Series : 2LKNM **SET ~ 3**

रोल नं.
Roll No.

प्रश्न-पत्र कोड
Q.P. Code **30/2/3**

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 **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* *अधिकतम अंक : **80***

*Time allowed : **3** hours* *Maximum Marks : **80***

सामान्य निर्देश :

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

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

(ii) *यह प्रश्न-पत्र **पाँच** खण्डों में विभाजित है – **क, ख, ग, घ** 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. बिंदु A(4a, 3a) की x-अक्ष से दूरी है :

(A) 3a (B) – 3a

(C) 4a (D) – 4a

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 distance of the point A(4a, 3a) from x-axis is :

(A) 3a (B) – 3a

(C) 4a (D) – 4a

2. 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।

3. यदि $\cot \theta = 3$ है, तो $\cos \theta$ का मान है :

(A) $\frac{1}{3}$ (B) $\frac{1}{\sqrt{10}}$

(C) $\frac{3}{\sqrt{10}}$ (D) $\frac{\sqrt{10}}{3}$

4. किसी प्राकृत संख्या n के लिए, 5^n का इकाई अंक होता है :

(A) 0 (B) 5

(C) 3 (D) 2

5. 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

6. 960 और 240 का लघुत्तम समापवर्त्य (LCM) है :

(A) 960

(B) 240

(C) 60

(D) 15

2. The natural number 1 is :

(A) a prime number.

(B) a composite number.

(C) prime as well as composite.

(D) neither prime nor composite.

3. Given $\cot \theta = 3$, the value of $\cos \theta$ is :

(A) $\frac{1}{3}$ (B) $\frac{1}{\sqrt{10}}$

(C) $\frac{3}{\sqrt{10}}$ (D) $\frac{\sqrt{10}}{3}$

4. For any natural number n, 5^n ends with the digit :

(A) 0 (B) 5

(C) 3 (D) 2

5. 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

6. The LCM of 960 and 240 is :

(A) 960

(B) 240

(C) 60

(D) 15

7. 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) $30\sqrt{3}$

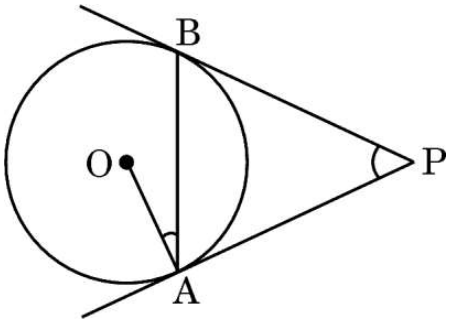
(C) 60 (D) 30

8. $p(x) = (x - 2)(x + 3)$ के कितने शून्यक हैं ?

(A) शून्य (B) एक

(C) दो (D) तीन

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



(A) 30° (B) 15°

(C) 45° (D) 10°

10. 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) $-\frac{1}{3}$

7. 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) $30\sqrt{3}$

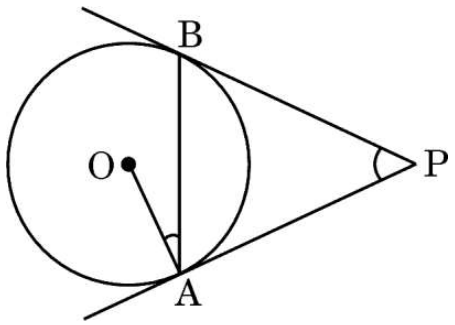
(C) 60 (D) 30

8. How many zeroes does $p(x) = (x - 2)(x + 3)$ have ?

(A) Zero (B) One

(C) Two (D) Three

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



(A) 30° (B) 15°

(C) 45° (D) 10°

10. 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 :

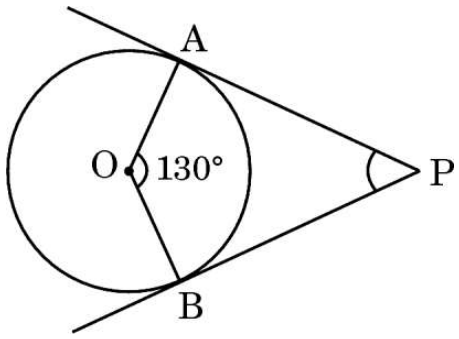
(A) $-\frac{2}{3}$

(B) $\frac{2}{3}$

(C) $\frac{1}{3}$

(D) $-\frac{1}{3}$

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



(A) $130°$

(B) $50°$

(C) $120°$

(D) $90°$

12. यदि रैखिक समीकरणों का युग्म : $a_1x + b_1y + c_1 = 0$ और $a_2x + b_2y + c_2 = 0$ संगत एवं आश्रित है, तो :

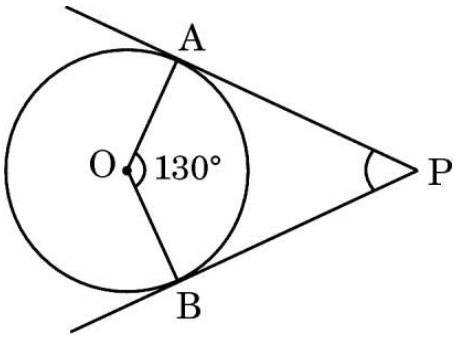
(A) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

(B) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2} = \frac{c_1}{c_2}$

(C) $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

(D) $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

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



(A) $130°$

(B) $50°$

(C) $120°$

(D) $90°$

12. If the pair of linear equations : $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ is consistent and dependent, then

(A) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

(B) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2} = \frac{c_1}{c_2}$

(C) $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

(D) $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

13. 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) $182\,\pi$

(B) $\frac{182}{3}\pi$

(C) $\frac{682}{3}\pi$

(D) $\frac{364}{3}\pi$

14. निम्नलिखित में से कौन-सा अनुक्रम एक समांतर श्रेढ़ी (A.P.) ***नहीं*** है ?

