D is the mid-point of side BC of ΔABC. CE and BF intersect at O, a point on AD. AD is produced to G such that OD = DG. Prove that (i) OBGC is a parallelogram. (ii) $EF \parallel BC$ (iii) $\Delta AEF \sim \Delta ABC$  		
Sol.	(i) $\because$ Diagonals OG and BC of quadrilateral OBGC bisect each other.		
	$\therefore$ OBGC is a parallelogram	I	1
	(ii) $CO \parallel GB \Rightarrow CE \parallel GB$	II	½
	In ΔAGB, $OE \parallel GB \Rightarrow \frac{AO}{OG} = \frac{AE}{EB}$	III	1
	Similarly in ΔAGC, $\frac{AO}{OG} = \frac{AF}{FC}$	IV	½
	$\Rightarrow \frac{AE}{EB} = \frac{AF}{FC} \Rightarrow EF \parallel BC$	V	1
	(iii) In ΔAEF and ΔABC		
	$\angle AEF = \angle ABC$ and $\angle A$ is common.		
	$\therefore \Delta AEF \sim \Delta ABC$	VI	1
	OR		

32. (b)	Through the mid-point Q of side CD of a parallelogram ABCD, the line AR is drawn which intersects BD at P and produced BC at R. Prove that (i) AQ = QR (ii) AP = 2PQ (iii) PR = 2AP  		
Sol.	(i) $QC \parallel AB \ \therefore \Delta RQC \sim \Delta RAB$		
	$\Rightarrow \frac{QR}{AR} = \frac{QC}{AB} = \frac{1}{2}$	I	1
	$\Rightarrow 2QR = AR \Longrightarrow$ Q is the mid point of AR		
	$\therefore AQ = QR$	II	1
	(ii) $\Delta PQD \sim \Delta PAB$		
	$\therefore \frac{QP}{AP} = \frac{DQ}{BA} = \frac{1}{2}$	III	1
	$\Rightarrow AP = 2PQ$	IV	½
	(iii) Since $AQ = QR$		
	$\Rightarrow AP + PQ = PR - PQ$	V	½
	$\Rightarrow AP + \frac{1}{2}AP = PR - \frac{1}{2}AP$		
	$\Rightarrow PR = 2AP$	VI	1
33. (a)	The mean of the following distribution is 53. Find the missing frequency p. **Class Interval :** 0 – 20 20 – 40 40 – 60 60 – 80 80 – 100 **Frequency :** 12 15 p 28 13 Hence, find mode of the distribution.		
Sol.			

Class Interval	x_i	f_i	$f_i x_i$
0−20	10	12	120
20−40	30	15	450
40−60	50	p	50p
60−80	70	28	1960
80−100	90	13	1170
		68 + p	$3700 + 50p$

Correct table — I — 2

Mean $= 53 = \dfrac{3700 + 50\text{p}}{68 + \text{p}}$ — II — ½

$\Rightarrow \text{p} = 32$ — III — ½

Modal class is $40 - 60$ — IV — ½

Mode $= 40 + \dfrac{32 - 15}{64 - 15 - 28} \times 20$ — V — 1

$= \dfrac{1180}{21}$ or 56.1 (approx.) — VI — ½

OR

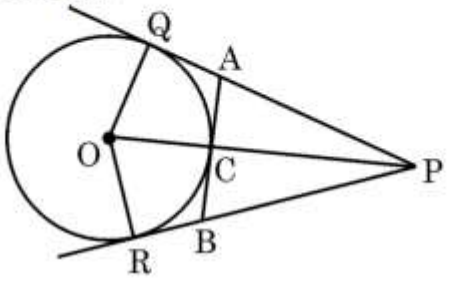
33. (b) Compute median of the following data :

Mid-value :	115	125	135	145	155	165	175
Frequency :	12	15	20	16	10	16	11

Sol.

