Series : NL1KM **SET ~ 3**

रोल नं.
Roll No.

प्रश्न–पत्र कोड
Q.P. Code **30/1/3**

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 **15** हैं।
Please check that this question paper contains **15** printed pages.

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

(III) 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.

(IV) **कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर–पुस्तिका में यथास्थान 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 **पांच** खण्डों में विभाजित है - **क, ख, ग, घ** एवं **ड़**।*

(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 ड़** 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 **ड़** के **2** अंकों के 3 प्रश्नों में आंतरिक विकल्प का प्रावधान दिया गया है।*

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

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

खण्ड – क $20 \times 1 = 20$

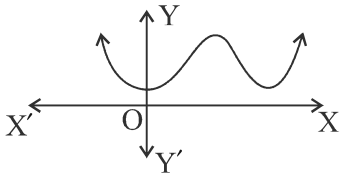
प्रश्न संख्या 1 से 20 तक बहुविकल्पीय प्रश्न हैं, जिनमें प्रत्येक प्रश्न 1 अंक का है।

1. प्राकृतिक संख्या n के लिए, 6^n का अंतिम अंक है : **1**

(a) 0 (b) 6 (c) 3 (d) 2

2. $y = f(x)$ का ग्राफ दिया गया है। **1**

$f(x)$ के शून्यकों की संख्या है :



(a) 0 (b) 1

(c) 2 (d) 4

3. यदि दो चरों में रैखिक समीकरणों का एक युग्म दो संपाती रेखाओं द्वारा निरूपित किया जाता है, तो समीकरणों के युग्म का/के : **1**

(a) एक अद्वितीय हल है (b) दो हल हैं

(c) कोई हल नहीं है (d) अपरिमित रूप से अनेक हल हैं

4. समान्तर श्रेढ़ी (AP) : $\sqrt{2}, 2\sqrt{2}, 3\sqrt{2}, 4\sqrt{2}, ...$ का सार्वअन्तर है : **1**

(a) $\sqrt{2}$ (b) 1 (c) $2\sqrt{2}$ (d) $-\sqrt{2}$

5. यदि Δ ABC और Δ DEF समरूप हैं, जहाँ 2 AB = DE और BC = 8 cm, तो EF बराबर है : **1**

(a) 4 cm (b) 8 cm (c) 12 cm (d) 16 cm

6. बिन्दुओं $(5, -4)$ और $(6, 4)$ को मिलाने वाले रेखाखंड का मध्य बिन्दु स्थित है : **1**

(a) x-अक्ष पर (b) y-अक्ष पर

(c) मूल बिन्दु पर (d) न x-अक्ष न ही y-अक्ष पर

General Instructions :

Read the following instructions very carefully and strictly follow them :

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

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

(iii) *In **Section A** – Question Nos. **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 Nos. **21** to **25** are Very Short Answer (VSA) type questions, carrying **2** marks each.*

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

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

(vii) *In **Section E** – Question Nos. **36** to **38** are **Case Study Based** 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 calculator is **not allowed.***

SECTION – A 20×1 = 20

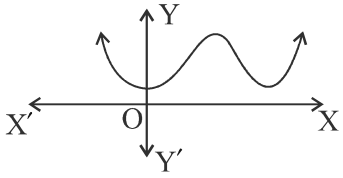
Question numbers 1 to 20 are multiple choice questions of 1 mark each.

1. For any natural number n, 6^n ends with the digit : **1**

(a) 0 (b) 6 (c) 3 (d) 2

2. The graph of $y = f(x)$ is given.

The number of zeroes of $f(x)$ is : **1**



(a) 0 (b) 1

(c) 2 (d) 4

3. If a pair of linear equations in two variables is represented by two coincident lines, then the pair of equations has : **1**

(a) a unique solution (b) two solutions

(c) no solution (d) an infinite number of solutions

4. The common difference of the AP : $\sqrt{2}, 2\sqrt{2}, 3\sqrt{2}, 4\sqrt{2}, ...$ is : **1**

(a) $\sqrt{2}$ (b) 1 (c) $2\sqrt{2}$ (d) $-\sqrt{2}$

5. If Δ ABC and Δ DEF are similar such that 2 AB = DE and BC = 8 cm, then EF is equal to : **1**

(a) 4 cm (b) 8 cm (c) 12 cm (d) 16 cm

6. The mid-point of the line segment joining the points (5, – 4) and (6, 4) lies on : **1**

(a) x-axis (b) y-axis

(c) origin (d) neither x-axis nor y-axis

7. यदि $\sin\theta = \frac{a}{b}$ दिया गया है, तो $\cos\theta$ बराबर है : 1

(a) $\frac{b}{\sqrt{b^2-a^2}}$ (b) $\frac{b}{a}$ (c) $\frac{\sqrt{b^2-a^2}}{b}$ (d) $\frac{a}{\sqrt{b^2-a^2}}$

8. यदि $\cos A = \frac{1}{2}$ है, तो $\sin^2 A + 2\cos^2 A$ का मान है : 1

(a) $\frac{3}{2}$ (b) $\frac{5}{4}$ (c) -1 (d) $\frac{1}{2}$

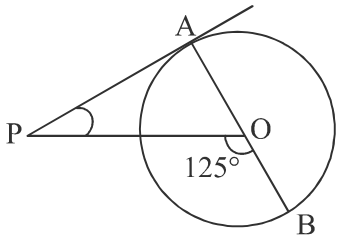
9. एक उड़ रही पतंग की डोरी भूमि पर एक बिंदु से बाँधी गई है। पतंग और भूमि पर उस बिंदु के बीच डोरी की लंबाई 80 मीटर है। डोरी भूमि से 30° का कोण बनाती है। भूमि से पतंग की ऊँचाई है : 1

(a) $20\sqrt{3}$ मीटर (b) 40 मीटर (c) $40\sqrt{3}$ मीटर (d) $80\sqrt{3}$ मीटर

10. यदि केन्द्र O वाले वृत्त पर बाह्य बिन्दु T से दो स्पर्श रेखाएँ TP और TQ इस प्रकार हैं कि $\angle POQ = 120°$, तो $\angle PTQ$ बराबर है : 1

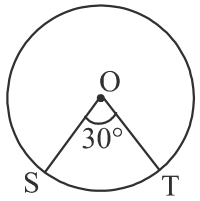
(a) 60° (b) 70° (c) 80° (d) 90°

11. दी गई आकृति में, PA केन्द्र O वाले वृत्त पर बाह्य बिन्दु P से खींची गई स्पर्श रेखा है। यदि $\angle POB = 125°$ है, तो $\angle APO$ बराबर है : 1



(a) 25° (b) 65°
(c) 90° (d) 35°

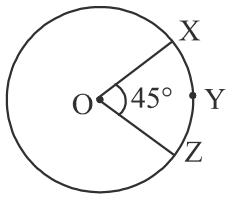
12. दी गई आकृति में केन्द्र O वाला एक वृत्त दर्शाया गया है। लघु त्रिज्यखंड का क्षेत्रफल 7 cm^2 है। वृत्त का क्षेत्रफल है : 1



(a) $84\pi\ cm^2$ (b) $\frac{84}{11}\ cm^2$

(c) $84\ cm^2$ (d) $\frac{\sqrt{84}}{\sqrt{\pi}}\ cm^2$

13. दी गई आकृति में, O वृत्त का केन्द्र है। XYZ वृत्त की एक चाप है, जो केन्द्र पर 45° का कोण अंतरित करती है। यदि वृत्त की त्रिज्या 32 cm है, तो चाप XYZ की लंबाई है : 1



(a) 4π cm (b) 8π cm
(c) 64π cm (d) 128π cm

14. एक गोले का आयतन $36\pi\ cm^3$ है, तो उसकी त्रिज्या (cm में) है : 1

(a) 3 (b) $3\sqrt{3}$ (c) $3^{\frac{2}{3}}$ (d) $3^{\frac{1}{3}}$

7. Given that $\sin\theta = \frac{a}{b}$, then $\cos\theta$ is equal to : **1**

(a) $\frac{b}{\sqrt{b^2 - a^2}}$ (b) $\frac{b}{a}$ (c) $\frac{\sqrt{b^2 - a^2}}{b}$ (d) $\frac{a}{\sqrt{b^2 - a^2}}$