(A) $2, \frac{5}{2}, 3, \frac{7}{2}, \ldots$

(B) $-1{\cdot}2, -3{\cdot}2, -5{\cdot}2, -7{\cdot}2, \ldots$

(C) $\sqrt{2}, \sqrt{8}, \sqrt{18}, \ldots$

(D) $1^2, 3^2, 5^2, 7^2, \ldots$

15. व्यास 'd' वाले अर्धवृत्त का क्षेत्रफल है :

(A) $\frac{\pi d^2}{16}$ (B) $\frac{\pi d^2}{4}$

(C) $\frac{\pi d^2}{8}$ (D) $\frac{\pi d^2}{2}$

13. 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) $182\,\pi$

(B) $\frac{182}{3}\pi$

(C) $\frac{682}{3}\pi$

(D) $\frac{364}{3}\pi$

14. Which of the following sequence is ***not*** an A.P. ?

(A) $2, \frac{5}{2}, 3, \frac{7}{2}, \ldots$

(B) $-1{\cdot}2, -3{\cdot}2, -5{\cdot}2, -7{\cdot}2, \ldots$

(C) $\sqrt{2}, \sqrt{8}, \sqrt{18}, \ldots$

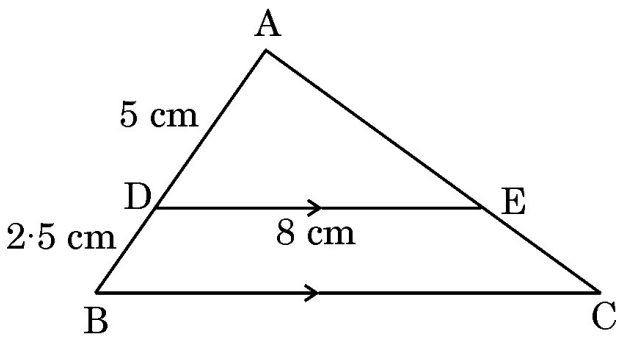
(D) $1^2, 3^2, 5^2, 7^2, \ldots$

15. The area of a semicircle of diameter 'd' is :

(A) $\frac{\pi d^2}{16}$ (B) $\frac{\pi d^2}{4}$

(C) $\frac{\pi d^2}{8}$ (D) $\frac{\pi d^2}{2}$

16. दिए गए चित्र में, Δ ABC को दर्शाया गया है, जिसमें DE || BC है । यदि AD = 5 cm, DB = 2·5 cm और DE = 8 cm है, तो BC की लंबाई है :



(A) 10 cm (B) 6 cm

(C) 12 cm (D) 7·5 cm

17. 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

18. 1, 2, 3, 4, ..., 25 तक की संख्याओं में से यादृच्छिक रूप से चुनी गई एक संख्या के भाज्य संख्या होने की प्रायिकता है :

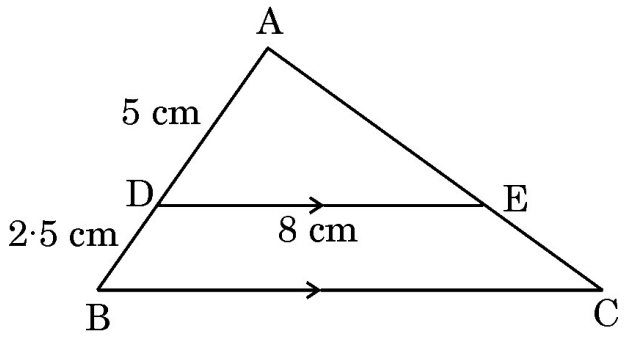
(A) $\frac{15}{25}$

(B) $\frac{10}{25}$

(C) $\frac{11}{25}$

(D) $\frac{9}{25}$

16. In the given figure Δ ABC is shown, in which DE || BC. If AD = 5 cm, DB = 2·5 cm and DE = 8 cm, then the length of BC is :



(A) 10 cm (B) 6 cm

(C) 12 cm (D) 7·5 cm

17. 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

18. 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) $\frac{9}{25}$

*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) ग़लत है।

(D) अभिकथन (A) ग़लत है, परन्तु तर्क (R) सही है।

19. *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।

20. *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।

*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 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 $(lb + bh + hl)$.

20. *Assertion (A) :* The mean of first 'n' natural numbers is $\frac{n-1}{2}$.

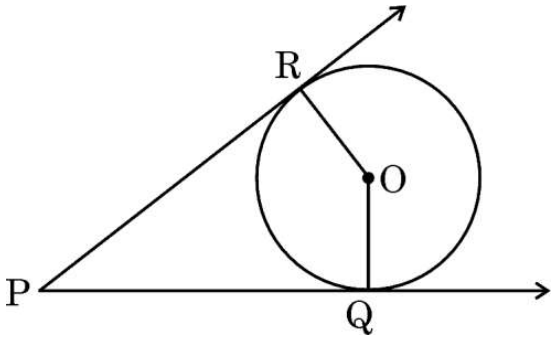
Reason (R): The sum of first 'n' natural numbers is $\frac{n(n+1)}{2}$.

खण्ड ख

*इस खण्ड में **5** अति लघु-उत्तरीय (VSA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक के **2** अंक हैं।* *5×2=10*

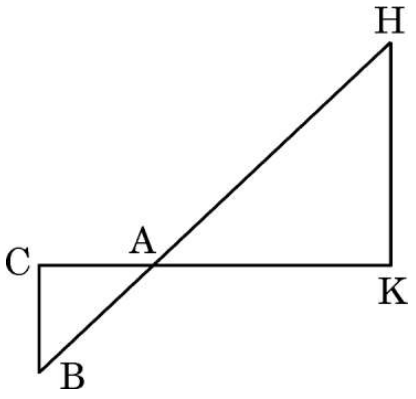
21. यदि बिन्दुओं (4, p) और (1, 0) के बीच की दूरी 5 है, तो p का मान क्या है ?

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



23. यदि α, β द्विघात बहुपद $px^2 + qx + r$ के शून्यक हैं, तो $\alpha^3\beta + \beta^3\alpha$ का मान ज्ञात कीजिए।

24. (क) दिए गए चित्र में, Δ AHK ~ Δ ABC है। यदि AK = 10 cm, BC = 3·5 cm और HK = 7 cm है, तो AC की लंबाई ज्ञात कीजिए।



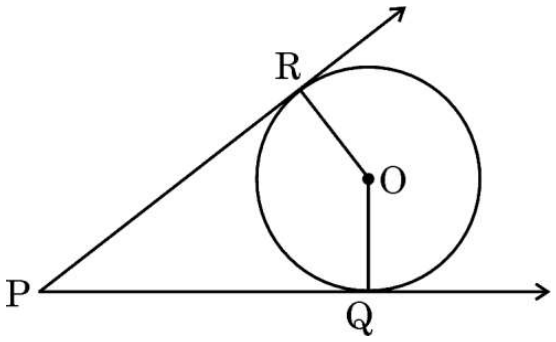
अथवा

SECTION B

*This section has **5** Very Short Answer (VSA) type questions carrying **2** marks each.* *5×2=10*

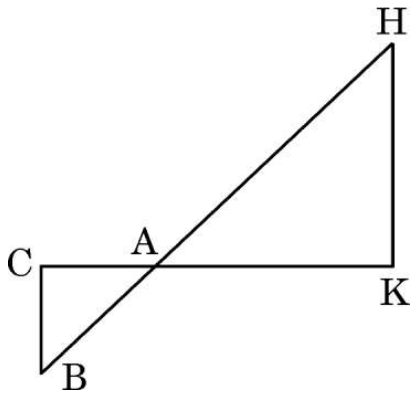
21. If the distance between the points (4, p) and (1, 0) is 5, what is the value of p ?

