

Series : 2LKNM



SET ~ 2

रोल नं.

Roll No.



प्रश्न-पत्र कोड
Q.P. Code

30/2/2

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

नोट / NOTE :

- (I) कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ **27** हैं।
Please check that this question paper contains **27** 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

Time allowed : 3 hours

अधिकतम अंक : 80

Maximum Marks : 80

सामान्य निर्देश :

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

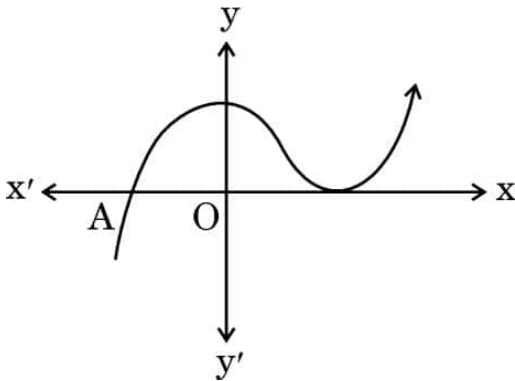
- (i) इस प्रश्न-पत्र में 38 प्रश्न हैं। सभी प्रश्न अनिवार्य हैं।
- (ii) यह प्रश्न-पत्र पाँच खण्डों में विभाजित है – क, ख, ग, घ एवं ङ।
- (iii) खण्ड क में प्रश्न संख्या 1 से 18 तक बहुविकल्पीय (MCQ) तथा प्रश्न संख्या 19 एवं 20 अभिकथन एवं तर्क आधारित 1 अंक के प्रश्न हैं।
- (iv) खण्ड ख में प्रश्न संख्या 21 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 3 प्रश्नों में आंतरिक विकल्प का प्रावधान दिया गया है।
- (ix) जहाँ आवश्यक हो स्वच्छ आकृतियाँ बनाइए। जहाँ आवश्यक हो $\pi = \frac{22}{7}$ लीजिए, यदि अन्यथा न दिया गया हो।
- (x) कैल्कुलेटर का उपयोग वर्जित है।

खण्ड क

इस खण्ड में 20 बहुविकल्पीय प्रश्न (MCQ) हैं, जिनमें प्रत्येक प्रश्न 1 अंक का है।

20 × 1 = 20

1. ग्राफ $y = f(x)$ दिया गया है। $y = f(x)$ के भिन्न शून्यकों की संख्या है :



(A) 0

(B) 1

(C) 2

(D) 3

General Instructions :

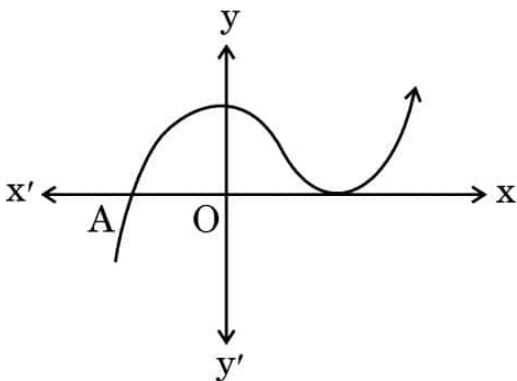
Read the following instructions very carefully and strictly follow them :

- (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 no. **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 no. **21** to **25** are very short answer (VSA) type questions, carrying **2** marks each.
- (v) In **Section C**, Questions no. **26** to **31** are short answer (SA) type questions, carrying **3** marks each.
- (vi) In **Section D**, Questions no. **32** to **35** are long answer (LA) type questions carrying **5** marks each.
- (vii) In **Section E**, Questions no. **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 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

This section has **20** Multiple Choice Questions (MCQs) carrying **1** mark each. $20 \times 1 = 20$

1. The graph of $y = f(x)$ is given. The number of distinct zeroes of $y = f(x)$ is :



(A) 0

(B) 1

(C) 2

(D) 3

2. कक्षा X के दो अनुभाग A और B हैं। अनुभाग A में 28 छात्र और अनुभाग B में 30 छात्र हैं। कक्षा पुस्तकालय के लिए आपको पुस्तकों की न्यूनतम संख्या क्या अर्जित करनी चाहिए ताकि उन्हें अनुभाग A या अनुभाग B के छात्रों में समान रूप से वितरित किया जा सके ?
- (A) 144 (B) 2
(C) 420 (D) 272
3. रैखिक समीकरणों का युग्म $\frac{3x}{2} + \frac{5y}{3} = 7$ और $9x + 10y = 14$, है :
- (A) संगत
(B) असंगत
(C) एक हल के साथ संगत
(D) अनेक हलों के साथ संगत
4. प्राकृत संख्या 1 :
- (A) एक अभाज्य संख्या है।
(B) एक भाज्य संख्या है।
(C) अभाज्य और भाज्य दोनों है।
(D) न तो अभाज्य और न ही भाज्य है।
5. x का मान ज्ञात कीजिए जिसके लिए $2x$, $(x + 10)$ और $(3x + 2)$ एक समांतर श्रेढी (A.P.) के तीन क्रमागत पद हैं :
- (A) 6 (B) - 6
(C) 18 (D) - 18
6. किसी प्राकृत संख्या n के लिए, 5^n का इकाई अंक होता है :
- (A) 0 (B) 5
(C) 3 (D) 2
7. त्रिभुजों ABC और PQR में, $\angle A = \angle Q$ और $\angle B = \angle R$ है, तो $AB : AC$ बराबर है :
- (A) PQ : PR
(B) PQ : QR
(C) QR : QP
(D) PR : QR

2. There are two sections A and B of Grade X. There are 28 students in Section A and 30 students in Section B. What is the minimum number of books you will acquire for the class library so that they can be distributed equally among students of Section A or Section B ?
- (A) 144 (B) 2
(C) 420 (D) 272
3. The pair of linear equations $\frac{3x}{2} + \frac{5y}{3} = 7$ and $9x + 10y = 14$, is :
- (A) consistent
(B) inconsistent
(C) consistent with one solution
(D) consistent with many solutions
4. The natural number 1 is :
- (A) a prime number.
(B) a composite number.
(C) prime as well as composite.
(D) neither prime nor composite.
5. The value of x for which $2x$, $(x + 10)$ and $(3x + 2)$ are the three consecutive terms of an A.P. is :
- (A) 6 (B) - 6
(C) 18 (D) - 18
6. For any natural number n, 5^n ends with the digit :
- (A) 0 (B) 5
(C) 3 (D) 2
7. In triangles ABC and PQR, $\angle A = \angle Q$ and $\angle B = \angle R$, then AB : AC is equal to :
- (A) PQ : PR
(B) PQ : QR
(C) QR : QP
(D) PR : QR

8. यदि α और β बहुपद $f(x) = px^2 - 2x + 3p$ के दो शून्यक हैं और $\alpha + \beta = \alpha\beta$ है, तो p का मान है :
- (A) $-\frac{2}{3}$
- (B) $\frac{2}{3}$
- (C) $\frac{1}{3}$
- (D) $-\frac{1}{3}$
9. एक बारंबारता बंटन का माध्य और माध्यक क्रमशः 43 और 43.4 हैं। इस बंटन का बहुलक है :
- (A) 43.4
- (B) 42.4
- (C) 44.2
- (D) 49.3
10. यदि बिंदुओं $(4, p)$ और $(1, 0)$ के बीच की दूरी 5 है, तो p बराबर है :
- (A) ± 4
- (B) 4
- (C) -4
- (D) 0
11. एक अर्धगोलाकार कटोरा स्टील से बना है, जिसकी मोटाई 1 cm है। कटोरे की बाहरी त्रिज्या 6 cm है। प्रयुक्त स्टील का आयतन (cm^3 में) है :
- (A) 182π
- (B) $\frac{182}{3}\pi$
- (C) $\frac{682}{3}\pi$
- (D) $\frac{364}{3}\pi$

8. If α and β are two zeroes of a polynomial $f(x) = px^2 - 2x + 3p$ and $\alpha + \beta = \alpha\beta$, then value of p is :
- (A) $-\frac{2}{3}$
- (B) $\frac{2}{3}$
- (C) $\frac{1}{3}$
- (D) $-\frac{1}{3}$
9. The mean and median of a frequency distribution are 43 and 43.4 respectively. The mode of the distribution is :
- (A) 43.4
- (B) 42.4
- (C) 44.2
- (D) 49.3
10. If the distance between the points $(4, p)$ and $(1, 0)$ is 5, then p is equal to :
- (A) ± 4 (B) 4
- (C) -4 (D) 0
11. A hemispherical bowl is made of steel of thickness 1 cm. The outer radius of the bowl is 6 cm. The volume of steel used (in cm^3) is :
- (A) 182π
- (B) $\frac{182}{3}\pi$
- (C) $\frac{682}{3}\pi$
- (D) $\frac{364}{3}\pi$

12. यदि $\cos A = \frac{4}{5}$ है, तो $\tan A$ का मान है :

(A) $\frac{3}{5}$

(B) $\frac{3}{4}$

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

(D) $\frac{5}{3}$

13. त्रिज्या 'r' तथा केन्द्रीय कोण 60° वाले एक वृत्तखंड का क्षेत्रफल है :

(A) $\frac{\pi r^2}{2} - \frac{1}{2}r^2$

(B) $\frac{2\pi r}{4} - \frac{\sqrt{3}}{4}r^2$

(C) $\frac{\pi r^2}{6} - \frac{\sqrt{3}}{4}r^2$

(D) $\frac{2\pi r}{4} - r^2 \sin 60^\circ$

14. यदि $2 \sin A = 1$ है, तो $\tan A + \cot A$ का मान है :