8. If $\cos A = \frac{1}{2}$, then the value of $\sin^2 A + 2\cos^2 A$ is : **1**

(a) $\frac{3}{2}$ (b) $\frac{5}{4}$ (c) -1 (d) $\frac{1}{2}$

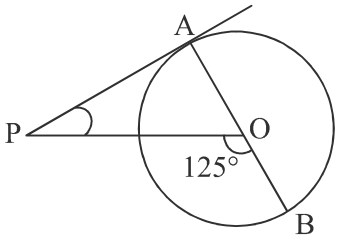
9. The string of a flying kite is tied to a point on the ground. The length of the string between the kite and the point on the ground is 80 m. The string makes an angle of 30° with the ground. The height of the kite above the ground is : **1**

(a) $20\sqrt{3}$ m (b) 40 m (c) $40\sqrt{3}$ m (d) $80\sqrt{3}$ m

10. If TP and TQ are two tangents to a circle with centre O from an external point T so that $\angle POQ = 120°$, then $\angle PTQ$ is equal to : **1**

(a) 60° (b) 70° (c) 80° (d) 90°

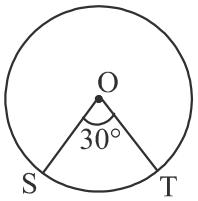
11. In the given figure, PA is a tangent from an external point P to a circle with centre O. If $\angle POB = 125°$, then $\angle APO$ is equal to : **1**



(a) 25° (b) 65°

(c) 90° (d) 35°

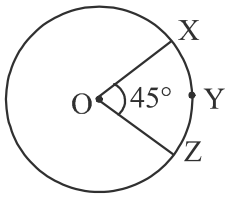
12. Shown in the given figure is a circle with centre O. The area of the minor sector is 7 cm^2. Area of circle is : **1**



(a) 84π cm^2 (b) $\frac{84}{11}$ cm^2

(c) 84 cm^2 (d) $\frac{\sqrt{84}}{\sqrt{\pi}}$ cm^2

13. In the given figure, O is the centre of circle. XYZ is an arc of the circle subtending an angle of 45° at the centre. If the radius of the circle is 32 cm, then the length of the arc XYZ is : **1**



(a) 4π cm (b) 8π cm

(c) 64π cm (d) 128π cm

14. The radius of a sphere (in cm) whose volume is 36π cm^3, is : **1**

(a) 3 (b) $3\sqrt{3}$ (c) $3^{\frac{2}{3}}$ (d) $3^{\frac{1}{3}}$

15. यदि आँकड़ों के किसी समूह का माध्य 12 तथा बहुलक 21 है, तो उसका माध्यक है : **1**

(a) 6 (b) 13.5 (c) 15 (d) 14

16. एक पांसे को एक बार फेंका जाता है। 3 के अलावा अन्य संख्या आने की प्रायिकता है : **1**

(a) $\frac{1}{6}$ (b) $\frac{3}{6}$ (c) $\frac{5}{6}$ (d) 1

17. 960 और 432 का महत्तम समापवर्तक (HCF) है : **1**

(a) 48 (b) 54 (c) 72 (d) 36

18. प्राकृत संख्या 2 है : **1**

(a) एक अभाज्य संख्या (b) एक भाज्य संख्या

(c) भाज्य और अभाज्य दोनों (d) न तो भाज्य और न ही अभाज्य

निर्देश : प्रश्न संख्या 19 और 20 अभिकथन एवं तर्क आधारित प्रश्न हैं। दो कथन दिए गए हैं, जिनमें एक को अभिकथन (A) तथा दूसरे को तर्क (R) द्वारा अंकित किया गया है। इन प्रश्नों के सही उत्तर नीचे दिए गए कोड (a), (b), (c) और (d) में से चुनकर दीजिए :

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

(b) अभिकथन (A) तथा तर्क (R) दोनों सत्य हैं, परन्तु तर्क (R), अभिकथन (A) की सही 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)** : बहुपद $p(y) = y^2 + 4y + 3$ के दो शून्यक होते हैं।

तर्क (R) : एक द्विघात बहुपद (quadratic polynomial) के अधिकतम दो शून्यक हो सकते हैं। **1**

20. **अभिकथन (A)** : अधिवर्ष (leap year) में 53 सोमवार आने की प्रायिकता $\frac{2}{7}$ होती है।

तर्क (R) : सामान्य वर्ष (non-leap year) में 53 सोमवार आने की प्रायिकता $\frac{5}{7}$ होती है। **1**

खण्ड – ख

प्रश्न संख्या 21 से 25 तक अति लघु–उत्तरीय (VSA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक प्रश्न के 2 अंक हैं।

21. क्या बिंदु P (1, 0), Q (– 5, 0) और R (– 2, 5) एक त्रिभुज बनाते हैं? यदि हाँ, तो बने त्रिभुज का प्रकार बताइए। **2**

22. **(A)** यदि $\tan\theta = \frac{24}{7}$, तो $\sin\theta + \cos\theta$ का मान ज्ञात कीजिए। **2**

अथवा

(B) यदि $\cot\theta = \frac{7}{8}$ है, तो $\frac{(1+\sin\theta)(1-\sin\theta)}{(1+\cos\theta)(1-\cos\theta)}$ का मान ज्ञात कीजिए। **2**

23. दो संकेंद्रीय वृत्तों की त्रिज्याएँ 5 cm और 4 cm हैं। बड़े वृत्त की उस जीवा की लंबाई ज्ञात कीजिए जो छोटे वृत्त को स्पर्श करती है। **2**

15. If the mean and mode of a data are 12 and 21 respectively, then its median is : **1**

(a) 6 (b) 13.5 (c) 15 (d) 14

16. A die is thrown once. Probability of getting a number other than 3 is : **1**

(a) $\frac{1}{6}$ (b) $\frac{3}{6}$ (c) $\frac{5}{6}$ (d) 1

17. The HCF of 960 and 432 is : **1**

(a) 48 (b) 54 (c) 72 (d) 36

18. The natural number 2 is : **1**

(a) a prime number (b) a composite number

(c) prime as well as composite (d) neither prime nor composite

Directions : Question numbers 19 and 20 are Assertion and Reason based questions. Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below :

(a) Both, Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of 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) :** The polynomial $p(y) = y^2 + 4y + 3$ has two zeroes.

Reason (R) : A quadratic polynomial can have at most two zeroes. **1**

20. **Assertion (A) :** The probability that a leap year has 53 Mondays is $\frac{2}{7}$.

Reason (R) : The probability that a non-leap year has 53 Mondays is $\frac{5}{7}$. **1**

SECTION – B

Question numbers 21 to 25 are Very Short Answer (VSA) type questions, carrying 2 marks each.

21. Do the points P (1, 0), Q (– 5, 0) and R (– 2, 5) form a triangle ? If so, name the type of triangle formed. **2**

22. **(A)** If $\tan\theta = \frac{24}{7}$, then find the value of $\sin\theta + \cos\theta$. **2**

OR

(B) If $\cot\theta = \frac{7}{8}$, then find the value of $\frac{(1+\sin\theta)(1-\sin\theta)}{(1+\cos\theta)(1-\cos\theta)}$. **2**

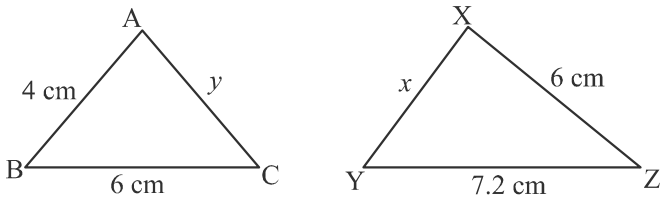
23. Two concentric circles are of radii 5 cm and 4 cm. Find the length of the chord of the larger circle which touches the smaller circle. **2**

24. एक द्विघात बहुपद ज्ञात कीजिए जिसके शून्यक $\left(5-2\sqrt{3}\right)$ और $\left(5+2\sqrt{3}\right)$ हैं। **2**

25. **(A)** Δ ABC में, DE || BC है। यदि AD = x, DB = $x - 2$, AE = $x + 2$ और EC = $x - 1$, तो x का मान ज्ञात कीजिए। **2**

अथवा

(B)