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



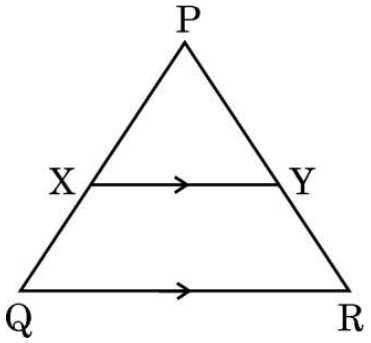
23. If α, β are the zeroes of the quadratic polynomial $px^2 + qx + r$, then find the value of $\alpha^3\beta + \beta^3\alpha$.

24. (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.



OR

(ख) दिए गए चित्र में, XY || QR, $\frac{PQ}{XQ} = \frac{7}{3}$ और PR = 6·3 cm है। YR की लंबाई ज्ञात कीजिए।



25. (क) यदि $\tan A = \frac{4}{3}$ है, तो $\sin A$ और $\cos A$ ज्ञात कीजिए।

अथवा

(ख) $\cos A$ और $\tan A$ को $\sin A$ के पदों में व्यक्त कीजिए।

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 किसी वृत्त के बाह्य बिंदु से खींची गई स्पर्श रेखाओं की लंबाइयाँ बराबर होती हैं।

अथवा

(ख) केंद्र O वाले वृत्त के बाह्य बिंदु T से दो स्पर्श रेखाएँ TP और TQ खींची गई हैं। सिद्ध कीजिए कि $\angle PTQ = 2 \angle OPQ$.

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

28. 42 सेमी त्रिज्या तथा 30° केंद्रीय कोण वाले वृत्त के त्रिज्यखंड का क्षेत्रफल ज्ञात कीजिए। साथ ही, संगत दीर्घ त्रिज्यखंड का क्षेत्रफल भी ज्ञात कीजिए। [$\pi = \frac{22}{7}$ लीजिए]

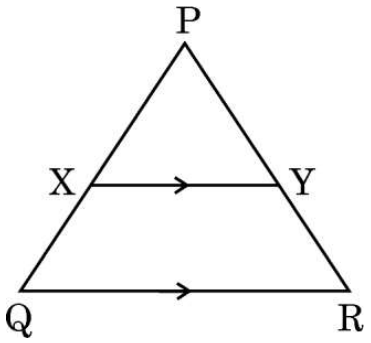
29. एक समचतुर्भुज PQRS के तीन शीर्ष P(2, – 3), Q(6, 5) और R(– 2, 1) हैं। चौथे शीर्ष S के निर्देशांक तथा उस बिंदु के निर्देशांक ज्ञात कीजिए, जहाँ दोनों विकर्ण PR और QS प्रतिच्छेद करते हैं।

30. दो भिन्न पासे एक साथ फेंके जाते हैं। प्रायिकता ज्ञात कीजिए कि प्राप्त संख्याओं का :

(i) योगफल सम है,

(ii) गुणनफल सम है।

(b) In the given figure, XY || QR, $\frac{PQ}{XQ} = \frac{7}{3}$ and PR = 6·3 cm. Find the length of YR.



25. (a) If $\tan A = \frac{4}{3}$, find sin A and cos A.

OR

(b) Express cos A and tan A in terms of sin A.

SECTION C

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

26. (a) Prove that the lengths of tangents drawn from an external point to a circle are equal.

OR

(b) Two tangents TP and TQ are drawn to a circle with centre O from an external point T. Prove that $\angle PTQ = 2 \angle OPQ$.

27. Prove that $\sqrt{5}$ is an irrational number.

28. Find the area of the sector of a circle of radius 42 cm and of central angle 30°. Also, find the area of the corresponding major sector. [Use $\pi = \frac{22}{7}$]

29. The three vertices of a rhombus PQRS are P(2, – 3), Q(6, 5) and R(– 2, 1). Find the coordinates of the fourth vertex S and coordinates of the point where both the diagonals PR and QS intersect.

30. Two different dice are thrown together. Find the probability that the numbers obtained have :

(i) even sum,

(ii) even product.

31. (क) सिद्ध कीजिए कि :

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

अथवा

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

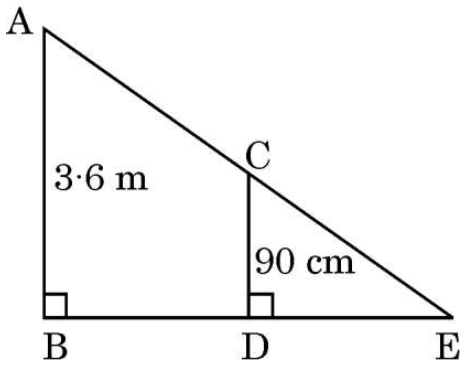
खण्ड घ

*इस खण्ड में **4** दीर्घ-उत्तरीय (LA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक के **5** अंक हैं।* *4×5=20*

32. (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।



31. (a) Prove that :

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

OR

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

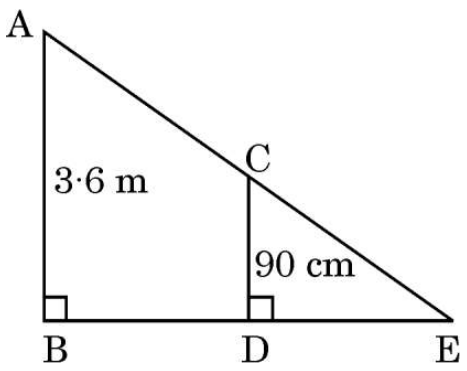
SECTION D

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

32. (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.



