



General Instructions :

Read the following instructions very carefully and strictly follow them :

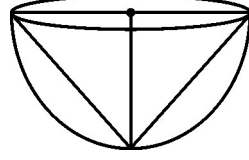
- (i) *This question paper contains **38** questions. **All** questions are **compulsory**.*
- (ii) *This question paper is divided into **FIVE** Sections – **A, B, C, D** and **E**.*
- (iii) *In Section–**A**, questions number **1** to **18** are Multiple Choice Questions (MCQs) and questions number **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.*



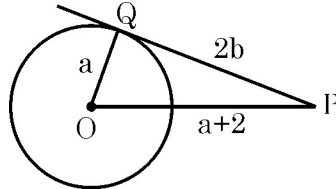
खण्ड - क

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) $314\sqrt{2} \text{ cm}^2$ (B) 314 cm^2
 (C) $\frac{3140}{3} \text{ cm}^2$ (D) $3140\sqrt{2} \text{ cm}^2$
2. यदि एक A.P. $-\frac{15}{4}, -\frac{10}{4}, -\frac{5}{4}, \dots$ का n वाँ 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 :



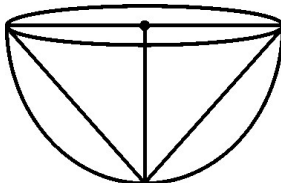
- (A) $a^2 + (a + 2)^2 = (2b)^2$ (B) $b^2 = a + 4$
 (C) $2a^2 + 1 = b^2$ (D) $b^2 = a + 1$



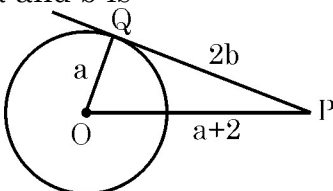
SECTION – A

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 $\pi = 3.14$)



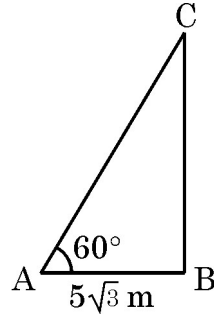
- (A) $314\sqrt{2} \text{ cm}^2$ (B) 314 cm^2
(C) $\frac{3140}{3} \text{ cm}^2$ (D) $3140\sqrt{2} \text{ cm}^2$
2. If a_n represents n^{th} term of the A.P. $-\frac{15}{4}, -\frac{10}{4}, -\frac{5}{4}, \dots$ then value of $a_{16} - a_{12}$ is
- (A) 4 (B) $\frac{5}{4}$
(C) 5 (D) $\frac{25}{4}$
3. Meena 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



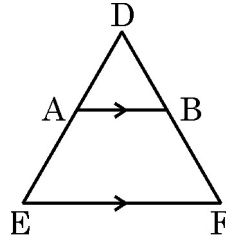
- (A) $a^2 + (a + 2)^2 = (2b)^2$ (B) $b^2 = a + 4$
(C) $2a^2 + 1 = b^2$ (D) $b^2 = a + 1$



6. $\frac{\sec A}{\sqrt{\sec^2 A - 1}}$ का सरलतम रूप है
(A) $\sin A$ (B) $\tan A$
(C) $\operatorname{cosec} A$ (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



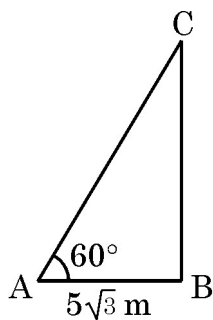
- (A) 10 m (B) $10\sqrt{3}$ m
(C) 15 m (D) $\frac{5}{2}\sqrt{3}$ m
9. दी गयी आकृति में $AB \parallel EF$ है। यदि $AB = 24$ cm, $EF = 36$ cm तथा $DA = 7$ cm है, तो AE बराबर है :



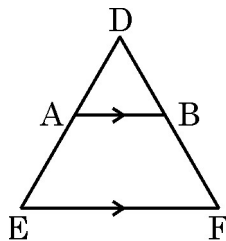
- (A) 2.5 cm (B) 10.5 cm
(C) 3.5 cm (D) $\frac{14}{3}$ cm



6. Simplest form of $\frac{\sec A}{\sqrt{\sec^2 A - 1}}$ is
- (A) $\sin A$ (B) $\tan A$
(C) $\operatorname{cosec} A$ (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, $AB \parallel EF$. 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