ऊपर दी गई आकृति में, यदि Δ ABC ~ Δ XYZ, तो x और y के मान ज्ञात कीजिए। **2**

खण्ड – ग

प्रश्न संख्या 26 से 31 तक लघु–उत्तरीय (SA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक प्रश्न के 3 अंक हैं।

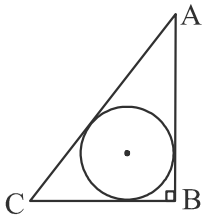
26. **(A)** यदि $x = h + a\cos\theta$, $y = k + b\sin\theta$, तो सिद्ध कीजिए :

$$\left(\frac{x-h}{a}\right)^2+\left(\frac{y-k}{b}\right)^2=1$$ **3**

अथवा

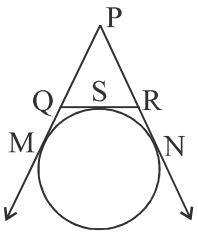
(B) सिद्ध कीजिए : $\frac{\tan A}{1+\sec A}-\frac{\tan A}{1-\sec A}=2\,\text{cosec}\,A$ **3**

27. **(A)** दी गई आकृति में एक समकोण Δ ABC दर्शाया गया है, जिसमें $\angle$ B = 90°, AB = 4 cm तथा BC = 3 cm हैं। त्रिभुज ABC में बने अंतःवृत्त की त्रिज्या ज्ञात कीजिए। **3**



अथवा

(B) दी गई आकृति में, यदि एक वृत्त, Δ PQR की भुजा QR को S पर और बढ़ाई गई भुजाओं PQ और PR को क्रमशः M और N पर स्पर्श करता है, तो सिद्ध कीजिए : PM = $\frac{1}{2}$ (PQ + QR + PR) **3**



28. एक लंबवृत्तीय बेलन और एक लंबवृत्तीय शंकु के आधार बराबर हैं तथा ऊँचाइयाँ भी बराबर हैं। यदि उनके वक्रपृष्ठीय क्षेत्रफलों का अनुपात 8:5 है, तो उनकी आधार त्रिज्या तथा ऊँचाई के बीच का अनुपात ज्ञात कीजिए। **3**

29. दो भिन्न सिक्कों को एक साथ उछाला जाता है। निम्नलिखित की प्रायिकता ज्ञात कीजिए :

(i) कम से कम एक चित (head) आना।

(ii) अधिक से अधिक एक पट (tail) आना।

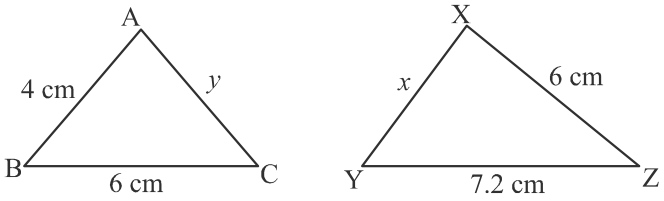
(iii) एक चित और एक पट आना। **3**

24. Find a quadratic polynomial whose zeroes are $\left(5-2\sqrt{3}\right)$ and $\left(5+2\sqrt{3}\right)$. **2**

25. **(A)** In Δ ABC, DE $\parallel$ BC. If AD = x, DB = x – 2, AE = x + 2 and EC = x – 1, then find the value of x. **2**

OR

(B)



In the figure given above, Δ ABC ~ Δ XYZ, then find the values of x and y. **2**

SECTION – C

Question numbers 26 to 31 are Short Answer (SA) type questions, carrying 3 marks each.

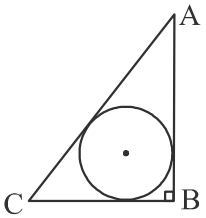
26. **(A)** If $x = h + a\cos\theta$, $y = k + b\sin\theta$, then prove that :

$$\left(\frac{x-h}{a}\right)^2+\left(\frac{y-k}{b}\right)^2=1$$ **3**

OR

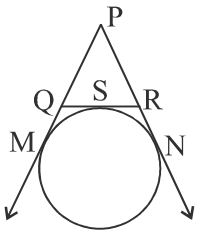
(B) Prove that : $\frac{\tan A}{1+\sec A}-\frac{\tan A}{1-\sec A}=2\ \text{cosec}\ A$ **3**

27. **(A)** In the given figure, Δ ABC is a right triangle in which $\angle$ B = 90°, AB = 4 cm and BC = 3 cm. Find the radius of the circle inscribed in the triangle ABC. **3**



OR

(B) In the given figure, if a circle touches the side QR of Δ PQR at S and extended sides PQ and PR at M and N respectively, then prove that : PM = $\frac{1}{2}$ (PQ + QR + PR) **3**



28. A right circular cylinder and a right circular cone have equal bases and equal heights. If their curved surface areas are in the ratio 8 : 5, then find the ratio between the radius of their bases to their height. **3**

29. Two different coins are tossed simultaneously. What is the probability of getting :

(i) at least one head ?

(ii) at most one tail ?

(iii) a head and a tail ? **3**

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

31. वह अनुपात ज्ञात कीजिए जिसमें x-अक्ष, बिंदुओं $(-6, 5)$ और $(-4, -1)$ को मिलाने वाले रेखाखंड को विभाजित करता है। प्रतिच्छेदन बिंदु भी ज्ञात कीजिए। **3**

खण्ड – घ

प्रश्न संख्या 32 से 35 तक दीर्घ–उत्तरीय (LA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक प्रश्न के 5 अंक हैं।

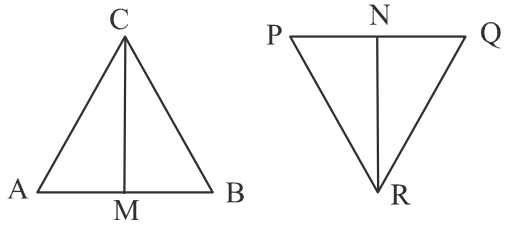
32. **(A)** आधारभूत समानुपातिकता प्रमेय (Basic Proportionality Theorem) का कथन लिखिए और सिद्ध कीजिए। **5**

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(B) दी गई आकृति में, Δ ABC तथा Δ PQR की क्रमशः CM तथा RN रेखाएँ माध्यिका (medians) हैं।

यदि $\Delta ABC \sim \Delta PQR$,

तो सिद्ध कीजिए :



(i) $\Delta AMC \sim \Delta PNR$

(ii) $\Delta CMB \sim \Delta RNQ$ **5**

33. कक्षा X के 80 छात्रों द्वारा गणित के मॉक टेस्ट में प्राप्त अंक नीचे सारणी में दिए गए हैं। आँकड़ों का **माध्यक** और **बहुलक** ज्ञात कीजिए: **5**

अंक	छात्रों की संख्या
0 और अधिक	80
10 और अधिक	77
20 और अधिक	72
30 और अधिक	65
40 और अधिक	55
50 और अधिक	43
60 और अधिक	28
70 और अधिक	16
80 और अधिक	10
90 और अधिक	8
100 और अधिक	0

34. रेखीय समीकरणों के युग्म $x - y + 2 = 0$ तथा $4x - y - 4 = 0$ का आलेख बनाइए। उन रेखाओं तथा x-अक्ष द्वारा घिरे त्रिभुज का क्षेत्रफल ज्ञात कीजिए। **5**

35. **(A)** एक तेज़ चलने वाली ट्रेन 200 किमी की यात्रा के लिए धीमी चलने वाली ट्रेन से एक घंटा कम समय लेती है। यदि धीमी चलने वाली ट्रेन की चाल तेज़ चलने वाली ट्रेन से 10 किमी/घंटा कम है, तो दोनों ट्रेनों की चाल ज्ञात कीजिए। **5**

अथवा

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

31. Find the ratio in which the x-axis divides the line segment joining the points $(-6, 5)$ and $(-4, -1)$. Also, find the point of intersection. **3**

SECTION – D

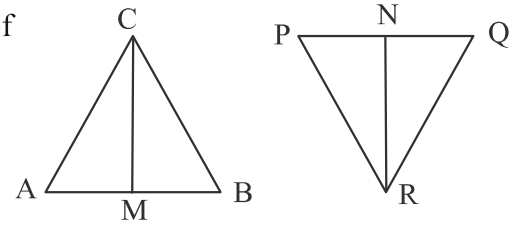
Question numbers 32 to 35 are Long Answer (LA) type questions, carrying 5 marks each.