(A) $\sqrt{3}$

(B) $\frac{4}{\sqrt{3}}$

(C) $\frac{\sqrt{3}}{2}$

(D) 1

12. If $\cos A = \frac{4}{5}$, then the value of $\tan A$ is :

(A) $\frac{3}{5}$

(B) $\frac{3}{4}$

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

(D) $\frac{5}{3}$

13. Area of a segment of a circle of radius 'r' and central angle 60° is :

(A) $\frac{\pi r^2}{2} - \frac{1}{2}r^2$

(B) $\frac{2\pi r}{4} - \frac{\sqrt{3}}{4}r^2$

(C) $\frac{\pi r^2}{6} - \frac{\sqrt{3}}{4}r^2$

(D) $\frac{2\pi r}{4} - r^2 \sin 60^\circ$

14. If $2 \sin A = 1$, then the value of $\tan A + \cot A$ is :

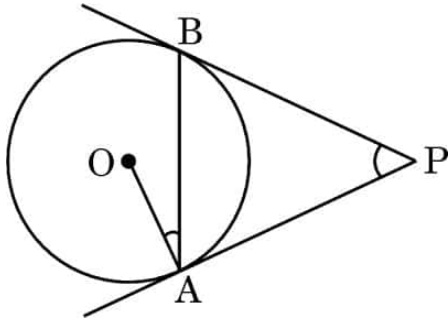
(A) $\sqrt{3}$

(B) $\frac{4}{\sqrt{3}}$

(C) $\frac{\sqrt{3}}{2}$

(D) 1

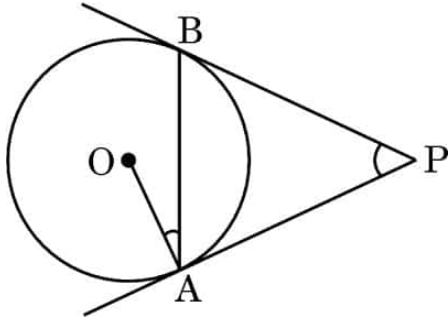
15. दिए गए चित्र में, PA और PB केन्द्र O वाले वृत्त की स्पर्श रेखाएँ हैं। यदि $\angle OAB = 15^\circ$, तो $\angle APB$ का मान बराबर है :



- (A) 30° (B) 15°
 (C) 45° (D) 10°
16. जमीन पर एक बिंदु से, जो एक ऊर्ध्वाधर मीनार के पाद से 60 m दूर है, मीनार के शीर्ष का उन्नयन कोण 45° पाया जाता है। मीनार की ऊँचाई (मीटर में) है :
- (A) $10\sqrt{3}$ (B) $30\sqrt{3}$
 (C) 60 (D) 30
17. 1, 2, 3, 4, ..., 25 तक की संख्याओं में से यादृच्छिक रूप से चुनी गई एक संख्या के भाज्य संख्या होने की प्रायिकता है :

- (A) $\frac{15}{25}$
 (B) $\frac{10}{25}$
 (C) $\frac{11}{25}$
 (D) $\frac{9}{25}$

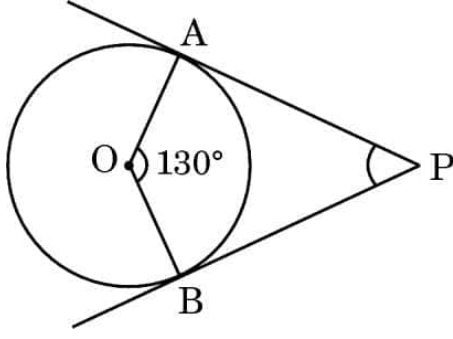
15. In the given figure, PA and PB are tangents to a circle centred at O. If $\angle OAB = 15^\circ$, then $\angle APB$ equals :



- (A) 30° (B) 15°
(C) 45° (D) 10°
16. From a point on the ground, which is 60 m away from the foot of a vertical tower, the angle of elevation of the top of the tower is found to be 45° . The height (in metres) of the tower is :
- (A) $10\sqrt{3}$ (B) $30\sqrt{3}$
(C) 60 (D) 30
17. The probability for a randomly selected number out of 1, 2, 3, 4, ..., 25 to be a composite number is :

- (A) $\frac{15}{25}$
(B) $\frac{10}{25}$
(C) $\frac{11}{25}$
(D) $\frac{9}{25}$

18. दिए गए चित्र में, PA और PB केन्द्र O वाले वृत्त की स्पर्श रेखाएँ हैं। यदि $\angle AOB = 130^\circ$, तो $\angle APB$ का मान बराबर है :



- (A) 130° (B) 50°
(C) 120° (D) 90°

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 विकल्पों (A), (B), (C) और (D) में से चुनकर दीजिए।

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

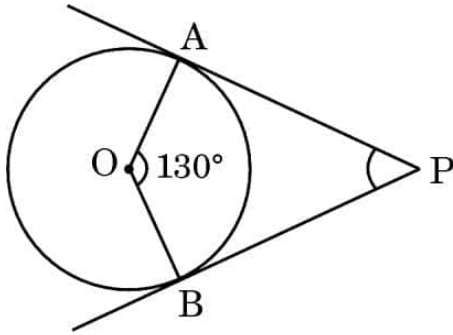
19. अभिकथन (A) : प्रथम 'n' प्राकृत संख्याओं का माध्य $\frac{n-1}{2}$ है।

तर्क (R) : प्रथम 'n' प्राकृत संख्याओं का योगफल $\frac{n(n+1)}{2}$ है।

20. अभिकथन (A) : 4 cm भुजा वाले दो घनों को सिरे-से-सिरा मिलाकर बनाए गए घनाभ का पृष्ठीय क्षेत्रफल 160 cm^2 है।

तर्क (R) : विमाओं $l \times b \times h$ वाले घनाभ का पृष्ठीय क्षेत्रफल $(lb + bh + hl)$ होता है।

18. In the given figure, PA and PB are tangents to a circle centred at O. If $\angle AOB = 130^\circ$, then $\angle APB$ is equal to :



- (A) 130° (B) 50°
(C) 120° (D) 90°

Questions number 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 options (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 mean of first 'n' natural numbers is $\frac{n-1}{2}$.

Reason (R): The sum of first 'n' natural numbers is $\frac{n(n+1)}{2}$.

20. Assertion (A) : The surface area of the cuboid formed by joining two cubes of sides 4 cm each, end-to-end, is 160 cm^2 .

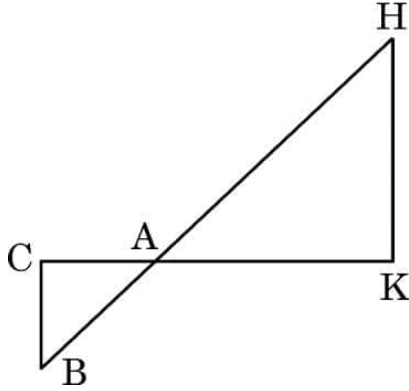
Reason (R): The surface area of a cuboid of dimensions $l \times b \times h$ is $(lb + bh + hl)$.

खण्ड ख

इस खण्ड में 5 अति लघु-उत्तरीय (VSA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक के 2 अंक हैं।

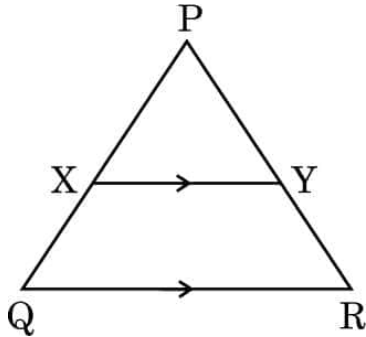
5×2=10

21. (क) दिए गए चित्र में, $\triangle AHK \sim \triangle ABC$ है। यदि $AK = 10$ cm, $BC = 3.5$ cm और $HK = 7$ cm है, तो AC की लंबाई ज्ञात कीजिए।



अथवा

- (ख) दिए गए चित्र में, $XY \parallel QR$, $\frac{PQ}{XQ} = \frac{7}{3}$ और $PR = 6.3$ cm है। YR की लंबाई ज्ञात कीजिए।

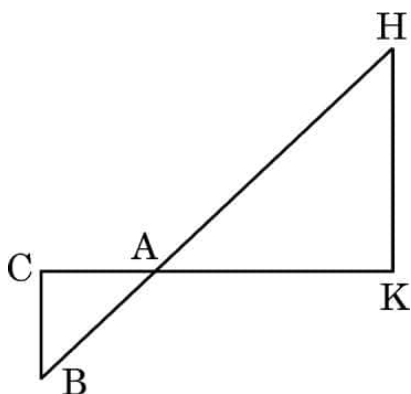


SECTION B

This section has 5 Very Short Answer (VSA) type questions carrying 2 marks each.

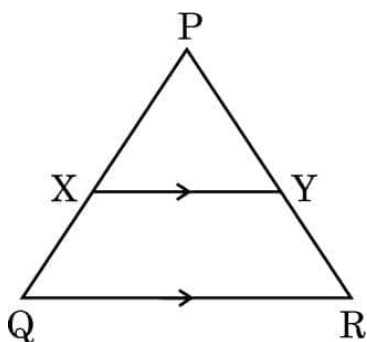
5×2=10

21. (a) In the given figure, $\triangle AHK \sim \triangle ABC$. If $AK = 10$ cm, $BC = 3.5$ cm and $HK = 7$ cm, find the length of AC .