33. एक एसबीआई स्वास्थ्य बीमा एजेंट ने 100 पॉलिसीधारकों की आयु के वितरण के लिए निम्नलिखित आँकड़े एकत्र किए। स्वास्थ्य बीमा पॉलिसियाँ उन व्यक्तियों को दी जाती हैं जिनकी आयु 15 वर्ष या उससे अधिक, लेकिन 60 वर्ष से कम है।

आयु (वर्ष में)	*पॉलिसीधारकों की संख्या*
15 – 20	2
20 – 25	4
25 – 30	18
30 – 35	21
35 – 40	33
40 – 45	11
45 – 50	3
50 – 55	6
55 – 60	2

पॉलिसीधारकों की बहुलक आयु एवं माध्यक आयु ज्ञात कीजिए।

34. निम्नलिखित रैखिक समीकरणों के युग्म का आलेखीय निरूपण कीजिए और इससे इस युग्म की संगति की स्थिति पर टिप्पणी कीजिए :

$x - 5y = 6; 2x - 10y = 12$

35. (क) एक कक्षा परीक्षा में, अनामिका के गणित और विज्ञान के प्राप्त अंकों का योगफल 30 है। यदि उसे गणित में 2 अंक अधिक और विज्ञान में 3 अंक कम मिले होते, तो अंकों का गुणनफल 210 होता। दोनों विषयों में उसके द्वारा प्राप्त अंक ज्ञात कीजिए।

अथवा

(ख) एक समकोण त्रिभुज का कर्ण (cm में) उसकी सबसे छोटी भुजा की दुगुनी लंबाई से 6 cm अधिक है। यदि इसकी तीसरी भुजा की लंबाई, सबसे छोटी भुजा की तीन गुनी लंबाई से 6 cm कम है, तो त्रिभुज की विमाएँ ज्ञात कीजिए।

33. An SBI health insurance agent found the following data for distribution of ages of 100 policy holders. The health insurance policies are given to persons of age 15 years and onwards, but less than 60 years.

Age (in yrs)	*Number of policy holders*
15 – 20	2
20 – 25	4
25 – 30	18
30 – 35	21
35 – 40	33
40 – 45	11
45 – 50	3
50 – 55	6
55 – 60	2

Find the modal age and median age of the policy holders.

34. Represent the following pair of linear equations graphically and hence comment on the condition of consistency of this pair :

$x - 5y = 6$; $2x - 10y = 12$

35. (a) In a class test, the sum of Anamika's marks obtained in Maths and Science is 30. Had she got 2 marks more in Maths and 3 marks less in Science, the product of the marks would have been 210. Find the marks she got in the two subjects.

OR

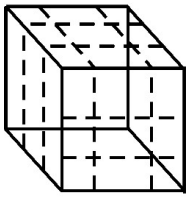
(b) The length of hypotenuse (in cm) of a right-angled triangle is 6 cm more than twice the length of its shortest side. If the length of its third side is 6 cm less than thrice the length of its shortest side, find the dimensions of the triangle.

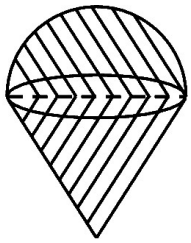
खण्ड ङ

*इस खण्ड में **3** प्रकरण अध्ययन आधारित प्रश्न हैं, जिनमें प्रत्येक के **4** अंक हैं।* *3×4=12*

प्रकरण अध्ययन – 1

36. 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 – 2

37. 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*

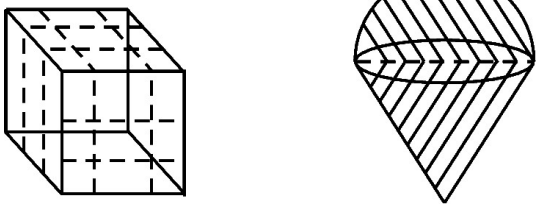
(ii) यदि किस्तों की कुल संख्या 40 है, तो अंतिम किस्त में चुकाई गई राशि कितनी है ? *1*

SECTION E

*This section has **3** case study based questions carrying **4** marks each.* *3×4=12*

Case Study – 1

36. 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 – 2

37. 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 30^{th} instalment. *1*

(ii) If the total number of instalments is 40, what is the amount paid in the last instalment ? *1*

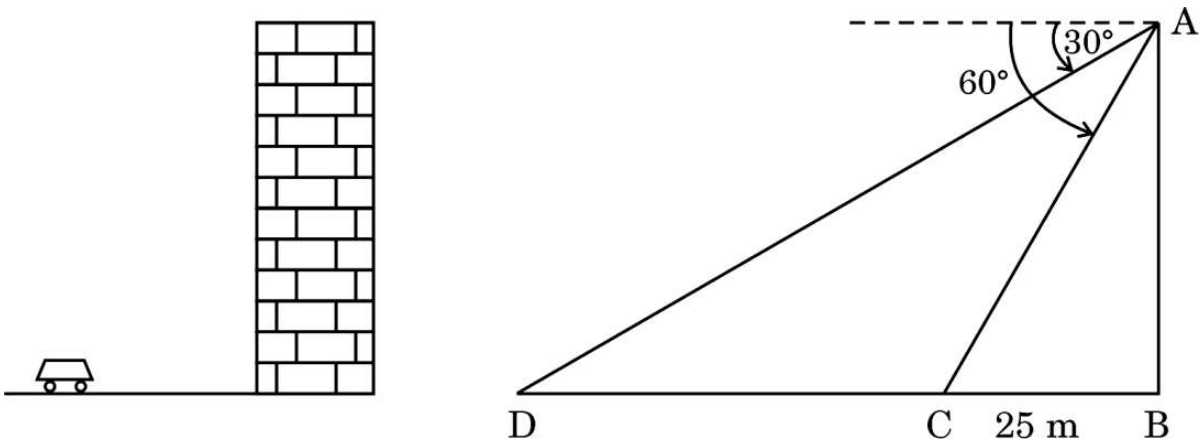
(iii) (क) 30वीं किस्त के बाद उसे अभी कितनी राशि चुकानी शेष है ? *2*