32. **(A)** State and prove Basic Proportionality Theorem. **5**

OR

(B) In the given figure, CM and RN are respectively the medians of Δ ABC and Δ PQR.

If Δ ABC ~ Δ PQR, then prove that :



(i) Δ AMC ~ Δ PNR

(ii) Δ CMB ~ Δ RNQ **5**

33. The marks obtained by 80 students of class X in a mock test of Mathematics are given below in the table. Find **median** and the **mode** of the data : **5**

Marks	Number of Students
0 and above	80
10 and above	77
20 and above	72
30 and above	65
40 and above	55
50 and above	43
60 and above	28
70 and above	16
80 and above	10
90 and above	8
100 and above	0

34. Draw the graph of the pair of linear equations $x - y + 2 = 0$ and $4x - y - 4 = 0$. Calculate the area of the triangle formed by the lines so drawn and the x-axis. **5**

35. **(A)** A faster train takes one hour less than a slower train for a journey of 200 km. If the speed of the slower train is 10 km/hr less than that of the faster train, find the speeds of the two trains. **5**

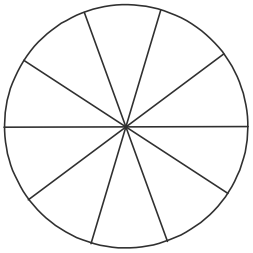
OR

(B) दो वर्गों के क्षेत्रफलों का योग 640 वर्गमीटर है। यदि उनके परिमापों का अंतर 64 मीटर है, तो दोनों वर्गों की भुजाएँ ज्ञात कीजिए। **5**

खण्ड – ड़

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

36. एक ब्रूच चाँदी के तार से 35 cm व्यास के वृत्त के आकार में बनाई गई है। तार का उपयोग 5 व्यास बनाने में भी किया जाता है, जो वृत्त को 10 बराबर त्रिज्यखंडों में विभाजित करते हैं।



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

(i) वृत्त की त्रिज्या बताइए। **1**

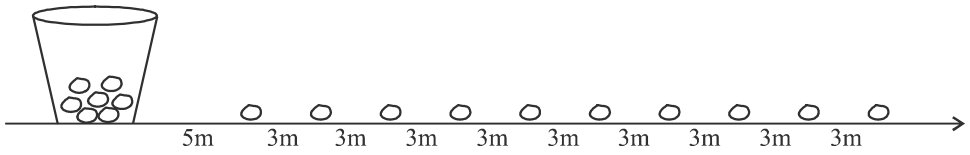
(ii) ब्रूच की परिधि बताइए। **1**

(iii) (a) आवश्यक चाँदी के तार की कुल लम्बाई बताइए। **2**

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(iii) (b) ब्रूच के प्रत्येक त्रिज्यखंड का क्षेत्रफल बताइए। **2**

37. आलू दौड़ में, प्रारंभिक बिंदु पर एक बाल्टी रखी गई है, जो पहले आलू से 5 मीटर दूर है। शेष आलू एक सीधी रेखा में 3 मीटर के अंतराल पर रखे गए हैं, जबकि कुल 10 आलू हैं, जैसा कि आकृति में दर्शाया गया है :



एक प्रतियोगी बाल्टी से चलकर निकटतम आलू उठाता है और बाल्टी में डालने के लिए लौटता है, फिर अगला आलू उठाता है। यह प्रक्रिया तब तक चलती है जब तक सभी आलू बाल्टी में न आ जाएँ।

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

(i) पहला आलू उठाने और बाल्टी में डालने में तय की गई दूरी बताइए। **1**

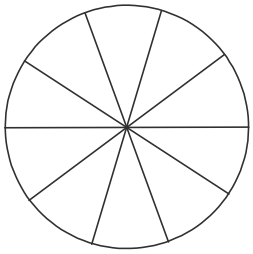
(ii) दूसरा आलू उठाने और बाल्टी में डालने में तय की गई दूरी बताइए। **1**

(B) The sum of the areas of two squares is 640 m^2. If the difference in their perimeters is 64 m, find the sides of the two squares. **5**

SECTION – E

Question numbers 36 to 38 are Case Study Based questions, carrying 4 marks each.

36. A brooch is crafted from silver wire in the shape of a circle with a diameter of 35 cm. The wire is also used to create 5 diameters, dividing the circle into 10 equal sectors as shown in figure.



Based on the above information, answer the following questions :

(i) What is the radius of circle ? **1**

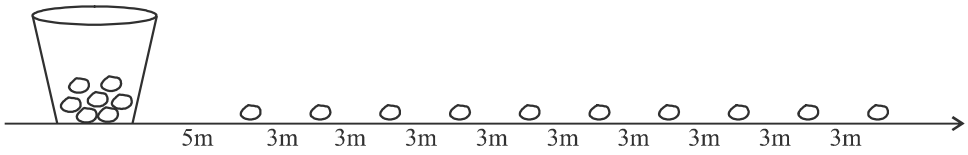
(ii) What is the circumference of the brooch ? **1**

(iii) (a) What is the total length of silver wire required ? **2**

OR

(iii) (b) What is the area of each sector of the brooch ? **2**

37. In a potato race, a bucket is placed at the starting point, which is 5 m from the first potato. The other potatoes are arranged 3 m apart in a straight line, with a total of 10 potatoes, as shown in the figure :



A competitor starts from the bucket, picks up the nearest potato, runs back to the bucket to drop it in, then returns to pick up the next potato. This process continues until all the potatoes are in the bucket.

Based on the above information, answer the following questions :

(i) What is the distance covered to pick up the first potato and drop it in bucket ? **1**

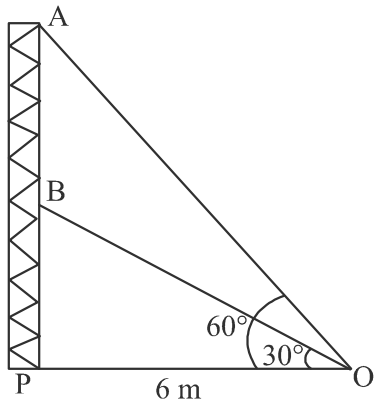
(ii) What is the distance covered to pick up the second potato and drop it in bucket ? **1**

(iii) (a) प्रतियोगी द्वारा तय की गई कुल दूरी बताइए। **2**

अथवा

(iii) (b) यदि प्रतियोगी की औसत गति 5 मीटर/सेकंड है, तो सभी आलू बाल्टी में डालने में लगा औसत समय ज्ञात कीजिए। **2**

38. रेडियो टॉवरों का उपयोग रेडियो और टेलीविज़न सहित विभिन्न संचार सेवाओं को प्रसारित करने के लिए किया जाता है। टॉवर या तो स्वयं ऐंटेना के रूप में कार्य करता है या अपनी संरचना पर एक या एक से अधिक ऐंटेना को सहारा देता है। इसी अवधारणा पर आधारित, एक रेडियो स्टेशन का टॉवर दो खंडों 'A' और 'B' में बनाया गया था। टॉवर को बिंदु 'O' से तारों द्वारा सहारा दिया गया है (जैसा कि चित्र में दिखाया गया है)।



टॉवर के आधार और बिंदु 'O' के बीच की दूरी 6 मीटर है। बिंदु 'O' से खंड 'B' के शीर्ष का उन्नयन कोण 30° है तथा खंड 'A' के शीर्ष का उन्नयन कोण 60° है।

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

(i) बिंदु 'O' से खंड 'B' के शीर्ष तक तार की लंबाई ज्ञात कीजिए। **1**

(ii) बिंदु 'O' से खंड 'A' के शीर्ष तक तार की लंबाई ज्ञात कीजिए। **1**

(iii) (a) AB की दूरी ज्ञात कीजिए। **2**

अथवा

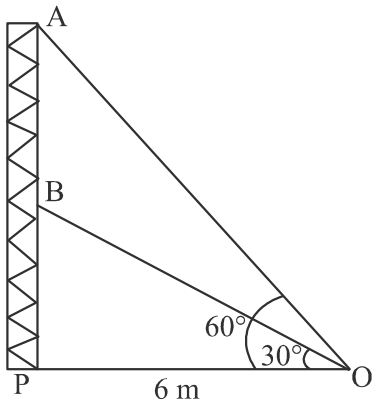
(iii) (b) Δ OPB का क्षेत्रफल ज्ञात कीजिए। **2**

(iii) (a) What is the total distance the competitor has to run ? **2**

OR

(iii) (b) If average speed of competitor is 5 m/s, then find the average time taken by competitor to put all the potatoes in the bucket. **2**

38. Radio towers are used for transmitting a range of communication services including radio and television. The tower will either act as an antenna itself or support one or more antennas on its structure. On a similar concept, a radio station tower was built in two sections 'A' and 'B'. Tower is supported by wires from a point 'O' (as shown in figure).