OR

- (b) In the given figure, $XY \parallel QR$, $\frac{PQ}{XQ} = \frac{7}{3}$ and $PR = 6.3$ cm. Find the length of YR .



22. (क) मान ज्ञात कीजिए :

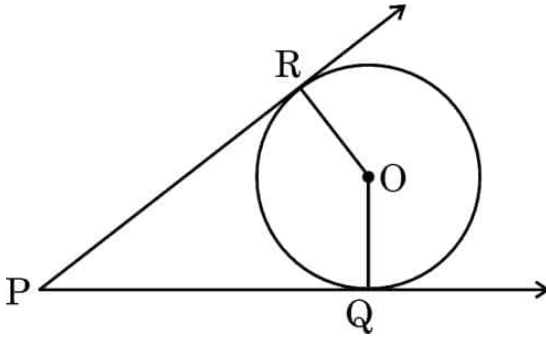
$$\frac{5 \cos^2 60^\circ + 4 \sec^2 30^\circ - \tan^2 45^\circ}{\sin^2 30^\circ + \cos^2 30^\circ}$$

अथवा

(ख) सिद्ध कीजिए कि :

$$1 + \frac{\cot^2 \alpha}{1 + \operatorname{cosec} \alpha} = \operatorname{cosec} \alpha$$

23. दिए गए चित्र में, O वृत्त का केंद्र है। PQ तथा PR स्पर्श रेखाएँ हैं। सिद्ध कीजिए कि चतुर्भुज PQOR चक्रीय है।



24. p का मान ज्ञात कीजिए, जिसके लिए द्विघात बहुपद $px^2 - 14x + 8$ का एक शून्यक दूसरे शून्यक का 6 गुना है।

25. यदि बिंदु A(4, 5), B(m, 6), C(4, 3) और D(1, n) एक समांतर चतुर्भुज ABCD के शीर्ष हैं, तो m और n के मान ज्ञात कीजिए।

22. (a) Evaluate :

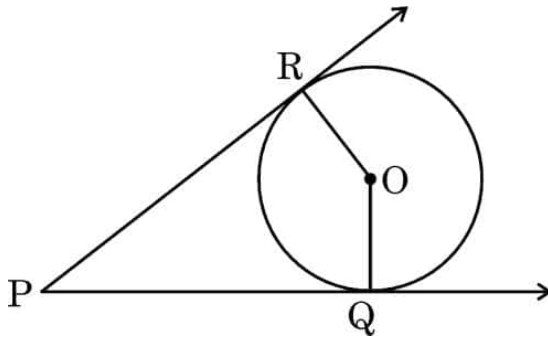
$$\frac{5 \cos^2 60^\circ + 4 \sec^2 30^\circ - \tan^2 45^\circ}{\sin^2 30^\circ + \cos^2 30^\circ}$$

OR

(b) Prove that :

$$1 + \frac{\cot^2 \alpha}{1 + \operatorname{cosec} \alpha} = \operatorname{cosec} \alpha$$

23. In the given figure, O is the centre of the circle. PQ and PR are tangents. Show that the quadrilateral PQOR is cyclic.



24. Find the value of p, for which one zero of the quadratic polynomial $px^2 - 14x + 8$ is 6 times the other.

25. If the points A(4, 5), B(m, 6), C(4, 3) and D(1, n) taken in this order are the vertices of a parallelogram ABCD, then find the values of m and n.

खण्ड ग

इस खण्ड में 6 लघु-उत्तरीय (SA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक के 3 अंक हैं।

6×3=18

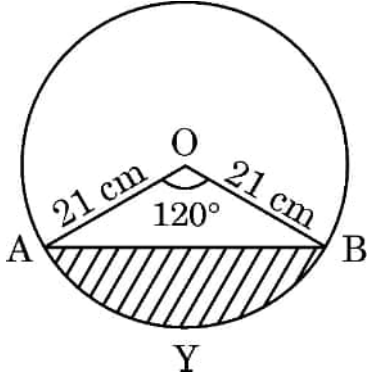
26. (क) सिद्ध कीजिए कि :

$$\frac{\sec^3 \theta}{\sec^2 \theta - 1} + \frac{\operatorname{cosec}^3 \theta}{\operatorname{cosec}^2 \theta - 1} = \sec \theta \cdot \operatorname{cosec} \theta (\sec \theta + \operatorname{cosec} \theta)$$

अथवा

(ख) यदि $\frac{\sec \alpha}{\operatorname{cosec} \beta} = p$ और $\frac{\tan \alpha}{\operatorname{cosec} \beta} = q$ है, तो सिद्ध कीजिए कि $(p^2 - q^2) \sec^2 \alpha = p^2$.

27. दिए गए चित्र में दर्शाए गए वृत्तखंड AYB का क्षेत्रफल ज्ञात कीजिए, यदि वृत्त की त्रिज्या 21 cm है तथा $\angle AOB = 120^\circ$. [$\pi = \frac{22}{7}$ का प्रयोग कीजिए]



28. दो पासों को एक साथ फेंका जाता है। प्रायिकता ज्ञात कीजिए कि (i) दोनों पासों पर आने वाली संख्याओं का योगफल 5 हो, और (ii) दोनों पासों पर आने वाली संख्याओं का अंतर 3 हो।

29. सिद्ध कीजिए कि $\sqrt{5}$ एक अपरिमेय संख्या है।

30. बिंदुओं $A(-1, 4)$ और $B(-3, -2)$ को मिलाने वाले रेखाखंड के समत्रिभाजन बिंदुओं (points of trisection) के निर्देशांक ज्ञात कीजिए।

SECTION C

This section has **6 Short Answer (SA) type questions carrying 3 marks each.** $6 \times 3 = 18$

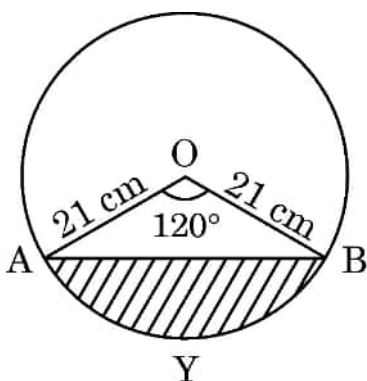
- 26.** (a) Prove that :

$$\frac{\sec^3 \theta}{\sec^2 \theta - 1} + \frac{\operatorname{cosec}^3 \theta}{\operatorname{cosec}^2 \theta - 1} = \sec \theta \cdot \operatorname{cosec} \theta (\sec \theta + \operatorname{cosec} \theta)$$

OR

- (b) If $\frac{\sec \alpha}{\operatorname{cosec} \beta} = p$ and $\frac{\tan \alpha}{\operatorname{cosec} \beta} = q$, then prove that $(p^2 - q^2) \sec^2 \alpha = p^2$.

- 27.** Find the area of the segment AYB shown in the figure, if the radius of the circle is 21 cm and $\angle AOB = 120^\circ$. [Use $\pi = \frac{22}{7}$]



- 28.** Two dice are thrown at the same time. Determine the probability that the
(i) sum of the numbers on the two dice is 5, and (ii) difference of the numbers on the two dice is 3.
- 29.** Prove that $\sqrt{5}$ is an irrational number.
- 30.** Find the coordinates of the points of trisection of the line segment joining the points A(-1, 4) and B(-3, -2).

31. (क) सिद्ध कीजिए कि वृत्त के किसी बिंदु पर स्पर्श रेखा, स्पर्श बिंदु से होकर जाने वाली त्रिज्या के लम्बवत होती है।

अथवा

- (ख) यदि एक समषट्भुज ABCDEF एक वृत्त के परिगत है, तो सिद्ध कीजिए कि $AB + CD + EF = BC + DE + FA$.

खण्ड घ

इस खण्ड में 4 दीर्घ-उत्तरीय (LA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक के 5 अंक हैं।

4×5=20

32. यदि निम्नलिखित बंटन का माध्यक 32.5 है, तो x और y के मान ज्ञात कीजिए।

वर्ग	बारंबारता
0 – 10	x
10 – 20	5
20 – 30	9
30 – 40	12
40 – 50	y
50 – 60	3
60 – 70	2
कुल	40

33. आरुष ने 2 पेंसिलें और 3 चॉकलेट ₹ 11 में खरीदीं तथा तनिष ने उसी दुकान से 1 पेंसिल और 2 चॉकलेट ₹ 7 में खरीदीं। इस स्थिति को रैखिक समीकरणों के युग्म के रूप में व्यक्त कीजिए। ग्राफीय विधि से 1 पेंसिल और 1 चॉकलेट का मूल्य ज्ञात कीजिए।

31. (a) Prove that the tangent at any point of a circle is perpendicular to the radius through the point of contact.

OR

- (b) If a regular hexagon ABCDEF circumscribes a circle, then prove that $AB + CD + EF = BC + DE + FA$.

SECTION D

This section has 4 Long Answer (LA) type questions carrying 5 marks each. $4 \times 5 = 20$

32. If the median of the following distribution is 32.5, then find the values of x and y.

<i>Class</i>	<i>Frequency</i>
0 – 10	x
10 – 20	5
20 – 30	9
30 – 40	12
40 – 50	y
50 – 60	3
60 – 70	2
Total	40

33. Aarush bought 2 pencils and 3 chocolates for ₹ 11 and Tanish bought 1 pencil and 2 chocolates for ₹ 7 from the same shop. Represent this situation in the form of a pair of linear equations. Find the price of 1 pencil and 1 chocolate, graphically.

