



Series WX1YZ/5



SET~3

रोल नं.							
Roll No.							

प्रश्न-पत्र कोड
Q.P. Code **430/5/3**

परीक्षार्थी प्रश्न-पत्र कोड को उत्तर-पुस्तिका के मुख-पृष्ठ पर अवश्य लिखें।

Candidates must write the Q.P. Code on the title page of the answer-book.

गणित (बुनियादी)

MATHEMATICS (BASIC)

*

निर्धारित समय : 3 घण्टे

अधिकतम अंक : 80

Time allowed : 3 hours

Maximum Marks : 80

नोट / NOTE :

- (i) कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ 23 हैं।
Please check that this question paper contains 23 printed pages.
- (ii) प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को परीक्षार्थी उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें।
Q.P. Code given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.
- (iii) कृपया जाँच कर लें कि इस प्रश्न-पत्र में 38 प्रश्न हैं।
Please check that this question paper contains 38 questions.
- (iv) कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में प्रश्न का क्रमांक अवश्य लिखें।
Please write down the serial number of the question in the answer-book 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 छात्र 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 students will read the question paper only and will not write any answer on the answer-book during this period.





सामान्य निर्देश :

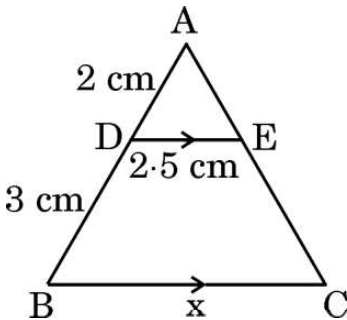
निम्नलिखित निर्देशों को बहुत सावधानी से पढ़िए और उनका सख्ती से पालन कीजिए :

- (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 एक-एक अंक के प्रश्न हैं।
- (iv) खण्ड ख में प्रश्न संख्या 21 से 25 तक अति लघु-उत्तरीय (VSA) प्रकार के दो-दो अंकों के प्रश्न हैं।
- (v) खण्ड ग में प्रश्न संख्या 26 से 31 तक लघु-उत्तरीय (SA) प्रकार के तीन-तीन अंकों के प्रश्न हैं।
- (vi) खण्ड घ में प्रश्न संख्या 32 से 35 तक दीर्घ-उत्तरीय (LA) प्रकार के पाँच-पाँच अंकों के प्रश्न हैं।
- (vii) खण्ड ङ में प्रश्न संख्या 36 से 38 तक प्रकरण अध्ययन आधारित चार-चार अंकों के प्रश्न हैं। प्रत्येक प्रकरण अध्ययन में आंतरिक विकल्प दो-दो 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 बहुविकल्पीय प्रश्न (MCQ) हैं, जिनमें प्रत्येक प्रश्न 1 अंक का है।

1. प्रथम 50 विषम प्राकृत संख्याओं का योगफल है :
 - (a) 5000
 - (b) 2500
 - (c) 2550
 - (d) 5050
2. दी गई आकृति में, $AD = 2$ cm, $DB = 3$ cm, $DE = 2.5$ cm और $DE \parallel BC$. x का मान है :



- (a) 6 cm
- (b) 3.75 cm
- (c) 6.25 cm
- (d) 7.5 cm





General Instructions :

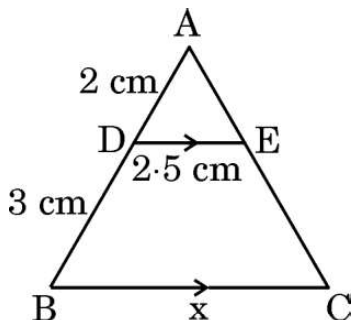
Read the following instructions very carefully and strictly follow them :

- (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 calculators is **not** allowed.

SECTION A

This section comprises multiple choice questions (MCQs) of 1 mark each.

1. The sum of the first 50 odd natural numbers is :
 - (a) 5000
 - (b) 2500
 - (c) 2550
 - (d) 5050
2. In the given figure, $AD = 2$ cm, $DB = 3$ cm, $DE = 2.5$ cm and $DE \parallel BC$. The value of x is :



- (a) 6 cm
- (b) 3.75 cm
- (c) 6.25 cm
- (d) 7.5 cm





3. एक वृत्त की त्रिज्या 3 cm है। इसकी दो समांतर स्पर्श-रेखाओं के बीच की दूरी है :

- (a) 12 cm (b) 6 cm
(c) 3 cm (d) 4.5 cm

4. नीचे दिए गए आँकड़ों का माध्यक वर्ग है :

वर्ग	20 – 40	40 – 60	60 – 80	80 – 100	100 – 120
बारंबारता	10	12	14	13	17

- (a) 80 – 100 (b) 20 – 40
(c) 40 – 60 (d) 60 – 80

5. किन्हीं आँकड़ों का माध्य और माध्यक क्रमशः 32 और 30 हैं। आनुभविक सम्बन्ध से इन आँकड़ों का बहुलक है :

- (a) 36 (b) 26
(c) 30 (d) 20

6. दो त्रिभुजों ΔPQR और ΔABC के लिए दिया गया है कि $\frac{AB}{BC} = \frac{PQ}{PR}$. ये दोनों त्रिभुजों के समरूप होने के लिए, निम्न में से कौन-सा सत्य होना चाहिए ?