Distance between the base of the tower and point 'O' is 6 m. From point 'O', the angle of elevation of the top of the section 'B' is 30° and the angle of elevation of the top of section 'A' is 60°.

Based on the above information, answer the following questions :

(i) Find the length of the wire from the point 'O' to the top of section 'B'. **1**

(ii) Find the length of the wire from the point 'O' to the top of section 'A'. **1**

(iii) (a) Find the distance AB. **2**

OR

(iii) (b) Find the area of Δ OPB. **2**



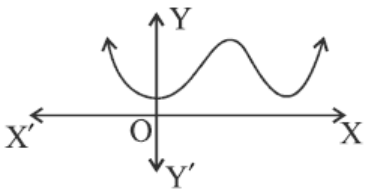
Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2026
MATHEMATICS (STANDARD) (041) (PAPER CODE 30/1/3)

General Instructions: -

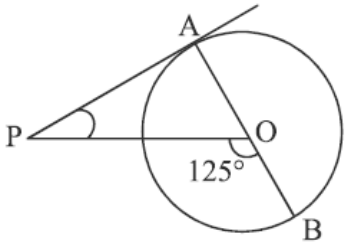
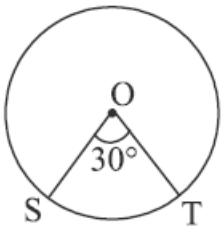
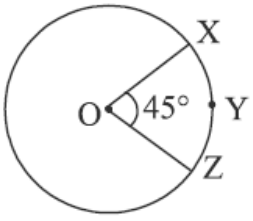
1.	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested 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 unassessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.
16.	The Examiners should acquaint themselves with the guidelines given in the "**Guidelines for spot Evaluation**" before starting the actual evaluation.
17.	Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly 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: 30/1/3)

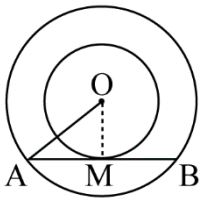
Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Step	Marks
	SECTION – A **Question Numbers 1 to 20 are multiple choice questions of 1 mark each.**		
1.	For any natural number n, 6^n ends with the digit : (a) 0 (b) 6 (c) 3 (d) 2		
Sol.	(b) 6		**1**
2.	The graph of $y = f(x)$ is given. The number of zeroes of $f(x)$ is : (a) 0 (b) 1 (c) 2 (d) 4 		
Sol.	(a) 0		**1**
3.	If a pair of linear equations in two variables is represented by two coincident lines, then the pair of equations has : (a) a unique solution (b) two solutions (c) no solution (d) an infinite number of solutions		
Sol.	(d) an infinite number of solutions		**1**
4.	The common difference of the AP : $\sqrt{2}, 2\sqrt{2}, 3\sqrt{2}, 4\sqrt{2}, ...$ is : (a) $\sqrt{2}$ (b) 1 (c) $2\sqrt{2}$ (d) $-\sqrt{2}$		
Sol.	(a) $\sqrt{2}$		**1**

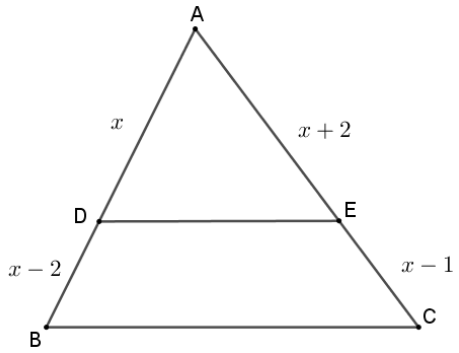
5.	If Δ ABC and Δ DEF are similar such that 2 AB = DE and BC = 8 cm, then EF is equal to : (a) 4 cm (b) 8 cm (c) 12 cm (d) 16 cm		
Sol.	(d) 16 cm		**1**
6.	The mid-point of the line segment joining the points $(5, -4)$ and $(6, 4)$ lies on : (a) x-axis (b) y-axis (c) origin (d) neither x-axis nor y-axis		
Sol.	(a) x-axis		**1**
7.	Given that $\sin\theta = \frac{a}{b}$, then $\cos\theta$ is equal to : (a) $\frac{b}{\sqrt{b^2-a^2}}$ (b) $\frac{b}{a}$ (c) $\frac{\sqrt{b^2-a^2}}{b}$ (d) $\frac{a}{\sqrt{b^2-a^2}}$		
Sol.	(c) $\frac{\sqrt{b^2-a^2}}{b}$		**1**
8.	If $\cos A = \frac{1}{2}$, then the value of $\sin^2 A + 2\cos^2 A$ is : (a) $\frac{3}{2}$ (b) $\frac{5}{4}$ (c) -1 (d) $\frac{1}{2}$		
Sol.	(b) $\frac{5}{4}$		**1**
9.	The string of a flying kite is tied to a point on the ground. The length of the string between the kite and the point on the ground is 80 m. The string makes an angle of 30° with the ground. The height of the kite above the ground is : (a) $20\sqrt{3}$ m (b) 40 m (c) $40\sqrt{3}$ m (d) $80\sqrt{3}$ m		
Sol.	(b) 40 m		**1**

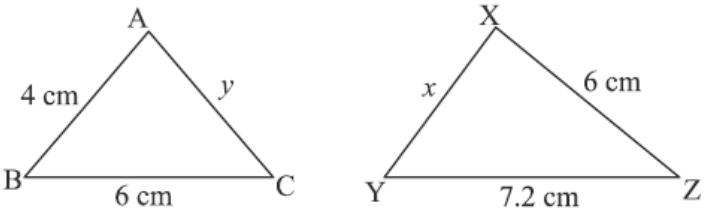
10.	If TP and TQ are two tangents to a circle with centre O from an external point T so that $\angle$ POQ = 120°, then $\angle$ PTQ is equal to : (a) 60° (b) 70° (c) 80° (d) 90°		
Sol.	(a) 60°		**1**
11.	In the given figure, PA is a tangent from an external point P to a circle with centre O. If $\angle$ POB = 125°, then $\angle$ APO is equal to : (a) 25° (b) 65° (c) 90° (d) 35° 		
Sol.	(d) 35°		**1**
12.	Shown in the given figure is a circle with centre O. The area of the minor sector is 7 cm^2. Area of circle is : (a) 84 π cm^2 (b) $\frac{84}{11}$ cm^2 (c) 84 cm^2 (d) $\frac{\sqrt{84}}{\sqrt{\pi}}$ cm^2 		
Sol.	(c) 84 cm^2		**1**
13.	In the given figure, O is the centre of circle. XYZ is an arc of the circle subtending an angle of 45° at the centre. If the radius of the circle is 32 cm, then the length of the arc XYZ is : (a) 4 π cm (b) 8 π cm (c) 64 π cm (d) 128 π cm 		
Sol.	(b) 8 π cm		**1**

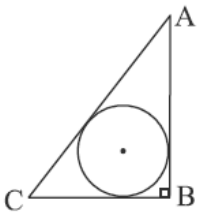
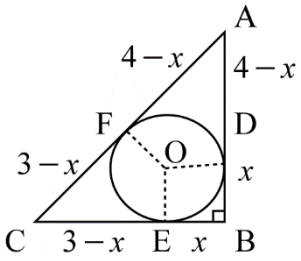
14.	The radius of a sphere (in cm) whose volume is $36\ \pi\ cm^3$, is : (a) 3 (b) $3\sqrt{3}$ (c) $3^{\frac{2}{3}}$ (d) $3^{\frac{1}{3}}$		
Sol.	(a) 3		**1**
15.	If the mean and mode of a data are 12 and 21 respectively, then its median is : (a) 6 (b) 13.5 (c) 15 (d) 14		
Sol.	(c) 15		**1**
16.	A die is thrown once. Probability of getting a number other than 3 is : (a) $\frac{1}{6}$ (b) $\frac{3}{6}$ (c) $\frac{5}{6}$ (d) 1		
Sol.	(c) $\frac{5}{6}$		**1**
17.	The HCF of 960 and 432 is : (a) 48 (b) 54 (c) 72 (d) 36		
Sol.	(a) 48		**1**
18.	The natural number 2 is : (a) a prime number (b) a composite number (c) prime as well as composite (d) neither prime nor composite		
Sol.	(a) a prime number		**1**