34. (क) 600 km की उड़ान में, एक विमान खराब मौसम के कारण धीमा हो गया। यात्रा के लिए इसका औसत वेग, सामान्य वेग से 200 km/h कम हो गया और उड़ान का समय 30 मिनट बढ़ गया। उड़ान का निर्धारित समय ज्ञात कीजिए।

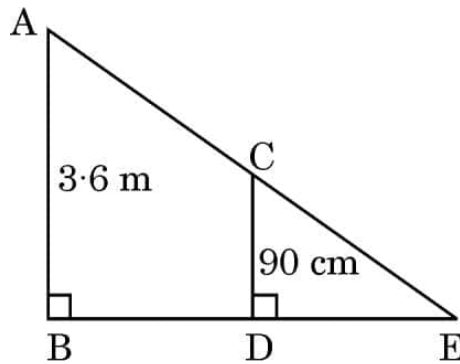
अथवा

- (ख) एक स्विमिंग पूल को भरने के लिए दो पाइपों का उपयोग किया जाता है। यदि बड़े व्यास वाले पाइप को 4 घंटे और छोटे व्यास वाले पाइप को 9 घंटे तक उपयोग किया जाए, तो केवल आधा पूल भरा जाता है। यदि छोटे व्यास वाला पाइप बड़े व्यास वाले पाइप की तुलना में पूल भरने में 10 घंटे अधिक लेता है, तो प्रत्येक पाइप को अलग-अलग पूल भरने में कितना समय लगेगा ?

35. (क) सिद्ध कीजिए कि यदि किसी त्रिभुज की एक भुजा के समान्तर एक रेखा खींची जाए जो अन्य दो भुजाओं को भिन्न बिंदुओं पर प्रतिच्छेद करे, तो अन्य दो भुजाएँ एक ही अनुपात में विभाजित होती हैं।

अथवा

- (ख) जैसा कि दिए गए चित्र में दर्शाया गया है, एक 90 cm लंबी लड़की एक लैंप पोस्ट के पाद से 1.2 m/s की चाल से दूर जा रही है। यदि लैंप जमीन से 3.6 m ऊपर है, तो 4 सेकंड बाद उसकी परछाई की लंबाई ज्ञात कीजिए।



34. (a) In a flight of 600 km, an aircraft slowed down its speed due to bad weather. Its average speed for the trip reduced by 200 km/h from its usual speed and time of flight increased by 30 minutes. Find the scheduled duration of the flight.

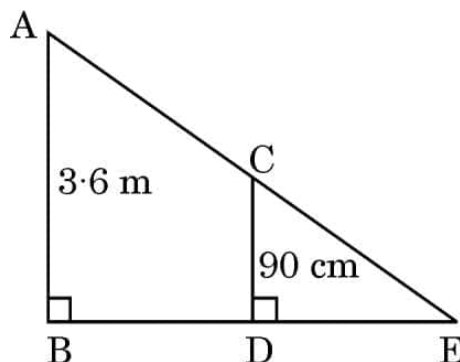
OR

- (b) Two pipes are used to fill a swimming pool. If the pipe of the larger diameter is used for 4 hours and the pipe of the smaller diameter for 9 hours, only half of the pool can be filled. Find how long it would take for each pipe to fill the pool, separately, if the pipe of smaller diameter takes 10 hours more than the pipe of larger diameter to fill the pool.

35. (a) Prove that if a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, then the other two sides are divided in the same ratio.

OR

- (b) As shown in the given figure, a girl of height 90 cm is walking away from the base of a lamp post at a speed of 1.2 m/s. If the lamp is 3.6 m above the ground, find the length of her shadow after 4 seconds.



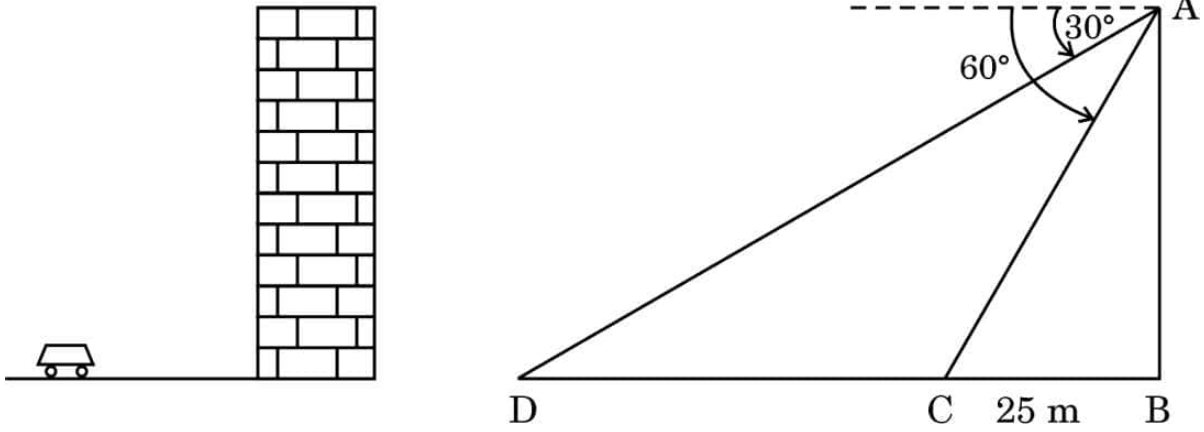
खण्ड ड

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

$3 \times 4 = 12$

प्रकरण अध्ययन – 1

- 36.** तेजस एक इमारत के शीर्ष पर खड़ा है और कार को 30° के अवनमन कोण पर देखता है, जो इमारत के पाद की ओर एकसमान चाल से आ रही है। 6 सेकंड बाद, अवनमन कोण बढ़कर 60° हो जाता है और उस समय कार इमारत से 25 m दूर है।



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

- | | | |
|-------|---|---|
| (i) | इमारत की ऊँचाई क्या है ? | 1 |
| (ii) | कार की दो स्थितियों के बीच की दूरी क्या है ? | 1 |
| (iii) | (क) कार को प्रारंभिक बिंदु से इमारत के पाद तक पहुँचने में कुल कितना समय लगेगा ? | 2 |

अथवा

- | | | |
|-------|---|---|
| (iii) | (ख) जब अवनमन कोण 60° होता है, तो प्रेक्षक से कार की दूरी क्या है ? | 2 |
|-------|---|---|

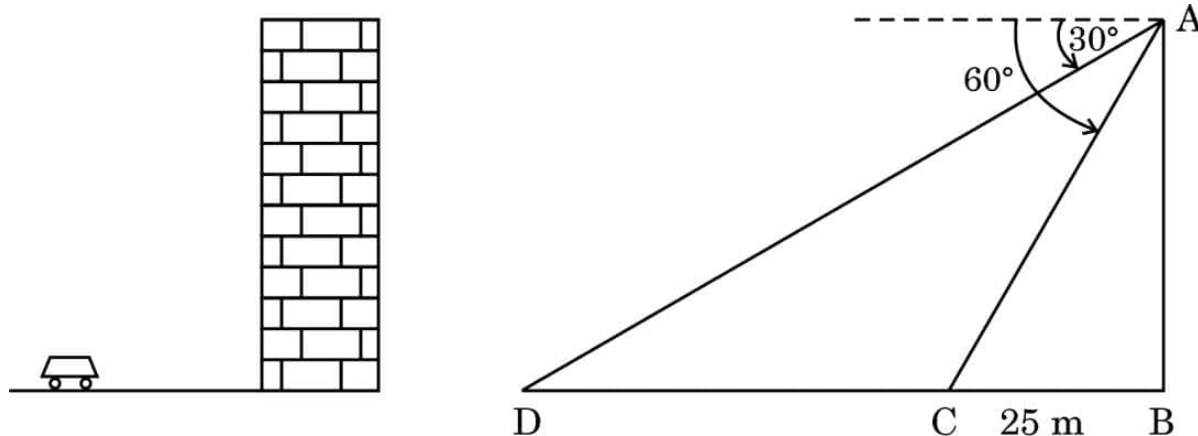
SECTION E

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

$3 \times 4 = 12$

Case Study - 1

- 36.** Tejas is standing at the top of a building and observes a car at an angle of depression of 30° as it approaches the base of the building at a uniform speed. 6 seconds later, the angle of depression increases to 60° , and at that moment, the car is 25 m away from the building.