10. समरूपता की कसौटी SAS का प्रयोग करते हुए देवांश ने सिद्ध किया कि $\triangle ABC \sim \triangle PQR$ 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 $\frac{9 \operatorname{cosec} \theta + 1}{9 \operatorname{cosec} \theta - 1}$ 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 $\frac{9 \operatorname{cosec} \theta + 1}{9 \operatorname{cosec} \theta - 1}$ 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. 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 :

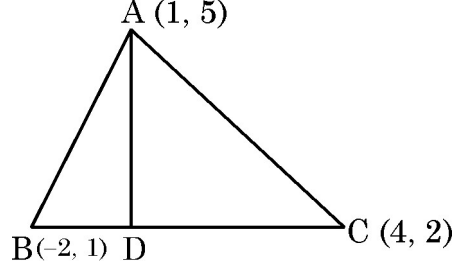
- (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(C) Assertion (A) is true, but Reason (R) is false.
(D) Assertion (A) is false, but Reason (R) is true.
19. **Assertion (A) :** H.C.F. $(36m^2, 18m) = 18m$, 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, $\triangle ABC$ की भुजा BC को बिंदु D 1 : 2 के अनुपात में विभाजित करता है। AD की लम्बाई ज्ञात कीजिए।



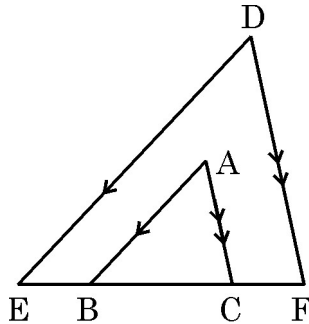
22. (a) मान ज्ञात कीजिए : $\frac{\sin^3 60^\circ - \tan 30^\circ}{\cos^2 45^\circ}$

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- (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, $AB \parallel DE$ तथा $AC \parallel DF$ है। दर्शाइये कि $\triangle ABC \sim \triangle DEF$ है। यदि $BC = 10$ cm, $EB = CF = 5$ cm तथा $AB = 7$ cm है, तो DE की लम्बाई ज्ञात कीजिए।



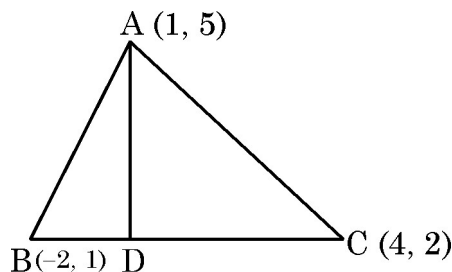
25. सिद्ध कीजिए कि $14 - 2\sqrt{3}$ एक अपरिमेय संख्या है। दिया गया है कि $\sqrt{3}$ एक अपरिमेय संख्या है।



SECTION – B

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

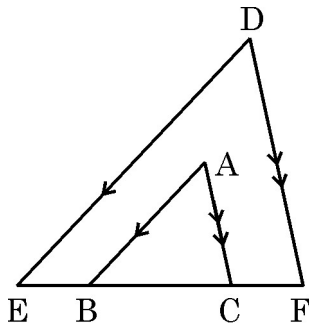
21. In the given figure, point D divides the side BC of $\triangle ABC$ in the ratio 1 : 2. Find length AD.



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

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 $\frac{3}{5}$, then find the number of yellow balls.
24. In the given figure, $AB \parallel DE$ and $AC \parallel DF$. Show that $\triangle ABC \sim \triangle DEF$. 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.



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., 15th term exceeds the 8th 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 nth term and hence 10th 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 :

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

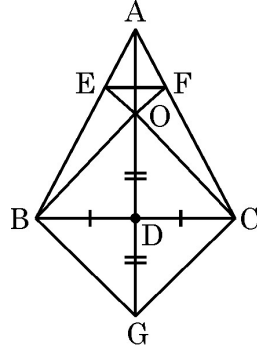
31. A chord of a circle, of radius 14 cm, subtends an angle of 60° at the centre. Find the area of the smaller sector and perimeter of the smaller segment.