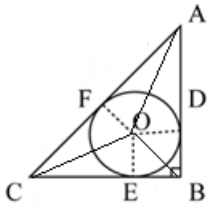
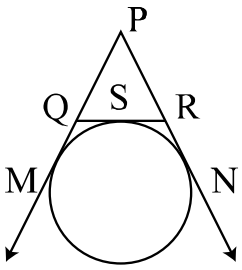
	Directions : Question numbers 19 and 20 are Assertion and Reason based questions. Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below : (a) Both, Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of 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) :** The polynomial $p(y) = y^2 + 4y + 3$ has two zeroes. **Reason (R) :** A quadratic polynomial can have at most two zeroes.		
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 probability that a leap year has 53 Mondays is $\frac{2}{7}$. **Reason (R) :** The probability that a non-leap year has 53 Mondays is $\frac{5}{7}$.		
Sol.	(c) Assertion (A) is true, but Reason (R) is false.		**1**
	SECTION – B **Question Numbers 21 to 25 are Very Short Answer (VSA) type questions, carrying 2 marks each.**		
21.	Do the points P (1, 0), Q (– 5, 0) and R (– 2, 5) form a triangle ? If so, name the type of triangle formed.		
Sol.	$PQ = \sqrt{(-5-1)^2 + (0-0)^2} = 6$ $QR = \sqrt{(-2+5)^2 + (5-0)^2} = \sqrt{34}$ or 5.8 $PR = \sqrt{(-2-1)^2 + (5-0)^2} = \sqrt{34}$ or 5.8 Since sum of any two sides is greater than the third side, ∴ Points P, Q and R form a triangle. $QR = PR \Rightarrow$ PQR forms an isosceles triangle.	**I** **II** **III**	**1** **½** **½**

22 (A).	If $\tan\theta = \frac{24}{7}$, then find the value of $\sin\theta + \cos\theta$.		
Sol.	$\tan\theta = \frac{24}{7} = \frac{P}{B}$ Getting $\sin\theta = \frac{24}{25}$ and $\cos\theta = \frac{7}{25}$ $\therefore \sin\theta + \cos\theta = \frac{24}{25} + \frac{7}{25}$ $= \frac{31}{25}$	**I** **II**	**1½** **½**
	OR		
22 (B).	If $\cot\theta = \frac{7}{8}$, then find the value of $\frac{(1+\sin\theta)(1-\sin\theta)}{(1+\cos\theta)(1-\cos\theta)}$.		
Sol.	$\frac{(1+\sin\theta)(1-\sin\theta)}{(1+\cos\theta)(1-\cos\theta)} = \frac{1-\sin^2\theta}{1-\cos^2\theta}$ $= \frac{\cos^2\theta}{\sin^2\theta} = \cot^2\theta$ $= \left(\frac{7}{8}\right)^2 = \frac{49}{64}$	**I** **II** **III**	**1** **½** **½**
23.	Two concentric circles are of radii 5 cm and 4 cm. Find the length of the chord of the larger circle which touches the smaller circle.		
Sol.	 Correct Figure $OM \perp AB$ $AM = \sqrt{5^2 - 4^2} = 3$ cm $AB = 2 \times 3 = 6$ cm	**I** **II** **III**	**½** **1** **½**

24.	Find a quadratic polynomial whose zeroes are $\left(5-2\sqrt{3}\right)$ and $\left(5+2\sqrt{3}\right)$.		
Sol.	Let α and β be the zeroes of the required polynomial. $\alpha = 5 - 2\sqrt{3}, \beta = 5 + 2\sqrt{3}$ $\alpha + \beta = 10$ $\alpha\beta = 13$ ∴ The quadratic polynomial is $x^2 - 10x + 13$	**I** **II** **III**	½ ½ **1**
25 (A).	In Δ ABC, DE $\parallel$ BC. If AD = x, DB = $x - 2$, AE = $x + 2$ and EC = $x - 1$, then find the value of x.		
Sol.	 Since DE $\parallel$ BC $\Rightarrow \frac{AD}{DB} = \frac{AE}{EC}$ $\Rightarrow \frac{x}{x-2} = \frac{x+2}{x-1}$ Solving, we get $x = 4$	**I** **II** **III**	**1** ½ ½
	OR		

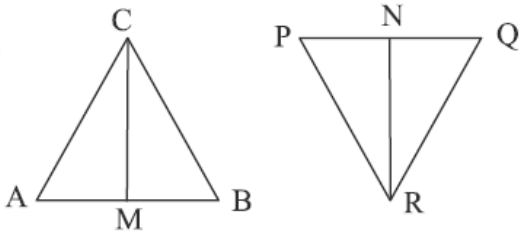
25 (B).	 In the figure given above, Δ ABC ~ Δ XYZ, then find the values of x and y.		
Sol.	$\Delta ABC \sim \Delta XYZ \Longrightarrow \frac{AB}{XY} = \frac{BC}{YZ} = \frac{AC}{XZ}$ $\Longrightarrow \frac{4}{x} = \frac{6}{7.2} = \frac{y}{6}$ Solving, we get $x = 4.8$ cm, $y = 5$ cm	**I** **II**	**1** **½ + ½**
	SECTION – C **Question numbers 26 to 31 are Short Answer (SA) type questions, carrying 3 marks each.**		
26 (A).	If $x = h + a\cos\theta$, $y = k + b\sin\theta$, then prove that : $\left(\frac{x-h}{a}\right)^2 + \left(\frac{y-k}{b}\right)^2 = 1$		
Sol.	$x = h + a\cos\theta \Longrightarrow \frac{x-h}{a} = \cos\theta$ $y = k + b\cos\theta \Longrightarrow \frac{y-k}{b} = \sin\theta$ $\therefore \text{LHS} = \left(\frac{x-h}{a}\right)^2 + \left(\frac{y-k}{b}\right)^2 = \cos^2\theta + \sin^2\theta = 1 = \text{RHS}$	**I** **II** **III**	**1** **1** **1**
	OR		

26 (B).	Prove that : $\frac{\tan A}{1+\sec A}-\frac{\tan A}{1-\sec A}=2\ \text{cosec}\ A$		
Sol.	$\text{LHS}=\frac{\tan A}{1+\sec A}-\frac{\tan A}{1-\sec A}=\frac{\frac{\sin A}{\cos A}}{1+\frac{1}{\cos A}}-\frac{\frac{\sin A}{\cos A}}{1-\frac{1}{\cos A}}$	**I**	**1**
	$=\frac{\sin A}{\cos A+1}-\frac{\sin A}{\cos A-1}$	**II**	**½**
	$=\sin A\left(\frac{-2}{-\sin^2 A}\right)$	**III**	**1**
	$=\frac{2}{\sin A}=2\ \text{cosec}\ A=\text{RHS}$	**IV**	**½**
27 (A).	In the given figure, Δ ABC is a right triangle in which $\angle$ B = 90°, AB = 4 cm and BC = 3 cm. Find the radius of the circle inscribed in the triangle ABC. 		
Sol.			
	AC = $\sqrt{3^2+4^2}=5$ cm	**I**	**½**
	Let BE = BD = x cm	**II**	**½**
	AD = $4-x$ = AF, CE = $3-x$ = CF	**III**	**½**
	AF + CF = AC $\Rightarrow 4-x+3-x=5$		
	$\therefore x=1$	**IV**	**1**
	BD = BE = 1 and $\angle$B = 90°		
	Hence radius of circle $= x = 1$ cm	**V**	**½**