Based on the information given above, answer the following questions :

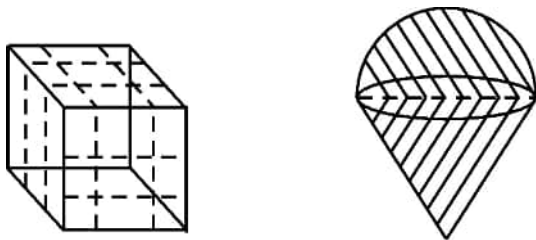
- (i) What is the height of the building ? 1
- (ii) What is the distance between the two positions of the car ? 1
- (iii) (a) What would be the total time taken by the car to reach the foot of the building from the starting point ? 2

OR

- (iii) (b) What is the distance of the observer from the car when it makes an angle of 60° ? 2

प्रकरण अध्ययन – 2

- 37.** एक रविवार को आपके माता-पिता आपको एक मेले में ले गए। आपने वहाँ बहुत सारे खिलौने देखे और आपने उनसे आपके लिए रूबिक क्यूब और स्ट्रॉबेरी आइसक्रीम खरीदने को कहा।



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

- (i) यदि रूबिक क्यूब के प्रत्येक किनारे की लंबाई 6 cm है, तो इसके विकर्ण की लंबाई ज्ञात कीजिए। 1
- (ii) यदि रूबिक क्यूब के प्रत्येक किनारे की लंबाई 7 cm है, तो इसका आयतन ज्ञात कीजिए। 1
- (iii) (क) यदि अर्धगोलाकार आइसक्रीम की आधार त्रिज्या 7 cm है, तो इसका वक्र पृष्ठीय क्षेत्रफल कितना है ? 2

अथवा

- (iii) (ख) यदि 4 cm किनारे वाले दो घनों को सिरे-से-सिरा मिलाकर जोड़ा जाए, तो बने घनाभ का पृष्ठीय क्षेत्रफल ज्ञात कीजिए। 2

प्रकरण अध्ययन – 3

- 38.** आपका बड़ा भाई एक कार खरीदना चाहता है और उसने कार के लिए बैंक से ऋण लेने की योजना बनाई। वह ₹ 1,18,000 की कुल ऋण राशि का भुगतान प्रथम किस्त ₹ 1,000 से शुरू करता है और प्रत्येक महीने किस्त में ₹ 100 की वृद्धि करता है।

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

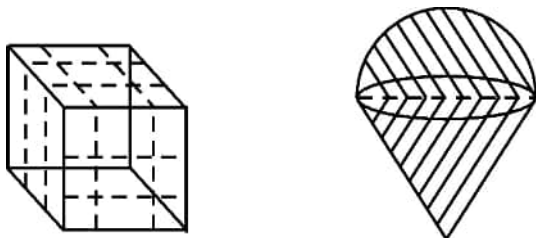
- (i) 30वीं किस्त में उसके द्वारा चुकाई गई राशि ज्ञात कीजिए। 1
- (ii) यदि किस्तों की कुल संख्या 40 है, तो अंतिम किस्त में चुकाई गई राशि कितनी है ? 1
- (iii) (क) 30वीं किस्त के बाद उसे अभी कितनी राशि चुकानी शेष है ? 2

अथवा

- (iii) (ख) 10वीं किस्त और अंतिम किस्त का अनुपात ज्ञात कीजिए। 2

Case Study – 2

37. On a Sunday your parents took you to a fair. You could see lot of toys displayed and you wanted them to buy a Rubik's cube and a strawberry ice-cream for you.



Based on the information given above, answer the following questions :

- (i) Find the length of the diagonal of Rubik's cube if each edge measures 6 cm. 1
- (ii) Find the volume of Rubik's cube if the length of the edge is 7 cm. 1
- (iii) (a) What is the curved surface area of hemisphere (ice-cream) if the base radius is 7 cm ? 2

OR

- (iii) (b) If two cubes of edges 4 cm are joined end-to-end, then find the surface area of the resulting cuboid. 2

Case Study – 3

38. Your elder brother wants to buy a car and plans to take a loan from a bank for his car. He repays his total loan of ₹ 1,18,000 by paying every month, starting with the first instalment of ₹ 1,000 and he increases the instalment by ₹ 100 every month.

Based on the information given above, answer the following questions :

- (i) Find the amount paid by him in the 30th instalment. 1
- (ii) If the total number of instalments is 40, what is the amount paid in the last instalment ? 1
- (iii) (a) What amount does he still have to pay after the 30th instalment ? 2

OR

- (iii) (b) Find the ratio of the tenth instalment to the last instalment. 2

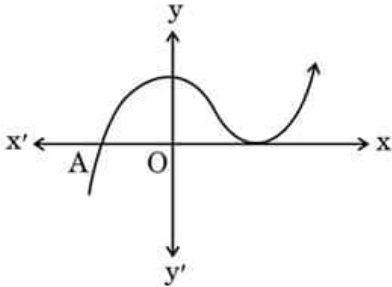
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Secondary School Examination, 2026
MATHEMATICS (STANDARD) (041) (PAPER CODE 30/2/2)

General Instructions: -

1.	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the Spot Evaluation Guidelines carefully.
2.	“Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, Evaluation done and several other aspects. It’s leakage to public in any manner could lead to derailment of the examination system and affect the life and future of millions of candidates. Sharing this policy/document to anyone, publishing in any magazine and printing in News Paper/Website etc. may invite action under various rules of the Board and 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.

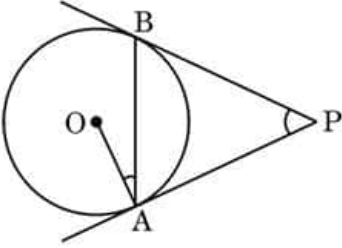
9.	If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note “Extra Question” .
10.	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
11.	A full scale of marks 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.

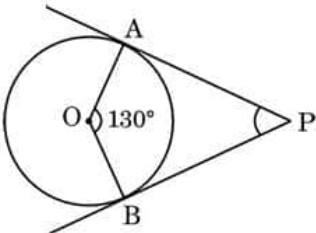
MARKING SCHEME
MATHEMATICS (Subject Code–041)
(PAPER CODE: 30/2/2)

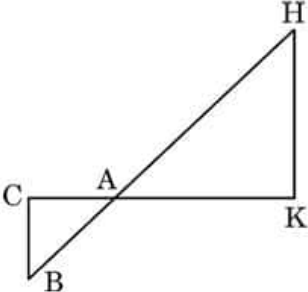
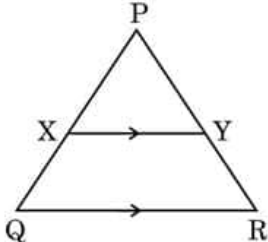
Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Step	Marks
	SECTION A This section has 20 Multiple Choice Questions (MCQs) carrying 1 mark each.		
1.	The graph of $y = f(x)$ is given. The number of distinct zeroes of $y = f(x)$ is :  (A) 0 (B) 1 (C) 2 (D) 3		
Sol.	(C) 2		1
2.	There are two sections A and B of Grade X. There are 28 students in Section A and 30 students in Section B. What is the minimum number of books you will acquire for the class library so that they can be distributed equally among students of Section A or Section B ? (A) 144 (B) 2 (C) 420 (D) 272		
Sol.	(C) 420		1
3.	The pair of linear equations $\frac{3x}{2} + \frac{5y}{3} = 7$ and $9x + 10y = 14$, is : (A) consistent (B) inconsistent (C) consistent with one solution (D) consistent with many solutions		
Sol.	(B) Inconsistent		1
4.	The natural number 1 is : (A) a prime number. (B) a composite number. (C) prime as well as composite. (D) neither prime nor composite.		
Sol.	(D) neither prime nor composite		1

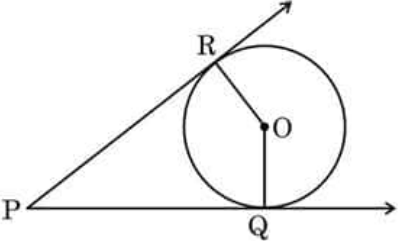
5.	The value of x for which $2x$, $(x + 10)$ and $(3x + 2)$ are the three consecutive terms of an A.P. is : (A) 6 (B) - 6 (C) 18 (D) - 18		
Sol.	(A) 6		1
6.	For any natural number n , 5^n ends with the digit : (A) 0 (B) 5 (C) 3 (D) 2		
Sol.	(B) 5		1
7.	In triangles ABC and PQR, $\angle A = \angle Q$ and $\angle B = \angle R$, then $AB : AC$ is equal to : (A) PQ : PR (B) PQ : QR (C) QR : QP (D) PR : QR		
Sol.	(C) QR : QP		1
8.	If α and β are two zeroes of a polynomial $f(x) = px^2 - 2x + 3p$ and $\alpha + \beta = \alpha\beta$, then value of p is : (A) $-\frac{2}{3}$ (B) $\frac{2}{3}$ (C) $\frac{1}{3}$ (D) $-\frac{1}{3}$		
Sol.	(B) $\frac{2}{3}$		1
9.	The mean and median of a frequency distribution are 43 and 43.4 respectively. The mode of the distribution is : (A) 43.4 (B) 42.4 (C) 44.2 (D) 49.3		
Sol.	(C) 44.2		1

10.	If the distance between the points (4, p) and (1, 0) is 5, then p is equal to : (A) ± 4 (B) 4 (C) -4 (D) 0		
Sol.	(A) ± 4		1
11.	A hemispherical bowl is made of steel of thickness 1 cm. The outer radius of the bowl is 6 cm. The volume of steel used (in cm^3) is : (A) 182π (B) $\frac{182}{3}\pi$ (C) $\frac{682}{3}\pi$ (D) $\frac{364}{3}\pi$		
Sol.	(B) $\frac{182}{3}\pi$		1
12.	If $\cos A = \frac{4}{5}$, then the value of $\tan A$ is : (A) $\frac{3}{5}$ (B) $\frac{3}{4}$ (C) $\frac{4}{3}$ (D) $\frac{5}{3}$		
Sol.	(B) $\frac{3}{4}$		1
13.	Area of a segment of a circle of radius 'r' and central angle 60° is : (A) $\frac{\pi r^2}{2} - \frac{1}{2}r^2$ (B) $\frac{2\pi r}{4} - \frac{\sqrt{3}}{4}r^2$ (C) $\frac{\pi r^2}{6} - \frac{\sqrt{3}}{4}r^2$ (D) $\frac{2\pi r}{4} - r^2 \sin 60^\circ$		
Sol.	(C) $\frac{\pi r^2}{6} - \frac{\sqrt{3}}{4}r^2$		1