- (a) $\angle A = \angle P$ (b) $\angle B = \angle Q$
(c) $\angle B = \angle P$ (d) $CA = QR$

7. यदि $\sin \theta = \frac{3}{4}$ है, तो $\frac{(\sec^2 \theta - 1) \cos^2 \theta}{\sin \theta}$ बराबर है :

- (a) $\frac{3}{5}$ (b) $\frac{3}{4}$
(c) $\frac{4}{3}$ (d) $\frac{9}{16}$

8. एक A.P. का 8वाँ पद 17 है और 14वाँ पद 29 है। इस A.P. का सार्व अन्तर है :

- (a) 3 (b) 2
(c) 5 (d) -2





3. A circle is of radius 3 cm. The distance between two of its parallel tangents is :

- (a) 12 cm (b) 6 cm
(c) 3 cm (d) 4.5 cm

4. The median class for the data given below is :

Class	20 – 40	40 – 60	60 – 80	80 – 100	100 – 120
Frequency	10	12	14	13	17

- (a) 80 – 100 (b) 20 – 40
(c) 40 – 60 (d) 60 – 80

5. Mean and median of some data are 32 and 30 respectively. Using empirical relation, mode of the data is :

- (a) 36 (b) 26
(c) 30 (d) 20

6. In two triangles ΔPQR and ΔABC , it is given that $\frac{AB}{BC} = \frac{PQ}{PR}$. For these

two triangles to be similar, which of the following should be true ?

- (a) $\angle A = \angle P$ (b) $\angle B = \angle Q$
(c) $\angle B = \angle P$ (d) $CA = QR$

7. If $\sin \theta = \frac{3}{4}$, then $\frac{(\sec^2 \theta - 1) \cos^2 \theta}{\sin \theta}$ equals :

- (a) $\frac{3}{5}$ (b) $\frac{3}{4}$
(c) $\frac{4}{3}$ (d) $\frac{9}{16}$

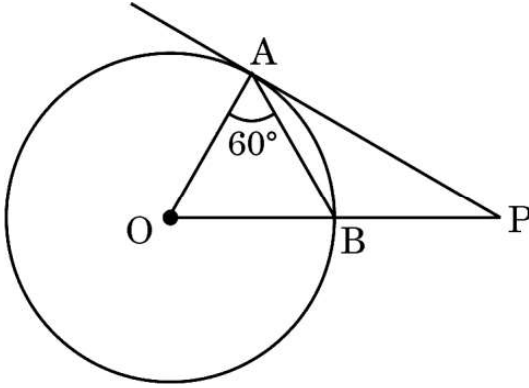
8. The 8th term of an A.P. is 17 and its 14th term is 29. The common difference of this A.P. is :

- (a) 3 (b) 2
(c) 5 (d) -2





9. दी गई आकृति में, O वृत्त का केंद्र है और PA वृत्त पर स्पर्श-रेखा है। यदि $\angle OAB = 60^\circ$ है, तो $\angle OPA$ बराबर है :