अथवा

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

प्रकरण अध्ययन – 3

38. 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*

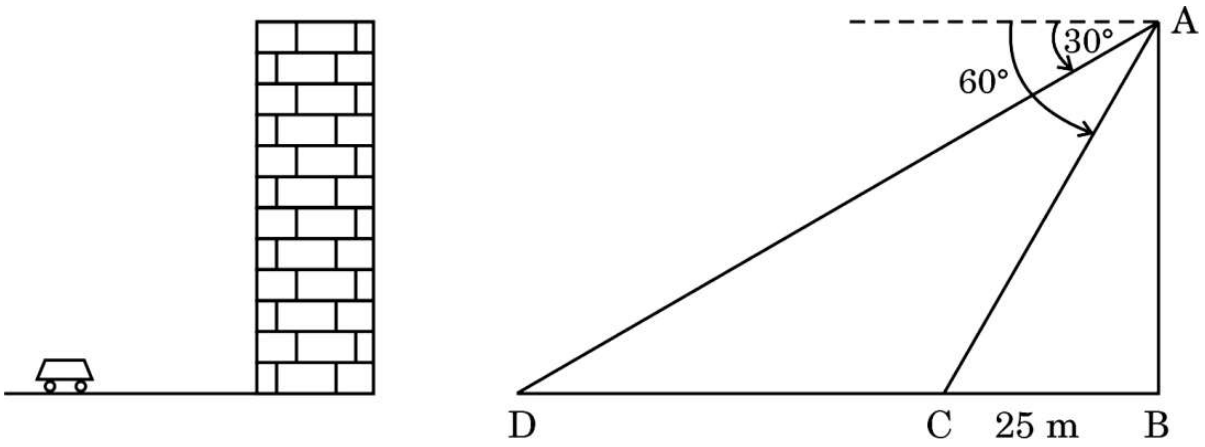
(iii) (a) What amount does he still have to pay after the 30^{th} instalment ? *2*

OR

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

Case Study – 3

38. 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*

Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2026
MATHEMATICS (STANDARD) (041) (PAPER CODE 30/2/3)

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.

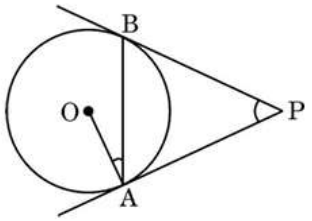
9.	If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note **"Extra Question"**.
10.	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
11.	A full scale of marks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

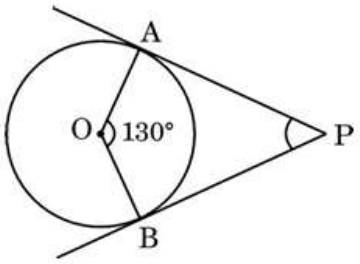
MARKING SCHEME

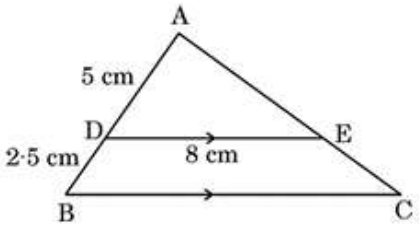
MATHEMATICS (Subject Code–041)

(PAPER CODE: 30/2/3)

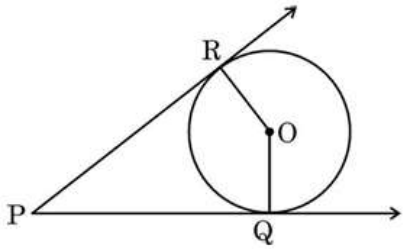
Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Step	Marks
	SECTION A This section has **20** Multiple Choice Questions (MCQs) carrying 1 mark each.		
1.	The distance of the point A(4a, 3a) from x-axis is : (A) 3a (B) – 3a (C) 4a (D) – 4a		
Sol.	(A) 3a		**1**
2.	The natural number 1 is : (A) a prime number. (B) a composite number. (C) prime as well as composite. (D) neither prime nor composite.		
Sol.	(D) neither prime nor composite		**1**
3.	Given cot θ = 3, the value of cos θ is : (A) $\frac{1}{3}$ (B) $\frac{1}{\sqrt{10}}$ (C) $\frac{3}{\sqrt{10}}$ (D) $\frac{\sqrt{10}}{3}$		
Sol.	(C) $\frac{3}{\sqrt{10}}$		**1**
4.	For any natural number n, 5^n ends with the digit : (A) 0 (B) 5 (C) 3 (D) 2		
Sol.	(B) 5		**1**
5.	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**

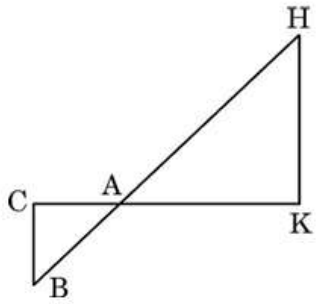
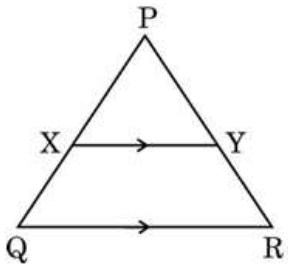
6.	The LCM of 960 and 240 is : (A) 960 (B) 240 (C) 60 (D) 15		
Sol.	(A) 960		**1**
7.	From a point on the ground, which is 60 m away from the foot of a vertical tower, the angle of elevation of the top of the tower is found to be 45°. The height (in metres) of the tower is : (A) $10\sqrt{3}$ (B) $30\sqrt{3}$ (C) 60 (D) 30		
Sol.	(C) 60		**1**
8.	How many zeroes does p(x) = (x – 2) (x + 3) have ? (A) Zero (B) One (C) Two (D) Three		
Sol.	(C) Two		**1**
9.	In the given figure, PA and PB are tangents to a circle centred at O. If ∠ OAB = 15°, then ∠ APB equals :  (A) 30° (B) 15° (C) 45° (D) 10°		
Sol.	(A) 30°		**1**
10.	If α and β are two zeroes of a polynomial $f(x) = px^2 - 2x + 3p$ and α + β = αβ, 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**

11.	In the given figure, PA and PB are tangents to a circle centred at O. If $\angle AOB = 130°$, then $\angle APB$ is equal to :  (A) 130° (B) 50° (C) 120° (D) 90°		
Sol.	(B) 50°		**1**
12.	If the pair of linear equations : $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ is consistent and dependent, then (A) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ (B) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2} = \frac{c_1}{c_2}$ (C) $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$ (D) $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$		
Sol.	(D) $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$		**1**
13.	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) $182\,\pi$ (B) $\frac{182}{3}\pi$ (C) $\frac{682}{3}\pi$ (D) $\frac{364}{3}\pi$		
Sol.	(B) $\frac{182}{3}\pi$		**1**