14.	If $2 \sin A = 1$, then the value of $\tan A + \cot A$ is : (A) $\sqrt{3}$ (B) $\frac{4}{\sqrt{3}}$ (C) $\frac{\sqrt{3}}{2}$ (D) 1		
Sol.	(B) $\frac{4}{\sqrt{3}}$		1
15.	In the given figure, PA and PB are tangents to a circle centred at O. If $\angle OAB = 15^\circ$, then $\angle APB$ equals :  (A) 30° (B) 15° (C) 45° (D) 10°		
Sol.	(A) 30°		1
16.	From a point on the ground, which is 60 m away from the foot of a vertical tower, the angle of elevation of the top of the tower is found to be 45°. The height (in metres) of the tower is : (A) $10\sqrt{3}$ (B) $30\sqrt{3}$ (C) 60 (D) 30		
Sol.	(C) 60		1
17.	The probability for a randomly selected number out of 1, 2, 3, 4, ..., 25 to be a composite number is : (A) $\frac{15}{25}$ (B) $\frac{10}{25}$ (C) $\frac{11}{25}$ (D) $\frac{9}{25}$		
Sol.	(A) $\frac{15}{25}$		1

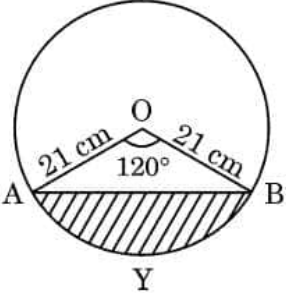
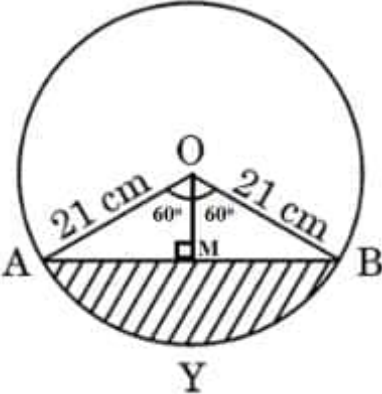
18.	In the given figure, PA and PB are tangents to a circle centred at O. If $\angle AOB = 130^\circ$, then $\angle APB$ is equal to :  (A) 130° (B) 50° (C) 120° (D) 90°		
Sol.	(B) 50°		1
	<i>Questions number 19 and 20 are Assertion and Reason based questions. Two statements are given, one labelled as 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.</i> (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 mean of first 'n' natural numbers is $\frac{n-1}{2}$. Reason (R): The sum of first 'n' natural numbers is $\frac{n(n+1)}{2}$.		
Sol.	(D) Assertion (A) is false, but Reason (R) is true		1
20.	Assertion (A) : The surface area of the cuboid formed by joining two cubes of sides 4 cm each, end-to-end, is 160 cm^2. Reason (R): The surface area of a cuboid of dimensions $l \times b \times h$ is $(2lb + 2bh + 2hl)$.		
Sol.	(C) Assertion (A) is true, but Reason (R) is false		1

	SECTION B This section has 5 Very Short Answer (VSA) type questions carrying 2 marks each.		
21(a)	In the given figure, $\Delta AHK \sim \Delta ABC$. If $AK = 10$ cm, $BC = 3.5$ cm and $HK = 7$ cm, find the length of AC. 		
Sol.	$\Delta AHK \sim \Delta ABC$		
	$\frac{AK}{AC} = \frac{HK}{BC}$	I	1
	$\Rightarrow \frac{10}{AC} = \frac{7}{3.5}$	II	$\frac{1}{2}$
	$\Rightarrow AC = 5$ cm	III	$\frac{1}{2}$
	OR		
21(b)	In the given figure, $XY \parallel QR$, $\frac{PQ}{XQ} = \frac{7}{3}$ and $PR = 6.3$ cm. Find the length of YR. 		
Sol.	$XY \parallel QR$		
	$\frac{PQ}{XQ} = \frac{PR}{YR}$	I	1
	$\Rightarrow \frac{7}{3} = \frac{6.3}{YR}$	II	$\frac{1}{2}$
	$\Rightarrow YR = 2.7$ cm	III	$\frac{1}{2}$

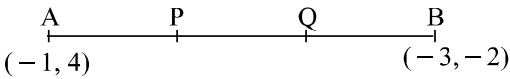
22 (a)	Evaluate : $\frac{5 \cos^2 60^\circ + 4 \sec^2 30^\circ - \tan^2 45^\circ}{\sin^2 30^\circ + \cos^2 30^\circ}$		
Sol.	$\frac{5 \cos^2 60^\circ + 4 \sec^2 30^\circ - \tan^2 45^\circ}{\sin^2 30^\circ + \cos^2 30^\circ}$		
	$= \frac{5 \left(\frac{1}{2}\right)^2 + 4 \left(\frac{2}{\sqrt{3}}\right)^2 - (1)^2}{1}$	I	1½
	$= \frac{67}{12}$	II	½
	OR		
22(b)	Prove that : $1 + \frac{\cot^2 \alpha}{1 + \operatorname{cosec} \alpha} = \operatorname{cosec} \alpha$		
Sol.	$\text{LHS} = 1 + \frac{\cot^2 \alpha}{1 + \operatorname{cosec} \alpha}$		
	$= 1 + \frac{(\operatorname{cosec} \alpha + 1)(\operatorname{cosec} \alpha - 1)}{(1 + \operatorname{cosec} \alpha)}$	I	1
	$= 1 + \operatorname{cosec} \alpha - 1$	II	½
	$= \operatorname{cosec} \alpha = \text{RHS}$	III	½
23.	In the given figure, O is the centre of the circle. PQ and PR are tangents. Show that the quadrilateral PQOR is cyclic. 		
Sol.	As radius is perpendicular to tangent,		
	$\angle PQO = 90^\circ, \angle PRO = 90^\circ$	I	1
	$\therefore \angle PQO + \angle PRO = 180^\circ$	II	½
	One pair of opposite angles is supplementary	III	½
	$\therefore \text{Quadrilateral PQOR is cyclic}$		

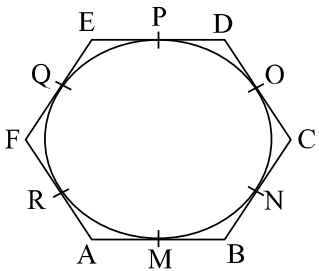
24	Find the value of p, for which one zero of the quadratic polynomial $px^2 - 14x + 8$ is 6 times the other.		
Sol.	Let the zeroes be α and 6α		
	Sum of zeroes $= \alpha + 6\alpha = \frac{14}{p}$	I	$\frac{1}{2}$
	$\Rightarrow \alpha = \frac{2}{p}$	II	$\frac{1}{2}$
	Product of zeroes $= \alpha \times 6\alpha = \frac{8}{p}$	III	$\frac{1}{2}$
	$\Rightarrow 6 \times \left(\frac{2}{p}\right)^2 = \frac{8}{p}$		
	$\Rightarrow p = 3$	IV	$\frac{1}{2}$
25	If the points A(4, 5), B(m, 6), C(4, 3) and D(1, n) taken in this order are the vertices of a parallelogram ABCD, then find the values of m and n.		
Sol.	Coordinates of mid-point of AC = Coordinates of mid-point of BD		
	$\left(\frac{4+4}{2}, \frac{5+3}{2}\right) = \left(\frac{1+m}{2}, \frac{n+6}{2}\right)$	I	1
	$m = 7$	II	$\frac{1}{2}$
	$n = 2$	III	$\frac{1}{2}$

	SECTION C This section has 6 Short Answer (SA) type questions carrying 3 marks each.		
26 (a)	Prove that : $\frac{\sec^3 \theta}{\sec^2 \theta - 1} + \frac{\operatorname{cosec}^3 \theta}{\operatorname{cosec}^2 \theta - 1} = \sec \theta \cdot \operatorname{cosec} \theta (\sec \theta + \operatorname{cosec} \theta)$		
Sol.	LHS $= \frac{\sec^3 \theta}{(\sec^2 \theta - 1)} + \frac{\operatorname{cosec}^3 \theta}{(\operatorname{cosec}^2 \theta - 1)}$		
	$= \frac{\sec^3 \theta}{\tan^2 \theta} + \frac{\operatorname{cosec}^3 \theta}{\cot^2 \theta}$	I	1
	$= \frac{1}{\cos^3 \theta} \times \frac{\cos^2 \theta}{\sin^2 \theta} + \frac{1}{\sin^3 \theta} \times \frac{\sin^2 \theta}{\cos^2 \theta}$	II	$\frac{1}{2}$
	$= \frac{1}{\cos \theta \sin^2 \theta} + \frac{1}{\sin \theta \cos^2 \theta}$	III	$\frac{1}{2}$
	$= \frac{1}{\sin \theta \cos \theta} \left[\frac{1}{\sin \theta} + \frac{1}{\cos \theta} \right]$	IV	$\frac{1}{2}$
	$= \sec \theta \cdot \operatorname{cosec} \theta (\sec \theta + \operatorname{cosec} \theta) = \text{RHS}$	V	$\frac{1}{2}$