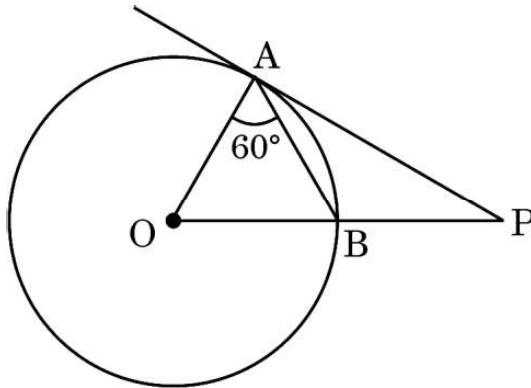


- (a) 60° (b) 30°
(c) 15° (d) 20°
10. 52 ताश के पत्तों की अच्छी प्रकार से फेंटी गई एक गड्डी से एक पत्ता यादृच्छया निकाला जाता है। निकाले गए पत्ते की एक लाल बादशाह होने की प्रायिकता है :
- (a) $\frac{1}{52}$ (b) $\frac{1}{26}$
(c) $\frac{2}{26}$ (d) $\frac{2}{13}$
11. यदि समीकरणों $3x + 2my = 2$ और $2x + 5y + 1 = 0$ द्वारा निरूपित रेखाएँ समांतर हैं, तो m का मान है :
- (a) $\frac{2}{5}$ (b) $-\frac{5}{4}$
(c) $\frac{3}{2}$ (d) $\frac{15}{4}$
12. $\Delta ABC \sim \Delta DEF$ और इनके परिमाण क्रमशः 32 cm और 24 cm हैं। यदि $AB = 10$ cm है, तो DE बराबर है :
- (a) 8 cm (b) 7.5 cm
(c) 15 cm (d) $5\sqrt{3}$ cm
13. समीकरण $3x^2 - 2\sqrt{6}x + 2 = 0$ के दो मूल :
- (a) वास्तविक और भिन्न हैं
(b) वास्तविक नहीं हैं
(c) वास्तविक और बराबर हैं
(d) परिमेय हैं





9. In the given figure, O is the centre of the circle and PA is a tangent to the circle. If $\angle OAB = 60^\circ$, then $\angle OPA$ is equal to :



- (a) 60° (b) 30°
(c) 15° (d) 20°
10. One card is drawn at random from a well shuffled deck of 52 playing cards. The probability that it is a red king is :
- (a) $\frac{1}{52}$ (b) $\frac{1}{26}$
(c) $\frac{2}{26}$ (d) $\frac{2}{13}$
11. If the lines represented by equations $3x + 2my = 2$ and $2x + 5y + 1 = 0$ are parallel, then the value of m is :
- (a) $\frac{2}{5}$ (b) $-\frac{5}{4}$
(c) $\frac{3}{2}$ (d) $\frac{15}{4}$
12. $\Delta ABC \sim \Delta DEF$ and their perimeters are 32 cm and 24 cm respectively. If $AB = 10$ cm, then DE equals :
- (a) 8 cm (b) 7.5 cm
(c) 15 cm (d) $5\sqrt{3}$ cm
13. The two roots of the equation $3x^2 - 2\sqrt{6}x + 2 = 0$ are :
- (a) real and distinct
(b) not real
(c) real and equal
(d) rational





14. यदि $\sin \theta = \frac{a}{b}$ है, तो $\sec \theta$ बराबर है ($0 \leq \theta \leq 90^\circ$) :

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

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

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

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

15. बिन्दुओं A(0, 6) और B(-6, 2) के बीच की दूरी है :

(a) 6 इकाई

(b) $2\sqrt{6}$ इकाई

(c) $2\sqrt{13}$ इकाई

(d) $13\sqrt{2}$ इकाई

16. k के मान, जिनके लिए द्विघात समीकरण $x^2 + 4x + k = 0$ के वास्तविक मूल हैं, हैं :

(a) $k \geq 4$

(b) $k \leq 4$

(c) $k \geq -4$

(d) $k \leq -4$

17. $(3^4 \times 2^2 \times 7^3)$ और $(3^2 \times 5 \times 7)$ का HCF है :

(a) 630

(b) 63

(c) 729

(d) 567

18. यदि द्विघात बहुपद $kx^2 + 3x + k$ का एक शून्यक 2 है, तो k का मान होगा :

(a) $-\frac{6}{5}$

(b) $\frac{6}{5}$

(c) $\frac{5}{6}$

(d) $-\frac{5}{6}$

प्रश्न संख्या 19 और 20 अभिकथन एवं तर्क आधारित प्रश्न हैं और प्रत्येक प्रश्न का 1 अंक है। दो कथन दिए गए हैं जिनमें एक को अभिकथन (A) तथा दूसरे को तर्क (R) द्वारा अंकित किया गया है। इन प्रश्नों के सही उत्तर नीचे दिए गए कोडों (a), (b), (c) और (d) में से चुनकर दीजिए।

- (a) अभिकथन (A) 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।





14. If $\sin \theta = \frac{a}{b}$, then $\sec \theta$ is equal to ($0 \leq \theta \leq 90^\circ$):

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

15. The distance between the points A(0, 6) and B(-6, 2) is :

- (a) 6 units (b) $2\sqrt{6}$ units
(c) $2\sqrt{13}$ units (d) $13\sqrt{2}$ units

16. The value(s) of k for which the roots of quadratic equation $x^2 + 4x + k = 0$ are real, is :

- (a) $k \geq 4$ (b) $k \leq 4$
(c) $k \geq -4$ (d) $k \leq -4$

17. HCF of $(3^4 \times 2^2 \times 7^3)$ and $(3^2 \times 5 \times 7)$ is :

- (a) 630 (b) 63
(c) 729 (d) 567

18. If one zero of the quadratic polynomial $kx^2 + 3x + k$ is 2, then the value of k is :

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

Questions number 19 and 20 are Assertion and Reason based questions carrying 1 mark each. 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.