खण्ड – घ

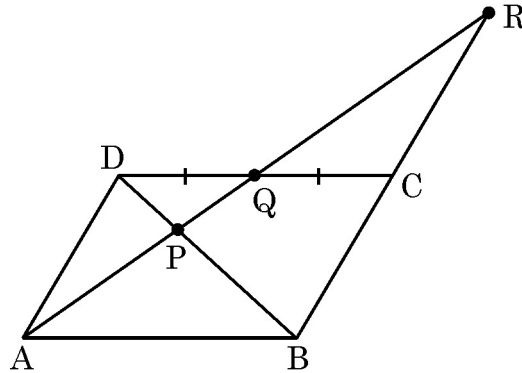
प्रश्न संख्या 32 से 35 तक दीर्घ-उत्तरीय प्रश्न हैं। प्रत्येक प्रश्न के 5 अंक हैं।

32. (a) $\triangle ABC$ 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) $EF \parallel BC$ है।
 - (iii) $\triangle AEF \sim \triangle ABC$



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- (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।

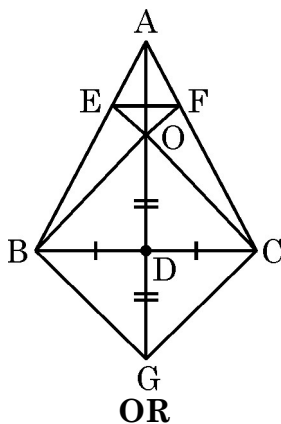
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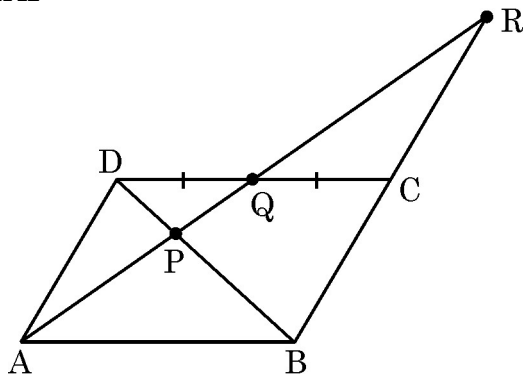
SECTION – D

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

32. (a) D is the mid-point of side BC of $\triangle ABC$. CE and BF intersect at O, a point on AD. AD is produced to G such that $OD = DG$. Prove that
- OBGC is a parallelogram.
 - $EF \parallel BC$
 - $\triangle AEF \sim \triangle ABC$



- (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
- $AQ = QR$
 - $AP = 2PQ$
 - $PR = 2AP$



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.

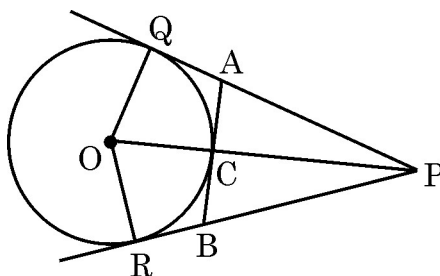
OR



(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।

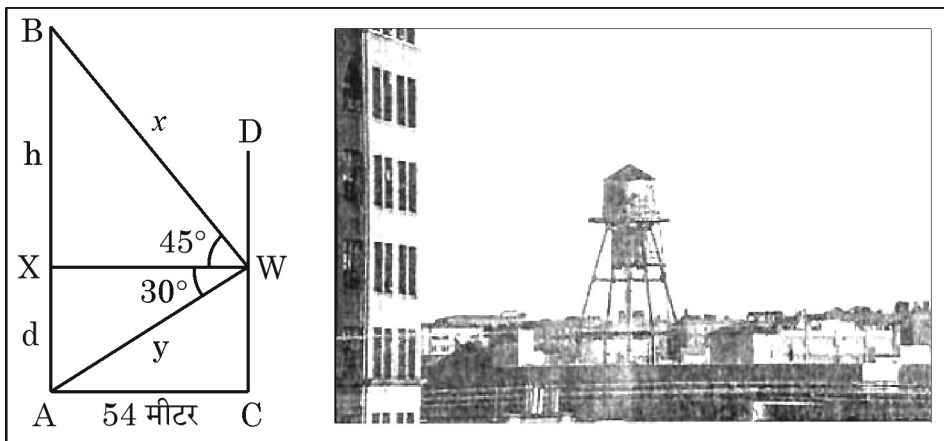


35. दो पानी के नल एक साथ एक हौज को $8\frac{8}{9}$ घंटों में भर सकते हैं। बड़े व्यास वाला नल, हौज को भरने में, कम व्यास वाले नल से 4 घंटे कम समय लेता है। प्रत्येक द्वारा अलग से हौज को भरने का समय ज्ञात कीजिए।

खण्ड – ड

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

36.



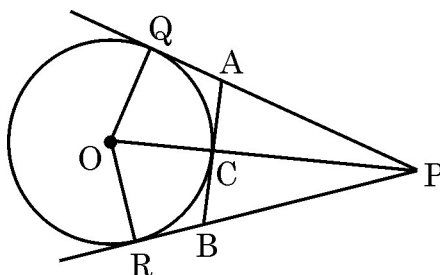


(b) Compute median of the following data :

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.