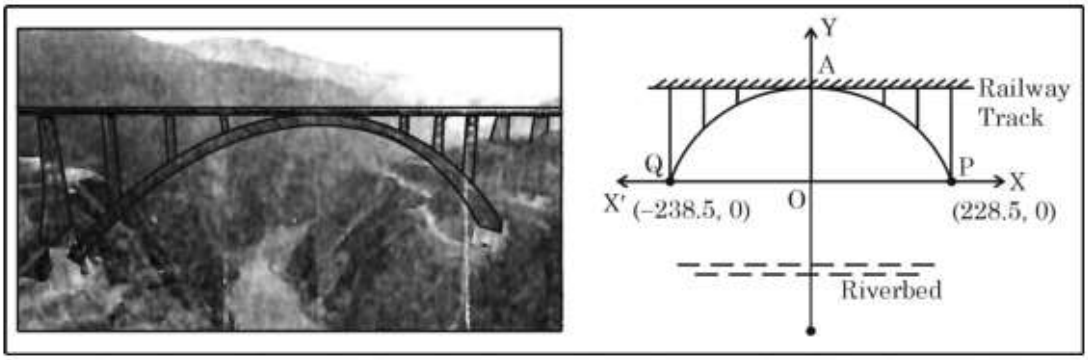
Mid-Value	Class Interval	f	cf
115	110−120	12	12
125	120−130	15	27
135	130−140	20	47
145	140−150	16	63
155	150−160	10	73
165	160−170	16	89
175	170−180	11	100

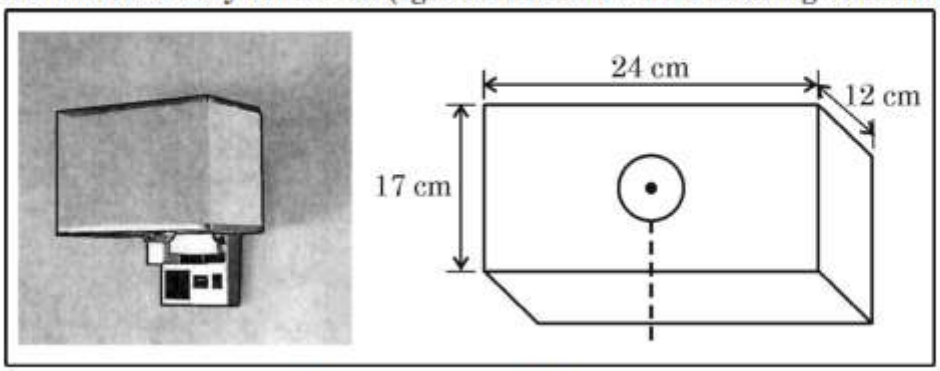
Correct table — I — 3

	$\frac{100}{2} = 50$, Median class is $140 - 150$	II	½
	$\text{Median} = 140 + \frac{50 - 47}{16} \times 10$	III	1
	$= \frac{1135}{8}$ or 141.8 (approx.)	IV	½
34.	PQ and PR are two tangents to a circle with centre O and radius 5 cm. AB is another tangent to the circle at C which lies on OP. If OP = 13 cm, then find the length AB and PA.  		
Sol.	$OP = 13$ cm, $OQ = 5$ cm		
	$\therefore PQ = \sqrt{169 - 25} = 12$ cm	I	1
	Let $AC = x = AQ$		
	$PC = 13 - 5 = 8$ cm and $PA = 12 - x$	II	1
	$AC \perp OP \ \therefore (12 - x)^2 = x^2 + 8^2$	III	1
	$\Rightarrow x = \frac{10}{3}$	IV	1
	$AB = 2AC = \frac{20}{3}$ cm or 6.6 cm (approx.)	V	½
	$PA = 12 - \frac{10}{3} = \frac{26}{3}$ cm or 8.6 cm (approx.)	VI	½
35.	Two water taps together can fill a tank in $8\frac{8}{9}$ hours. The tap of larger diameter takes 4 hours less than the smaller one to fill the tank separately. Find the time in which each tap can separately fill the tank.		

Sol.	Let tap of smaller diameter takes x hours to fill the tank.		
	$\therefore$ tap of larger diameter takes $x - 4$ hours to fill the tank.		
	$\frac{1}{x} + \frac{1}{x-4} = \frac{9}{80}$	I	2
	$\Longrightarrow 9x^2 - 196x + 320 = 0$	II	1
	$\Longrightarrow (x - 20)(9x - 16) = 0$	III	1
	$\Longrightarrow x = 20, \frac{16}{9}$		
	$x = \frac{16}{9}$ (rejected)		
	$\therefore x = 20$	IV	½
	Hence, tap of smaller diameter and larger diameter takes		
	20 hours & 16 hours respectively, to fill the tank.	V	½