	OR		
26 (b)	If $\frac{\sec \alpha}{\operatorname{cosec} \beta} = p$ and $\frac{\tan \alpha}{\operatorname{cosec} \beta} = q$, then prove that $(p^2 - q^2) \sec^2 \alpha = p^2$.		
Sol.	LHS = $(p^2 - q^2) \sec^2 \alpha$		
	$= \left(\frac{\sec^2 \alpha}{\operatorname{cosec}^2 \beta} - \frac{\tan^2 \alpha}{\operatorname{cosec}^2 \beta} \right) \times \sec^2 \alpha$	I	$\frac{1}{2}$
	$= \left(\frac{\sec^2 \alpha - \tan^2 \alpha}{\operatorname{Cosec}^2 \beta} \right) \times \sec^2 \alpha$	II	1
	$= \left(\frac{1}{\operatorname{cosec}^2 \beta} \right) \times \sec^2 \alpha$	III	1
	$= p^2 = \text{RHS}$	IV	$\frac{1}{2}$
27.	Find the area of the segment AYB shown in the figure, if the radius of the circle is 21 cm and $\angle AOB = 120^\circ$. [Use $\pi = \frac{22}{7}$]		
			
Sol.	Area of segment AYB = ar (sector AOBY) – ar (ΔAOB)		
	$= \frac{120}{360} \times \frac{22}{7} \times 21 \times 21 - 21 \times 21 \times \sin 60^\circ \cos 60^\circ$	I	2
	$= 462 - 441 \times \frac{\sqrt{3}}{2} \times \frac{1}{2}$	II	$\frac{1}{2}$
	$= \left(462 - 441 \frac{\sqrt{3}}{4} \right) \text{ cm}^2$	III	$\frac{1}{2}$
	or $\frac{21}{4} (88 - 21\sqrt{3}) \text{ cm}^2$		
	ALTERNATE SOLUTION:		
			

	Area of sector AOBY = $\frac{120}{360} \times \frac{22}{7} \times 21 \times 21$		
	= 462 cm ² -----(i)	I	½
	Draw OM ⊥ AB, ∴ ∠ AOM = 60°		
	$\cos 60^\circ = \frac{1}{2} = \frac{OM}{21}$		
	⇒ OM = $\frac{21}{2}$ cm	II	½
	$\sin 60^\circ = \frac{\sqrt{3}}{2} = \frac{AM}{21}$		
	⇒ AM = $\frac{21\sqrt{3}}{2}$ cm	III	½
	⇒ AB = 21√3 cm	V	½
	∴ ar (ΔAOB) = $\frac{1}{2} \times 21\sqrt{3} \times \frac{21}{2}$		
	= $\frac{441}{4}\sqrt{3}$ cm ² ----- (ii)	VI	½
	Area of segment AYB = ar (sector AOBY) – ar (ΔAOB)		
	= $\left(462 - 441\frac{\sqrt{3}}{4}\right)$ cm ²	VII	½
	or $\frac{21}{4} (88 - 21\sqrt{3})$ cm ²		
28.	Two dice are thrown at the same time. Determine the probability that the (i) sum of the numbers on the two dice is 5, and (ii) difference of the numbers on the two dice is 3.		
Sol.	Total outcomes = 36	I	½
	(i) Number of outcomes with sum of the numbers on the two dice is 5 = 4		
	(1,4) (4,1) (2,3) (3,2)		
	P(sum of the numbers on two dice is 5) = $\frac{4}{36}$ or $\frac{1}{9}$	II	1
	(ii) Number of outcomes with difference of the numbers on the two dice is 3= 6		
	(1,4) (4,1) (5,2) (2,5) (6,3) (3,6)		
	P(difference of the numbers on the two dice is 3) = $\frac{6}{36}$ or $\frac{1}{6}$	III	1½
29.	Prove that $\sqrt{5}$ is an irrational number.		
Sol.	Let $\sqrt{5}$ be a rational number.		
	∴ $\sqrt{5} = \frac{p}{q}$, where q ≠ 0 and p & q are coprime.	I	½

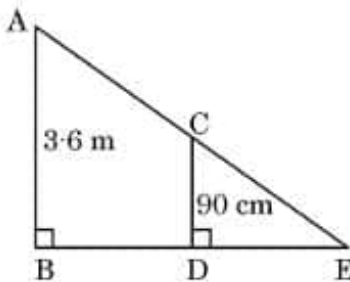
	$5q^2 = p^2 \Rightarrow p^2$ is divisible by 5 $\Rightarrow p$ is divisible by 5 ----- (i)	II	1
	Let $p = 5a$, where 'a' is some integer		
	$25a^2 = 5q^2 \Rightarrow q^2 = 5a^2 \Rightarrow q^2$ is divisible by 5 $\Rightarrow q$ is divisible by 5 --- (ii)	III	1
	(i) and (ii) leads to contradiction as 'p' and 'q' are coprime	IV	$\frac{1}{2}$
	$\therefore \sqrt{5}$ is an irrational number.		
30.	Find the coordinates of the points of trisection of the line segment joining the points A(- 1, 4) and B(- 3, - 2).		
Sol.			
	Let P and Q be the points of trisection of AB, therefore AP :PB = 1:2		
	Coordinates of P = $\left(\frac{1(-3)+2(-1)}{3}, \frac{1(-2)+2(4)}{3} \right)$	I	1
	$= \left(\frac{-5}{3}, 2 \right)$	II	$\frac{1}{2}$
	Q is the mid-point of PB		
	Coordinates of Q = $\left(\frac{\frac{-5}{3}+(-3)}{2}, \frac{2+(-2)}{2} \right)$	III	1
	$= \left(\frac{-7}{3}, 0 \right)$	IV	$\frac{1}{2}$
31(a)	Prove that the tangent at any point of a circle is perpendicular to the radius through the point of contact.		
Sol.	for correct figure	I	1
	for correct Given, To Prove	II	$\frac{1}{2}$
	for correct Proof	III	$1\frac{1}{2}$
	OR		

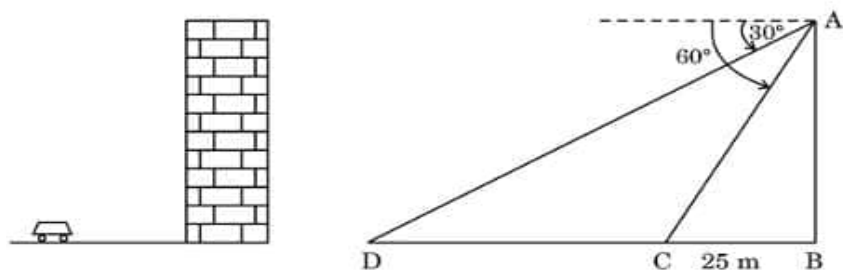
31(b)	If a regular hexagon ABCDEF circumscribes a circle, then prove that $AB + CD + EF = BC + DE + FA$.		
Sol.			
	correct figure	I	$\frac{1}{2}$
	$ \begin{array}{l} AM = AR \\ BM = BN \\ CN = CO \\ DO = DP \\ EQ = EP \\ FQ = FR \end{array} \left. \vphantom{\begin{array}{l} AM = AR \\ BM = BN \\ CN = CO \\ DO = DP \\ EQ = EP \\ FQ = FR \end{array}} \right\} $	II	1
	LHS = $AB + CD + EF = (AM + BM) + (CO + OD) + (EQ + QF)$	III	$\frac{1}{2}$
	$= AR + BN + CN + DP + EP + EP + FR$	IV	$\frac{1}{2}$
	$= (AR + FR) + (BN + CN) + (DP + EP)$		
	$= BC + DE + FA = \text{RHS}$	V	$\frac{1}{2}$

	SECTION D																														
	This section has 4 Long Answer (LA) type questions carrying 5 marks each.																														
32.	If the median of the following distribution is 32.5, then find the values of x and y. <table><tr><th>Class</th><th>Frequency</th></tr><tr><td>0 – 10</td><td>x</td></tr><tr><td>10 – 20</td><td>5</td></tr><tr><td>20 – 30</td><td>9</td></tr><tr><td>30 – 40</td><td>12</td></tr><tr><td>40 – 50</td><td>y</td></tr><tr><td>50 – 60</td><td>3</td></tr><tr><td>60 – 70</td><td>2</td></tr><tr><td>Total</td><td>40</td></tr></table>		Class	Frequency	0 – 10	x	10 – 20	5	20 – 30	9	30 – 40	12	40 – 50	y	50 – 60	3	60 – 70	2	Total	40											
Class	Frequency																														
0 – 10	x																														
10 – 20	5																														
20 – 30	9																														
30 – 40	12																														
40 – 50	y																														
50 – 60	3																														
60 – 70	2																														
Total	40																														
Sol.	<table><tr><td>Class</td><td>f</td><td>cf</td></tr><tr><td>0 - 10</td><td>x</td><td>x</td></tr><tr><td>10 - 20</td><td>5</td><td>5+x</td></tr><tr><td>20 - 30</td><td>9</td><td>14+x</td></tr><tr><td>30 - 40</td><td>12</td><td>26+x</td></tr><tr><td>40 - 50</td><td>y</td><td>26+x+y</td></tr><tr><td>50 - 60</td><td>3</td><td>29+x+y</td></tr><tr><td>60 - 70</td><td>2</td><td>31+x+y</td></tr><tr><td>Total</td><td>40</td><td></td></tr></table>		Class	f	cf	0 - 10	x	x	10 - 20	5	5+x	20 - 30	9	14+x	30 - 40	12	26+x	40 - 50	y	26+x+y	50 - 60	3	29+x+y	60 - 70	2	31+x+y	Total	40			
Class	f	cf																													
0 - 10	x	x																													
10 - 20	5	5+x																													
20 - 30	9	14+x																													
30 - 40	12	26+x																													
40 - 50	y	26+x+y																													
50 - 60	3	29+x+y																													
60 - 70	2	31+x+y																													
Total	40																														
	Correct table	I	1½																												
	31+ x + y = 40																														
	⇒ x + y = 9-----(i)	II	1																												
	Median class = 30 – 40	III	½																												
	Median = 32.5 = 30 + $\frac{20-(14+ x)}{12} \times 10$	IV	1																												
	⇒ x = 3	V	½																												
	⇒ y = 6	VI	½																												