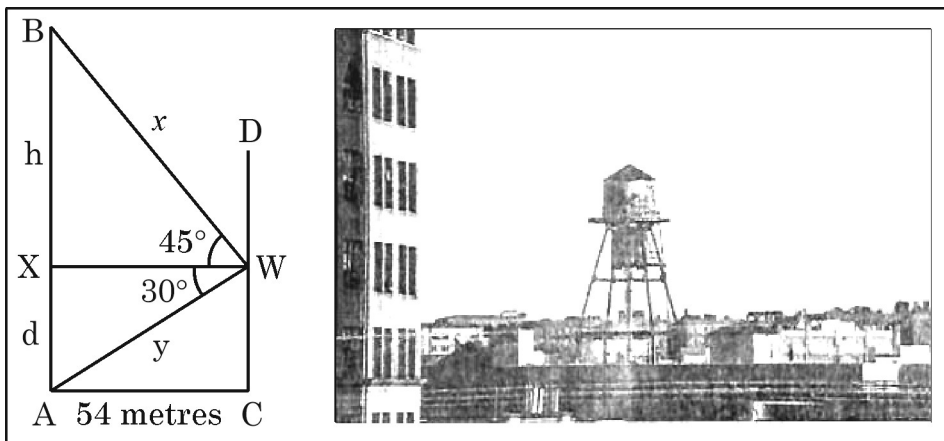


35. Two water taps together can fill a tank in $8\frac{8}{9}$ hours. The tap of larger diameter takes 4 hours less than the smaller one to fill the tank separately. Find the time in which each tap can separately fill the tank.

SECTION – E

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

36.





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.

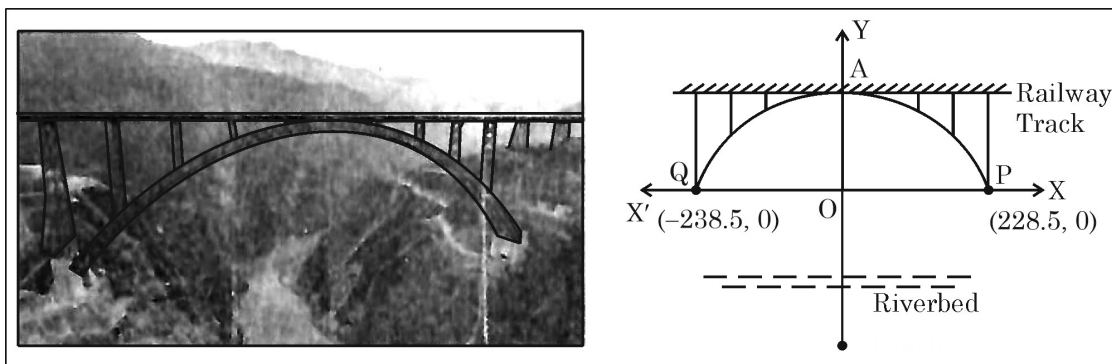
From a window (W) of the building, the angle of elevation of top of the tank is 45° and angle of depression of its foot is 30° .

- (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 :

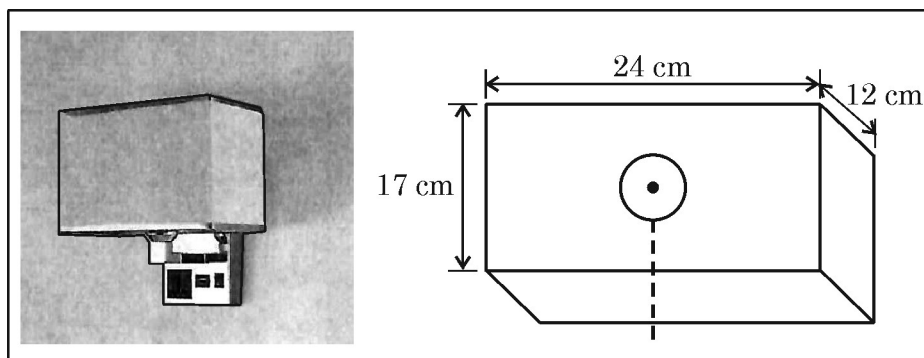
- (i) Write the co-ordinates of point A. 1
- (ii) Find the span of the arch. 1
- (iii) (a) Write the zeroes of the polynomial using diagram and verify the relationship between sum of zeroes and polynomials. 2

OR

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



38. 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 $24 \text{ cm} \times 12 \text{ cm} \times 17 \text{ cm}$.

- (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