	ALTERNATE SOLUTION:  AC = $\sqrt{3^2 + 4^2} = 5$ cm Let r be the radius of the circle ar(ΔABC) = $\frac{1}{2} \times 4 \times 3 = 6\ cm^2$ Also, ar(ΔABC) = $\left(\frac{1}{2} \times r \times 4\right) + \left(\frac{1}{2} \times r \times 3\right) + \left(\frac{1}{2} \times r \times 5\right)$ $\Rightarrow 6r = 6 \Rightarrow r = 1$ Hence the radius of the circle is 1 cm.	**I** **II** **III** **IV**	½ ½ **1** **1**
	OR		
27 (B).	In the given figure, if a circle touches the side QR of Δ PQR at S and extended sides PQ and PR at M and N respectively, then prove that : PM = $\frac{1}{2}$ (PQ + QR + PR)  		
Sol.	 PM = PN QS = QM RS = RN PM + PN = PQ + QM + PR + RN	**I** **II**	1½ ½

	2 PM = PQ + QS + PR + RS = PQ + QS + RS + PR = PQ + QR + PR ∴ PM = $\frac{1}{2}$ (PQ + QR + PR)	**III** **IV**	½ ½
28.	A right circular cylinder and a right circular cone have equal bases and equal heights. If their curved surface areas are in the ratio 8 : 5, then find the ratio between the radius of their bases to their height.		
Sol.	Let r and h be the radius and height of cylinder as well as cone respectively $\frac{2\pi rh}{\pi rl} = \frac{8}{5}$ $\Longrightarrow \frac{2h}{\sqrt{r^2+h^2}} = \frac{8}{5}$ $\Longrightarrow 100\,h^2 = 64\,r^2 + 64\,h^2$ $\Longrightarrow 36\,h^2 = 64\,r^2$ $\therefore \frac{r}{h} = \frac{3}{4}$ Hence the required ratio is 3: 4	**I** **II** **III**	**1** **1** **1**
29.	Two different coins are tossed simultaneously. What is the probability of getting : (i) at least one head ? (ii) at most one tail ? (iii) a head and a tail ?		
Sol.	Possible Outcomes are HH, HT, TH, TT (i) P (at least one head) = $\frac{3}{4}$ (ii) P (at most one tail) = $\frac{3}{4}$ (iii) P (a head and a tail) = $\frac{2}{4}$ or $\frac{1}{2}$	**I** **II** **III**	**1** **1** **1**

30.	Prove that $\sqrt{3}$ is an irrational number.		
Sol.	Let $\sqrt{3}$ be a rational number.		
	$\therefore \sqrt{3} = \frac{p}{q}$, where $q \neq 0$ and p & q are coprime.	**I**	½
	$3q^2 = p^2 \implies p^2$ is divisible by $3 \implies p$ is divisible by 3 ----- (i)	**II**	**1**
	Let $p = 3a$, where 'a' is some integer		
	$9a^2 = 3q^2 \implies q^2 = 3a^2 \implies q^2$ is divisible by 3		
	$\implies q$ is divisible by 3 ----- (ii)	**III**	**1**
	(i) and (ii) leads to a contradiction as 'p' and 'q' are coprime.	**IV**	½
	$\therefore \sqrt{3}$ is an irrational number.		
31.	Find the ratio in which the x-axis divides the line segment joining the points $(-6, 5)$ and $(-4, -1)$. Also, find the point of intersection.		
Sol.	$(-6, 5)$ A — k — P — 1 — $(-4, -1)$ B; P is $(x, 0)$		
	Let coordinates of P be $(x, 0)$ and P divides the line segement AB in the ratio $k : 1$	**I**	½
	$\left(\frac{-4k-6}{k+1}, \frac{-k+5}{k+1}\right) = (x, 0)$	**II**	**1**
	$\implies \frac{-k+5}{k+1} = 0 \implies k = 5$	**III**	½
	Hence the required ratio is 5: 1	**IV**	½
	$\therefore$ Coordinates of P are $\left(\frac{-4\times5-6}{5+1}, 0\right) = \left(-\frac{13}{3}, 0\right)$	**V**	½

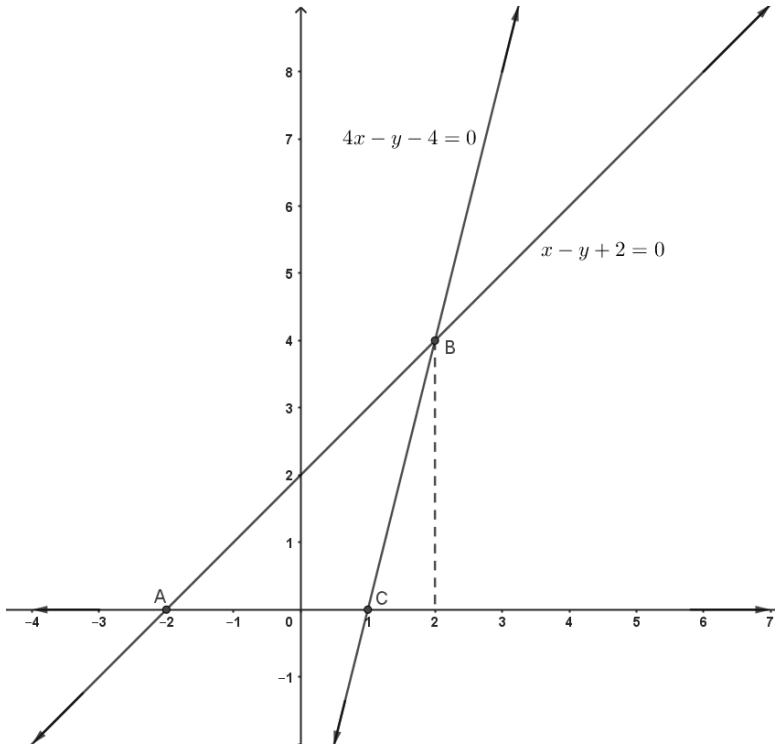
	SECTION – D **Question numbers 32 to 35 are Long Answer (LA) type questions, carrying 5 marks each.**		
32 (A).	State and prove Basic Proportionality Theorem.		
Sol.	For Correct Statement - If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, the other two sides are divided in the same ratio. For Correct given, to prove, construction and figure For correct proof	**I** **II** **III**	**1** **2** **2**
	OR		
32 (B).	In the given figure, CM and RN are respectively the medians of Δ ABC and Δ PQR. If Δ ABC ~ Δ PQR, then prove that : (i) Δ AMC ~ Δ PNR (ii) Δ CMB ~ Δ RNQ  		
Sol.	(i) $\Delta ABC \sim \Delta PQR \Rightarrow \angle A = \angle P$ $\frac{AB}{PQ} = \frac{AC}{PR} \Rightarrow \frac{2\,AM}{2\,PN} = \frac{AC}{PR}$ (as CM and RN are the medians) $\therefore \Delta AMC \sim \Delta PNR$ (ii) $\Delta ABC \sim \Delta PQR \Rightarrow \angle B = \angle Q$ $\frac{AB}{PQ} = \frac{BC}{QR} \Rightarrow \frac{2\,MB}{2\,NQ} = \frac{BC}{QR}$ (as CM and RN are the medians) $\therefore \Delta CMB \sim \Delta RNQ$	**I** **II** **III** **IV** **V** **VI**	**½** **1½** **½** **½** **1½** **½**

33. The marks obtained by 80 students of class X in a mock test of Mathematics are given below in the table. Find **median** and the **mode** of the data :

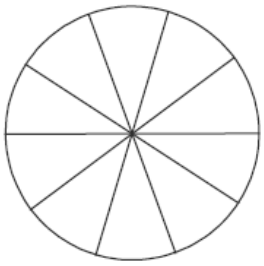
Marks	Number of Students
0 and above	80
10 and above	77
20 and above	72
30 and above	65
40 and above	55
50 and above	43
60 and above	28
70 and above	16
80 and above	10
90 and above	8
100 and above	0

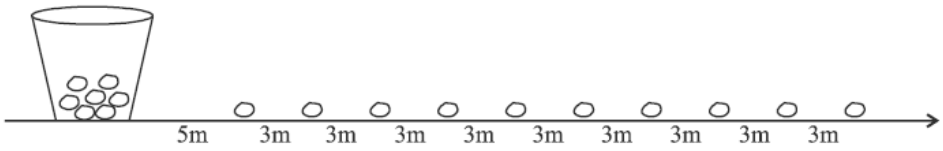
Sol.