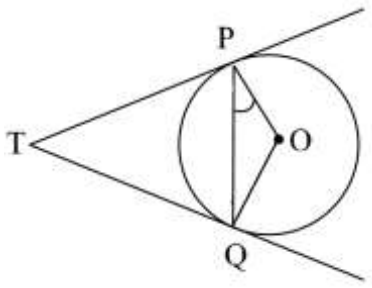
14.	Which of the following sequence is ***not*** an A.P. ? (A) $2, \frac{5}{2}, 3, \frac{7}{2}, \ldots$ (B) $-1{\cdot}2, -3{\cdot}2, -5{\cdot}2, -7{\cdot}2, \ldots$ (C) $\sqrt{2}, \sqrt{8}, \sqrt{18}, \ldots$ (D) $1^2, 3^2, 5^2, 7^2, \ldots$		
Sol.	(D) $1^2, 3^2, 5^2, 7^2, \ldots$		**1**
15.	The area of a semicircle of diameter 'd' is : (A) $\frac{\pi d^2}{16}$ (B) $\frac{\pi d^2}{4}$ (C) $\frac{\pi d^2}{8}$ (D) $\frac{\pi d^2}{2}$		
Sol.	(C) $\frac{\pi d^2}{8}$		**1**
16.	In the given figure Δ ABC is shown, in which DE $\|\|$ BC. If AD = 5 cm, DB = 2·5 cm and DE = 8 cm, then the length of BC is :  (A) 10 cm (B) 6 cm (C) 12 cm (D) 7·5 cm		
Sol.	(C) 12 cm		**1**
17.	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**

18.	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**
	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.* (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 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 $(lb + bh + hl)$.		
Sol.	(C) Assertion (A) is true, but Reason (R) is false		**1**
20.	*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**

	SECTION B This section has **5** Very Short Answer (VSA) type questions carrying 2 marks each.		
21.	**If the distance between the points (4, p) and (1, 0) is 5, what is the value of p ?**		
Sol.	$\sqrt{(4-1)^2+(p-0)^2} = 5$	**I**	**1**
	$\Longrightarrow 9 + p^2 = 25$	**II**	½
	$\Longrightarrow p = \pm 4$	**III**	½
22.	**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,		
	∠ PQO = 90°, ∠PRO = 90°	**I**	**1**
	∴ ∠ PQO + ∠PRO = 180°	**II**	½
	One pair of opposite angles is supplementary	**III**	½
	∴Quadrilateral PQOR is cyclic		
23.	**If α, β are the zeroes of the quadratic polynomial $px^2 + qx + r$, then find the value of $\alpha^3\beta + \beta^3\alpha$.**		
Sol.	$px^2 + qx + r$		
	$\alpha + \beta = \frac{-q}{p}$, $\alpha\beta = \frac{r}{p}$	**I**	**1**
	$\alpha^3\beta + \beta^3\alpha$		
	$= \alpha\beta\,(\alpha^2 + \beta^2)$		
	$= \alpha\beta\,[(\alpha+\beta)^2 - 2\alpha\beta] = \frac{r}{p}\left[\left(-\frac{q}{p}\right)^2 - 2\left(\frac{r}{p}\right)\right]$	**II**	½

	$= \frac{r}{p^3}(q^2 - 2pr)$	**III**	½
24(a)	In the given figure, Δ AHK ~ Δ 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**
	$\frac{10}{AC} = \frac{7}{3.5}$	**II**	½
	AC = 5 cm	**III**	½
	OR		
24(b)	In the given figure, XY || QR, $\frac{PQ}{XQ} = \frac{7}{3}$ and PR = 6·3 cm. Find the length of YR.  		
Sol.	XY||QR		
	$\frac{PQ}{XQ} = \frac{PR}{YR}$	**I**	**1**
	$\Rightarrow \frac{7}{3} = \frac{6.3}{YR}$	**II**	½
	$\Rightarrow YR = 2.7$ cm	**III**	½

25 (a)	If $\tan A = \frac{4}{3}$, find sin A and cos A.		
Sol.	$\sin A = \frac{4}{5}$	**I**	**1**
	$\cos A = \frac{3}{5}$	**II**	**1**
	OR		
25(b)	Express cos A and tan A in terms of sin A.		
Sol.	$\cos A = \sqrt{1 - \sin^2 A}$	**I**	**1**
	$\tan A = \frac{\sin A}{\cos A} = \frac{\sin A}{\sqrt{1-\sin^2 A}}$	**II**	**1**

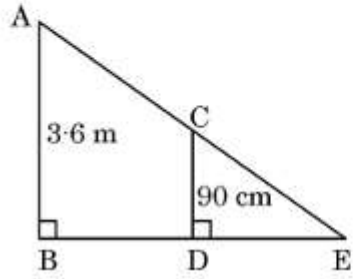
	SECTION C This section has **6** Short Answer (SA) type questions carrying 3 marks each.		
26 (a)	Prove that the lengths of tangents drawn from an external point to a circle are equal.		
Sol.	for correct figure	**I**	**1**
	for correct Given, To Prove	**II**	**½**
	for correct Proof	**III**	**1½**
	OR		
26(b)	Two tangents TP and TQ are drawn to a circle with centre O from an external point T. Prove that $\angle PTQ = 2 \angle OPQ$.		
Sol.			
	For correct figure	**I**	**½**
	$OP = OQ \Rightarrow \angle OPQ = \angle OQP$		

	$\angle$ OPQ + $\angle$ OQP + $\angle$POQ = 180°	**II**	½
	$\Longrightarrow \angle$ POQ = 180° − 2 $\angle$ OPQ -------(i)	**III**	½
	Also, $\angle$ OPT + $\angle$ OQT + $\angle$ POQ + $\angle$ PTQ = 360°		
	$\Longrightarrow \angle$ POQ = 180° − $\angle$ PTQ -------(ii)	**IV**	**1**
	using (i) and (ii)		
	180° − 2 $\angle$ OPQ = 180° − $\angle$ PTQ		
	$\Longrightarrow$ 2 $\angle$ OPQ = $\angle$ PTQ	**V**	½
27	**Prove that $\sqrt{5}$ is an irrational number.**		
Sol.	Let $\sqrt{5}$ be a rational number.		
	$\therefore \sqrt{5} = \frac{p}{q}$, where q ≠ 0 and p & q are coprime.	**I**	½
	$5q^2 = p^2 \Longrightarrow p^2$ is divisible by 5 $\Longrightarrow$ p is divisible by 5 ----- (i)	**II**	**1**
	let p = 5a, where 'a' is some integer		
	$25a^2 = 5q^2 \Longrightarrow q^2 = 5a^2 \Longrightarrow q^2$ is divisible by 5 $\Longrightarrow$ q is divisible by 5 --- (ii)	**III**	**1**
	(i) and (ii) leads to contradiction as 'p' and 'q' are coprime.	**IV**	½
	$\therefore \sqrt{5}$ is an irrational number.		
28.	**Find the area of the sector of a circle of radius 42 cm and of central angle 30°. Also, find the area of the corresponding major sector. [Use $\pi = \frac{22}{7}$]**		
Sol.	Area of minor sector = $\frac{30}{360} \times \frac{22}{7} \times 42 \times 42$	**I**	**1**
	= 462 cm^2	**II**	½
	Angle of corresponding major sector = 330°	**III**	½
	Area of Major Sector = $\frac{330}{360} \times \frac{22}{7} \times 42 \times 42$	**IV**	½
	= 5082 cm^2	**V**	½