	SECTION E This section (Q. 36 to 38) has 3 case study based questions of 4 marks each.		
36.	 Elevated water storage tanks are built to store and supply water to nearby colonies. In the diagram given above, AB is an elevated water tank and CD is a nearby multistorey building. The building is 54 metres away from the water tank. From a window (W) of the building, the angle of elevation of top of the tank is 45° and angle of depression of its foot is 30°. (i) Write a relation between d (the height of window) and y. (ii) Determine the value of h. (iii) (a) Determine height of the water tank. **OR** (iii) (b) Find the value of x and height of the window above ground level.		
Sol.	(i) $\sin 30° = \frac{1}{2} = \frac{d}{y} \Rightarrow 2d = y$	I	1
	(ii) $\tan 45° = 1 = \frac{h}{WX} = \frac{h}{54} \Rightarrow h = 54$ m	I	1
	(iii) (a) $\tan 30° = \frac{1}{\sqrt{3}} = \frac{d}{54} \Rightarrow d = 18\sqrt{3}$ m	I	1
	Height of the tank $= h + d = \left(54 + 18\sqrt{3}\right)$ m	II	1
	OR		
	(iii) (b) $\angle WAC = 30°, \tan 30° = \frac{1}{\sqrt{3}} = \frac{WC}{54} \Rightarrow WC = 18\sqrt{3}$ m	I	1
	$\sin 45° = \frac{1}{\sqrt{2}} = \frac{h}{x} \Rightarrow x = h\sqrt{2} \Rightarrow x = 54\sqrt{2}$ m	II	1

37.	 An arch of a railway bridge, built on Chenab riverbed, is shown in the above diagram. It is a parabolic arch connecting two hills at P and Q. If the parabolic curve is represented by the polynomial $p(x) = -0.0025x^2 - 0.025x + 136$. Observe the diagram and based on above information, answer the following questions : (i) Write the co-ordinates of point A. (ii) Find the span of the arch. (iii) (a) Write the zeroes of the polynomial using diagram and verify the relationship between sum of zeroes and polynomials. **OR** (iii) (b) Find the values of $p(x)$ at $x = 100$ and $x = -100$. Are they same ?		
Sol.	(i) At $x = 0, p(x) = 136$		
	$\therefore$ Coordinates of point A $= (0,136)$	I	1
	(ii) Span of the arch $= 238.5 + 228.5 = 467$ units	I	1
	(iii) (a) Zeroes of the polynomial are 228.5 and -238.5	I	1
	Sum of zeroes $= -10 = -\frac{-0.025}{-0.0025} = -\frac{\text{coefficient of x}}{\text{coefficient of x}^2}$	II	1
	OR		
	(iii) (b) $p(100) = 108.5$	I	1
	$p(-100) = 113.5$	II	½
	$\therefore p(100) \neq p(-100)$	III	½

38.	A wall mounted lamp, made of fabric, is shown below. Lamp has cuboidal shape, open from top and bottom. A spherical bulb of diameter 7 cm is latched with a very thin rod. (Ignore the rod while making calculations.)  Dimensions of the cuboid are 24 cm × 12 cm × 17 cm. (i) Find the surface area of the bulb. (ii) What could be the maximum diameter of the bulb if at least 1 cm space is left from each side ? (iii) (a) Find the area of the fabric used if there is a fold of 2 cm on top and bottom edges. **OR** (iii) (b) Find the space available inside the lamp.		
Sol.	(i) Surface area of the bulb $= 4 \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} = 154 \text{ cm}^2$	I	1
	(ii) Maximum diameter of the bulb = Minimum side length − 2 cm $= 12 - 2 = 10$ cm	I	1
	(iii) (a) With 2 cm extra cloth for top and bottom edges, new dimensions are 24 cm × 12 cm × 21 cm	I	1
	Area of fabric used $= 2 \times 21 \times (24 + 12) = 1512 \text{ cm}^2$	II	1
	OR		
	(iii) (b)Space available $= 24 \times 12 \times 17 - \frac{4}{3} \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times \frac{7}{2}$ $= 4896 - \frac{539}{3}$ $= \frac{14149}{3} \text{ cm}^3$ or 4716.3 cm^3 (approx.)	I II	1 1