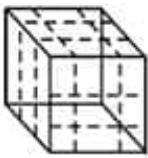
33	Aarush bought 2 pencils and 3 chocolates for ₹ 11 and Tanish bought 1 pencil and 2 chocolates for ₹ 7 from the same shop. Represent this situation in the form of a pair of linear equations. Find the price of 1 pencil and 1 chocolate, graphically.		
Sol.	Let the cost of 1 pencil be ₹ x		
	Let the cost of 1 chocolate be ₹ y		
	$2x + 3y = 11$	I	1
	$x + 2y = 7$	II	1
	for correct graph of $2x + 3y = 11$	III	1
	for correct graph of $x + 2y = 7$	IV	1
	$x = 1, y = 3$	V	$\frac{1}{2} + \frac{1}{2}$
	$\therefore$ Cost of 1 pencil = ₹ 1 and Cost of 1 chocolate = ₹ 3		
34(a)	In a flight of 600 km, an aircraft slowed down its speed due to bad weather. Its average speed for the trip reduced by 200 km/h from its usual speed and time of flight increased by 30 minutes. Find the scheduled duration of the flight.		
Sol.	Let the average speed of the aircraft be x km/h		
	Time taken by aircraft = $\frac{600}{x}$		
	Time taken by aircraft when flight is delayed by 30 min = $\frac{600}{x-200}$		

	$\frac{600}{x-200} - \frac{600}{x} = \frac{1}{2}$	I	2
	$\Rightarrow x^2 - 200x - 240000 = 0$	II	1
	$\Rightarrow (x - 600)(x + 400) = 0$	III	1
	$\Rightarrow x = 600, x = -400$		
	$x = -400 \text{ (rejected)}$		
	$\therefore x = 600$	IV	$\frac{1}{2}$
	$\therefore \text{Scheduled duration of the flight} = \frac{600}{600} = 1 \text{ hour}$	V	$\frac{1}{2}$
	OR		
34(b)	Two pipes are used to fill a swimming pool. If the pipe of the larger diameter is used for 4 hours and the pipe of the smaller diameter for 9 hours, only half of the pool can be filled. Find how long it would take for each pipe to fill the pool, separately, if the pipe of smaller diameter takes 10 hours more than the pipe of larger diameter to fill the pool.		
Sol.	Let time taken to fill the pool by larger diameter pipe alone be x hours		
	Time taken to fill the pool by smaller diameter pipe alone = (x + 10) hours		
	$\frac{4}{x} + \frac{9}{x+10} = \frac{1}{2}$	I	2
	$\Rightarrow x^2 - 16x - 80 = 0$	II	1
	$\Rightarrow (x + 4)(x - 20) = 0$	III	1
	$\Rightarrow x = -4, x = 20$		
	$x = -4 \text{ (rejected)}$		
	$\therefore x = 20$	IV	$\frac{1}{2}$
	Time taken to fill the pool by larger diameter pipe alone = 20 hours		
	Time taken to fill the pool by smaller diameter pipe alone = 30 hours	V	$\frac{1}{2}$
35 (a)	Prove that if a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, then the other two sides are divided in the same ratio.		
Sol.	for correct figure, given, To prove, construction	I	2
	for correct Proof	II	3
	OR		

35 (b)	As shown in the given figure, a girl of height 90 cm is walking away from the base of a lamp post at a speed of 1.2 m/s. If the lamp is 3.6 m above the ground, find the length of her shadow after 4 seconds. 		
Sol.	BD = speed $\times$ time = $1.2 \times 4 = 4.8$ m	I	1
	$\triangle ABE \sim \triangle CDE$	II	2
	$\Rightarrow \frac{BE}{DE} = \frac{AB}{CD}$	III	$\frac{1}{2}$
	$\Rightarrow \frac{4.8 + DE}{DE} = \frac{3.6}{0.9}$	IV	1
	$\Rightarrow DE = 1.6$ m	V	$\frac{1}{2}$
	$\therefore$ Shadow of the girl after walking for 4 seconds is 1.6 m long		

SECTION E			
This section has 3 case study based questions carrying 4 marks each.			
36.	Tejas is standing at the top of a building and observes a car at an angle of depression of 30° as it approaches the base of the building at a uniform speed. 6 seconds later, the angle of depression increases to 60°, and at that moment, the car is 25 m away from the building. 		

	Based on the information given above, answer the following questions : (i) What is the height of the building ? (ii) What is the distance between the two positions of the car ? (iii) (a) What would be the total time taken by the car to reach the foot of the building from the starting point ? OR (iii) (b) What is the distance of the observer from the car when it makes an angle of 60° ?		
Sol.	The diagram shows a right-angled triangle ABC where AB is the building of height 25 m, BC is the distance from the base to the car at 25 m, and AC is the line of sight from the car to the top of the building. The angle of depression from A to C is 60°. A horizontal dashed line is drawn from A to the left, and the angle between this line and the line of sight from A to D is 30°. The angle of elevation from D to A is 30°. The car is at point C, and the observer is at point D.		
	(i) In $\triangle ABC$,		
	$\tan 60^\circ = \sqrt{3} = \frac{AB}{25}$	I	$\frac{1}{2}$
	$\Rightarrow AB = 25\sqrt{3}$	II	$\frac{1}{2}$
	$\therefore$ Height of building = $25\sqrt{3}$ m		
	(ii) In $\triangle ABD$,		
	$\tan 30^\circ = \frac{1}{\sqrt{3}} = \frac{25\sqrt{3}}{BD}$	I	$\frac{1}{2}$
	$\Rightarrow BD = 75$		
	$\therefore$ Distance between two positions of car = $75 - 25 = 50$ m	II	$\frac{1}{2}$
	(iii) (a) Time taken to cover the distance of 50 m = 6 sec		
	Time taken to cover the distance of 75 m = $\frac{6}{50} \times 75$	I	1
	= 9 sec	II	1
	OR		
	(iii) (b) In $\triangle ABC$,		
	$\cos 60^\circ = \frac{BC}{AC}$	I	1

	$\Rightarrow \frac{1}{2} = \frac{25}{AC}$		
	$\Rightarrow AC = 50$	II	1
	$\therefore$ Distance of the observer from car when it makes the angle of $60^\circ = 50$ m		
37.	On a Sunday your parents took you to a fair. You could see lot of toys displayed and you wanted them to buy a Rubik's cube and a strawberry ice-cream for you.   Based on the information given above, answer the following questions : (i) Find the length of the diagonal of Rubik's cube if each edge measures 6 cm. (ii) Find the volume of Rubik's cube if the length of the edge is 7 cm. (iii) (a) What is the curved surface area of hemisphere (ice-cream) if the base radius is 7 cm ? OR (iii) (b) If two cubes of edges 4 cm are joined end-to-end, then find the surface area of the resulting cuboid.		
Sol.	(i) Length of diagonal of cube = $\sqrt{3} \times \text{side}$		
	$= 6\sqrt{3}$ cm	I	1
	(ii) Volume of Rubik's cube = $(7)^3$		
	$= 343 \text{ cm}^3$	I	1
	(iii) (a) CSA of hemisphere = $2 \times \frac{22}{7} \times 7 \times 7$	I	1
	$= 308 \text{ cm}^2$	II	1
	OR		
	(iii) (b) Surface area of resulting cuboid = $5(4)^2 + 5(4)^2$	I	1
	$= 160 \text{ cm}^2$	II	1
	ALTERNATE SOLUTION :		
	(iii) (b) Surface area of resulting cuboid = $2(8 \times 4 + 4 \times 4 + 8 \times 4)$	I	1
	$= 160 \text{ cm}^2$	II	1

38.	Your elder brother wants to buy a car and plans to take a loan from a bank for his car. He repays his total loan of ₹ 1,18,000 by paying every month, starting with the first instalment of ₹ 1,000 and he increases the instalment by ₹ 100 every month. Based on the information given above, answer the following questions : (i) Find the amount paid by him in the 30th instalment. (ii) If the total number of instalments is 40, what is the amount paid in the last instalment ? (iii) (a) What amount does he still have to pay after the 30th instalment ? OR (iii) (b) Find the ratio of the tenth instalment to the last instalment.		
Sol.	a = 1000, d = 100		
	(i) $a_{30} = 1000 + 29(100)$		
	= 3900	I	1
	Amount paid in 30 th instalment = ₹ 3900		
	(ii) $a_{40} = 1000 + 39(100)$		
	= 4900	I	1
	Amount paid in last instalment = ₹ 4900		
	(iii) (a) $S_{30} = \frac{30}{2} \times [2(1000) + 29 \times 100]$		
	= 73500	I	1
	Amount still he has to pay = 118000 – 73500 = ₹ 44500	II	1
	OR		
	(iii) (b) $\frac{a_{10}}{a_{40}} = \frac{1000+900}{1000+3900}$	I	1
	= $\frac{1900}{4900}$		
	= $\frac{19}{49}$	II	1
	The ratio is 19:49		