29.	The three vertices of a rhombus PQRS are P(2, – 3), Q(6, 5) and R(– 2, 1). Find the coordinates of the fourth vertex S and coordinates of the point where both the diagonals PR and QS intersect.		
Sol.	Let the coordinates of fourth vertex S be (x,y)		
	Coordinates of mid-point of PR = Coordinates of mid-point of QS		
	$\left(\frac{x+6}{2}, \frac{y+5}{2}\right) = \left(\frac{2-2}{2}, \frac{-3+1}{2}\right)$	**I**	**1**
	$x = -6$	**II**	**½**
	$y = -7$	**III**	**½**
	$\therefore$ coordinates of S = $(-6, -7)$		
	mid- point of diagonal PR = $(0, -1)$	**IV**	**1**
30.	Two different dice are thrown together. Find the probability that the numbers obtained have : (i) even sum, (ii) even product.		
Sol.	(i) Number of outcomes with even sum =18		
	(1,1) (1,3) (1,5) (3,1) (3,3) (3,5) (5,1) (5,3) (5,5), (2,2) (2,4) (2,6) (4,2) (4,4) (4,6) (6,2) (6,4) (6,6)		
	P(even sum) = $\frac{18}{36}$ or $\frac{1}{2}$	**I**	**1½**
	(ii) Number of outcomes with even product = 27		
	(1,2) (1,4) (1,6) (2,1) (2,2) (2,3) (2,4) (2,5) (2,6) (3,2) (3,4) (3,6) (4,1) (4,2) (4,3) (4,4) (4,5) (4,6) (5,2) (5,4) (5,6) (6,1) (6,2) (6,3) (6,4) (6,5) (6,6)		
	P(even product) = $\frac{27}{36}$ or $\frac{3}{4}$	**II**	**1½**
31(a)	Prove that : $\frac{\sec^3\theta}{\sec^2\theta - 1} + \frac{\text{cosec}^3\theta}{\text{cosec}^2\theta - 1} = \sec\theta \cdot \text{cosec}\,\theta\,(\sec\theta + \text{cosec}\,\theta)$		
Sol.	LHS $= \frac{\sec^3\theta}{(\sec^2\theta - 1)} + \frac{\text{cosec}^3\theta}{(\text{cosec}^2\theta - 1)}$		

	$= \frac{\sec^3\theta}{\tan^2\theta} + \frac{\operatorname{cosec}^3\theta}{\cot^2\theta}$	**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**	½
	$= \frac{1}{\cos\theta \sin^2\theta} + \frac{1}{\sin\theta \cos^2\theta}$	**III**	½
	$= \frac{1}{\sin\theta\cos\theta}\left[\frac{1}{\sin\theta} + \frac{1}{\cos\theta}\right]$	**IV**	½
	$= \sec\theta \cdot \operatorname{cosec}\theta\,(\sec\theta + \operatorname{cosec}\theta) = \text{RHS}$	**V**	½
	OR		
31(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**	½
	$= \left(\frac{\sec^2\alpha - \tan^2\alpha}{\operatorname{Cosec}^2\beta}\right) \times \sec^2\alpha$	**II**	**1**
	$= \left(\frac{1}{\operatorname{cosec}^2\beta}\right) \times \sec^2\alpha$	**III**	**1**
	$= p^2 = \text{RHS}$	**IV**	½

	SECTION D This section has **4** Long Answer (LA) type questions carrying 5 marks each.		
32 (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		

32 (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 × time = $1.2 \times 4 = 4.8$ m	**I**	**1**
	$\Delta ABE \sim \Delta CDE$	**II**	**2**
	$\Longrightarrow \frac{BE}{DE} = \frac{AB}{CD}$	**III**	½
	$\Longrightarrow \frac{4.8 + DE}{DE} = \frac{3.6}{0.9}$	**IV**	**1**
	$\Longrightarrow$ DE = 1.6 m	**V**	½
	∴ Shadow of the girl after walking for 4 seconds is 1.6 m long		

33. An SBI health insurance agent found the following data for distribution of ages of 100 policy holders. The health insurance policies are given to persons of age 15 years and onwards, but less than 60 years.

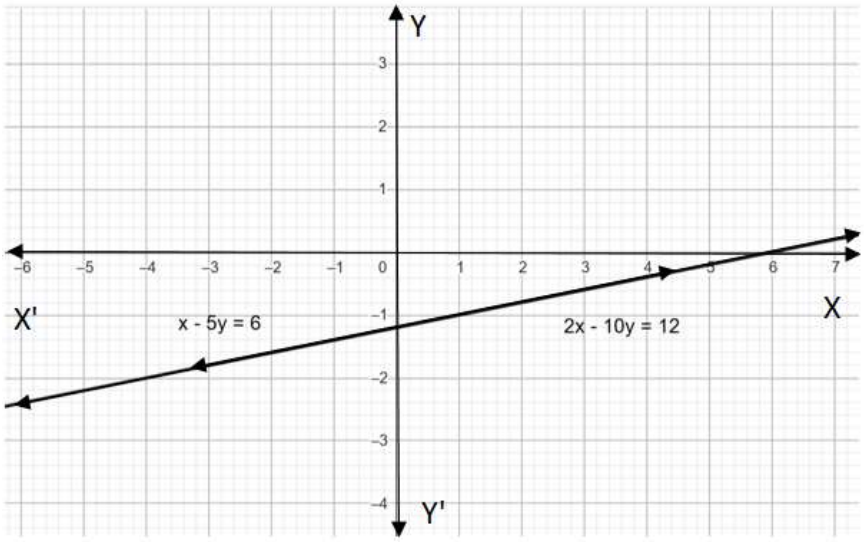
Age (in yrs)	*Number of policy holders*
15 – 20	2
20 – 25	4
25 – 30	18
30 – 35	21
35 – 40	33
40 – 45	11
45 – 50	3
50 – 55	6
55 – 60	2

Find the modal age and median age of the policy holders.