Marks	Number of Students	Class Interval	f	Cf
0 and above	80	$0-10$	3	3
10 and above	77	$10-20$	5	8
20 and above	72	$20-30$	7	15
30 and above	65	$30-40$	10	25
40 and above	55	$40-50$	12	37
50 and above	43	$50-60$	15	52
60 and above	28	$60-70$	12	64
70 and above	16	$70-80$	6	70
80 and above	10	$80-90$	2	72
90 and above	8	$90-100$	8	80
Total			80	

	Correct Table	I	1
	$n = 80 \Longrightarrow \frac{n}{2} = 40$		
	$\therefore 50 - 60$ is the median class	II	½
	Median $= 50 + \left(\frac{40-37}{15}\right) \times 10$	III	1
	$= 50 + 2 = 52$	IV	½
	$50 - 60$ is the modal class	V	½
	Mode $= 50 + \left(\frac{15-12}{2\times15-12-12}\right) \times 10$	VI	1
	$= 50 + 5 = 55$	VII	½
34.	Draw the graph of the pair of linear equations $x - y + 2 = 0$ and $4x - y - 4 = 0$. Calculate the area of the triangle formed by the lines so drawn and the x-axis.		
Sol.			
	Correct graph of the equation $4x - y - 4 = 0$	I	2
	Correct graph of the equation $x - y + 2 = 0$	II	2
	Area of the required triangle ABC $= \frac{1}{2} \times 3 \times 4 = 6$ sq. units	III	1

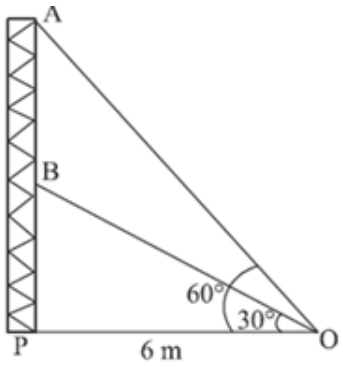
35 (A).	A faster train takes one hour less than a slower train for a journey of 200 km. If the speed of the slower train is 10 km/hr less than that of the faster train, find the speeds of the two trains.		
Sol.	Let the speed of faster train be x km/h $\therefore$ speed of slower train $= (x - 10)$ km/h According to the question, $\frac{200}{x-10} - \frac{200}{x} = 1$ $\Longrightarrow x^2 - 10x - 2000 = 0$ $\Longrightarrow (x - 50)(x + 40) = 0$ $\therefore x = 50$ $x = -40$ (Rejected) Hence, speed of faster train $= 50$ km/h and speed of slower train $= 40$ km/h	**I** **II** **III** **IV** **V**	**2** **1** **1** **½** **½**
	OR		
35 (B).	The sum of the areas of two squares is 640 m^2. If the difference in their perimeters is 64 m, find the sides of the two squares.		
Sol.	Let the sides of the two squares be x m and y m $(x > y)$ $x^2 + y^2 = 640$ and $4x - 4y = 64 \Longrightarrow y = x - 16$ $\therefore x^2 + (x - 16)^2 = 640$ $\Longrightarrow x^2 - 16x - 192 = 0$ $\Longrightarrow (x - 24)(x + 8) = 0$ $\therefore x = 24$	**I** **II** **III** **IV** **V**	**1** **1** **1** **1** **½**

	$x = -8$ (Rejected) $\Rightarrow y = 24 - 16 = 8$ Hence the sides of the two squares are 24 m and 8 m	**VI**	**½**
	SECTION – E **Question numbers 36 to 38 are Case Study Based questions, carrying 4 marks each**		
36.	A brooch is crafted from silver wire in the shape of a circle with a diameter of 35 cm. The wire is also used to create 5 diameters, dividing the circle into 10 equal sectors as shown in figure.  **Based on the above information, answer the following questions :** (i) What is the radius of circle ? (ii) What is the circumference of the brooch ? (iii) (a) What is the total length of silver wire required ? **OR** (iii) (b) What is the area of each sector of the brooch ?		
Sol.	(i) $r = \frac{35}{2}$ cm = 17.5 cm	**I**	**1**
	(ii) Circumference $= 2 \times \frac{22}{7} \times \frac{35}{2} = 110$ cm	**I**	**1**
	(iii) (a) Total length of wire required $= (5 \times 35 + 110)$ cm	**I**	**1**
	$= 285$ cm	**II**	**1**
	OR		
	(iii) (b) Central angle of each sector $= \frac{360}{10} = 36°$	**I**	**1**
	Area of each sector $= \frac{36}{360} \times \frac{22}{7} \times \frac{35}{2} \times \frac{35}{2}$		
	$= \frac{385}{4}$ or $96.25\ cm^2$	**II**	**1**

37.	In a potato race, a bucket is placed at the starting point, which is 5 m from the first potato. The other potatoes are arranged 3 m apart in a straight line, with a total of 10 potatoes, as shown in the figure :  A competitor starts from the bucket, picks up the nearest potato, runs back to the bucket to drop it in, then returns to pick up the next potato. This process continues until all the potatoes are in the bucket. **Based on the above information, answer the following questions :** (i) What is the distance covered to pick up the first potato and drop it in bucket ? (ii) What is the distance covered to pick up the second potato and drop it in bucket ? (iii) (a) What is the total distance the competitor has to run ? **OR** (iii) (b) If average speed of competitor is 5 m/s, then find the average time taken by competitor to put all the potatoes in the bucket.		
Sol.	(i) Required distance for the first potato = 5 + 5 = 10 m	**I**	**1**
	(ii) Required distance for the second potato = 8 + 8 = 16 m	**I**	**1**
	(iii) (a) Distances covered form an A.P. with $a = 10$ and $d = 6$	**I**	**1**
	$\therefore S_{10} = \frac{10}{2}[2 \times 10 + 9 \times 6]$ $= 5 \times 74 = 370$ m	**II**	**1**
	OR		
	(iii) (b) Distances covered form an A.P. with $a = 10$ and $d = 6$	**I**	**½**
	$\therefore S_{10} = \frac{10}{2}[2 \times 10 + 9 \times 6]$ $= 5 \times 74 = 370$ m	**II**	**1**
	Time $= \frac{370}{5} = 74$ seconds	**III**	**½**

38.

Radio towers are used for transmitting a range of communication services including radio and television. The tower will either act as an antenna itself or support one or more antennas on its structure. On a similar concept, a radio station tower was built in two sections 'A' and 'B'. Tower is supported by wires from a point 'O' (as shown in figure).



Distance between the base of the tower and point 'O' is 6 m. From point 'O', the angle of elevation of the top of the section 'B' is 30° and the angle of elevation of the top of section 'A' is 60°.

Based on the above information, answer the following questions :

(i) Find the length of the wire from the point 'O' to the top of section 'B'.

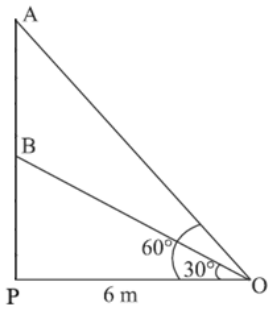
(ii) Find the length of the wire from the point 'O' to the top of section 'A'.

(iii) (a) Find the distance AB.

OR

(iii) (b) Find the area of Δ OPB.

Sol.



(i) $\cos 30° = \frac{\sqrt{3}}{2} = \frac{6}{OB}$ — **I** ½

$\Rightarrow OB = \frac{12}{\sqrt{3}}$ or $4\sqrt{3}$ m — **II** ½

(ii) $\cos 60° = \frac{1}{2} = \frac{6}{OA}$ — **I** ½

$\Rightarrow OA = 12$ m — **II** ½

(iii) (a) $\tan 30° = \frac{1}{\sqrt{3}} = \frac{BP}{6}$

$\Rightarrow BP = 2\sqrt{3}$ m — **I** **1**

$\tan 60° = \sqrt{3} = \frac{AP}{6}$

	$\Rightarrow AP = 6\sqrt{3}$ m	**II**	**½**
	$AB = AP - BP = 6\sqrt{3} - 2\sqrt{3} = 4\sqrt{3}$ m	**III**	**½**
	OR		
(iii)	(b) $\tan 30° = \frac{1}{\sqrt{3}} = \frac{BP}{6}$		
	$\Rightarrow BP = 2\sqrt{3}$ m	**I**	**1**
	$ar(\Delta OPB) = \frac{1}{2} \times BP \times OP$		
	$= \frac{1}{2} \times 2\sqrt{3} \times 6 = 6\sqrt{3}\, m^2$	**II**	**1**