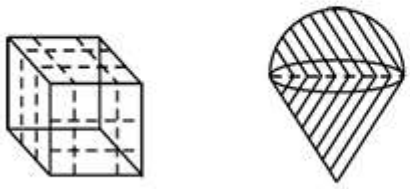
Sol.

Age (in years)	f	cf
15 - 20	2	2
20 - 25	4	6
25 - 30	18	24
30 – 35	21	45
35 - 40	33	78
40 – 45	11	89
45 - 50	3	92
50 – 55	6	98
55 – 60	2	100
Total	100	

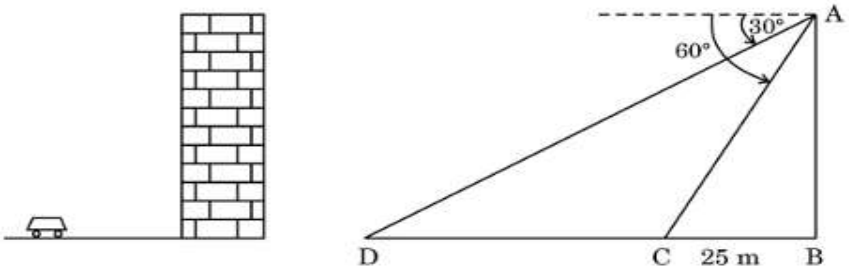
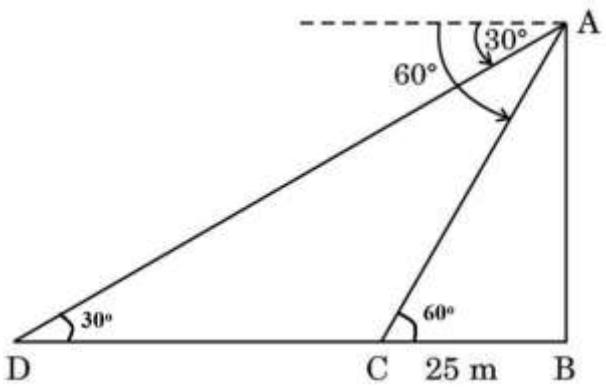
For correct table	**I**	**1**
Modal class = 35– 40	**II**	**½**
Mode = $35 + \frac{33-21}{2(33)-21-11} \times 5$	**III**	**1**
$= \frac{625}{17} = 36.7$(approx.)	**IV**	**½**
Modal age = 36.7 years (approx.)		
$\frac{n}{2} = 50$, Median class = 35 – 40	**V**	**½**
Median = $35 + \frac{50-45}{33} \times 5$	**VI**	**1**
$= \frac{1180}{33} = 35.7$(approx.)	**VII**	**½**
Median age = 35.7 years (approx.)		

34.	**Represent the following pair of linear equations graphically and hence comment on the condition of consistency of this pair :** **$x - 5y = 6$; $2x - 10y = 12$**		
Sol.			
	For correct graph of both the equations	**I**	**2+2**
	Since lines are coincident, so the system of linear equations is consistent with infinitely many solutions	**II**	**1**
35(a)	**In a class test, the sum of Anamika's marks obtained in Maths and Science is 30. Had she got 2 marks more in Maths and 3 marks less in Science, the product of the marks would have been 210. Find the marks she got in the two subjects.**		
Sol.	Let the marks obtained in Maths be x		
	Then the marks obtained in Science = $30 - x$		
	$(x + 2)(30 - x - 3) = 210$	**I**	**2**
	$\Rightarrow x^2 - 25x + 156 = 0$	**II**	**1**
	$\Rightarrow (x - 13)(x - 12) = 0$	**IV**	**½**
	$\therefore x = 13, x = 12$	**V**	**½**
	Either marks in Maths and Science are 13 and 17 respectively	**VI**	**½**
	or marks in Maths and Science are 12 and 18 respectively	**VII**	**½**
	OR		

35 (b)	**The length of hypotenuse (in cm) of a right-angled triangle is 6 cm more than twice the length of its shortest side. If the length of its third side is 6 cm less than thrice the length of its shortest side, find the dimensions of the triangle.**		
Sol.	Let the shortest side be x cm		
	Then hypotenuse = $(2x + 6)$ cm		
	and the third side = $(3x - 6)$ cm		
	$x^2 + (3x - 6)^2 = (2x + 6)^2$	**I**	**2**
	$\Rightarrow 6x^2 - 60x = 0$	**II**	**1**
	$\Rightarrow 6x(x - 10) = 0$	**III**	**½**
	$\Rightarrow x = 0, x = 10$		
	$x = 0$ (rejected)		
	$\therefore x = 10$	**IV**	**½**
	$\therefore$ shortest side = 10 cm		
	and hypotenuse = 26 cm	**V**	**½**
	and third side = 24 cm	**VI**	**½**

	SECTION E This section has **3** case study based questions carrying 4 marks each.		
36.	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 = $\sqrt{3} \times side$		
	$= 6\sqrt{3}$ cm	**I**	**1**
	(ii) Volume of Rubik's cube = $(7)^3$		
	$= 343$ cm^3	**I**	**1**
	(iii) (a) CSA of hemisphere = $2 \times \frac{22}{7} \times 7 \times 7$	**I**	**1**
	$= 308$ cm^2	**II**	**1**
	OR		
	(iii) (b) Surface area of resulting cuboid = $5(4)^2 + 5(4)^2$	**I**	**1**
	$= 160$ 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**
	$= 160$ cm^2	**II**	**1**

37.	**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 30^{th} 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 30^{th} 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		

38.	**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.	 		
	(i) In ΔABC,		
	$\tan 60^o = \sqrt{3} = \frac{AB}{25}$	**I**	½
	$\Rightarrow AB = 25\sqrt{3}$	**II**	½
	∴ Height of building = $25\sqrt{3}$ m		
	(ii) In ΔABD,		

	$\tan 30^o = \frac{1}{\sqrt{3}} = \frac{25\sqrt{3}}{BD}$	**I**	½
	$\Rightarrow$ BD = 75		
	∴ Distance between two positions of car = 75 − 25 = 50 m	**II**	½
	(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 ΔABC,		
	$\cos 60^o = \frac{BC}{AC}$	**I**	**1**
	$\Rightarrow \frac{1}{2} = \frac{25}{AC}$		
	AC = 50	**II**	**1**
	∴ Distance of the observer from car when it makes the angle of 60^o = 50 m		