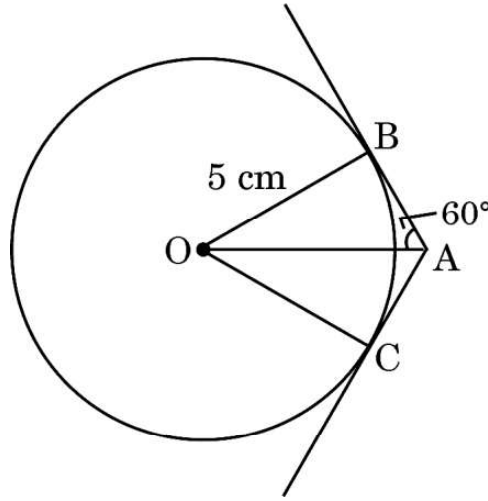


19. अभिकथन (A) : 'a' cm भुजा के एक खोखले घन के अन्दर जो बड़े से बड़ा गोला रखा जा सकता है, उसका पृष्ठीय क्षेत्रफल $\pi a^2 \text{ cm}^2$ है ।
तर्क (R) : त्रिज्या 'r' के एक गोले का पृष्ठीय क्षेत्रफल $\frac{4}{3} \pi r^3$ होता है ।
20. अभिकथन (A) : दो सिक्के एक साथ उछालने पर, कोई पट न प्राप्त होने की प्रायिकता $\frac{1}{4}$ है ।
तर्क (R) : एक घटना E की प्रायिकता $P(E)$, $0 \leq P(E) \leq 1$ को संतुष्ट करती है ।

खण्ड ख

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

21. दी गई आकृति में, केन्द्र O के वृत्त पर स्पर्श-रेखाएँ AB और AC खींची गई हैं । यदि $\angle OAB = 60^\circ$ तथा $OB = 5 \text{ cm}$ हो, तो OA और AC की लम्बाइयाँ ज्ञात कीजिए ।



22. A.P. : $-\frac{29}{3}, -9, -\frac{25}{3}, -\frac{23}{3}, \dots$ के पहले 20 पदों का योगफल ज्ञात कीजिए ।

23. (क) मान ज्ञात कीजिए :

$$\frac{\sin 30^\circ + \tan 45^\circ}{\sec 30^\circ + \cot 45^\circ}$$

अथवा

- (ख) $A = 30^\circ$ और $B = 60^\circ$ के लिए, सत्यापित कीजिए कि :

$$\sin(A + B) = \sin A \cos B + \cos A \sin B$$





19. *Assertion (A)* : The surface area of largest sphere that can be inscribed in a hollow cube of side 'a' cm is $\pi a^2 \text{ cm}^2$.

Reason (R) : The surface area of a sphere of radius 'r' is $\frac{4}{3} \pi r^3$.

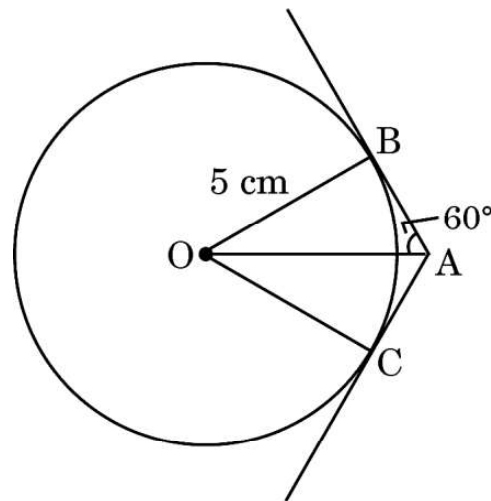
20. *Assertion (A)* : When two coins are tossed together, the probability of getting no tail is $\frac{1}{4}$.

Reason (R) : The probability P(E) of an event E satisfies $0 \leq P(E) \leq 1$.

SECTION B

This section comprises very short answer (VSA) type questions of 2 marks each.

21. In the given figure, tangents AB and AC are drawn to a circle centred at O. If $\angle OAB = 60^\circ$ and $OB = 5 \text{ cm}$, find lengths OA and AC.



22. Find the sum of the first 20 terms of the A.P. : $-\frac{29}{3}, -9, -\frac{25}{3}, -\frac{23}{3}, \dots$

23. (a) Evaluate :

$$\frac{\sin 30^\circ + \tan 45^\circ}{\sec 30^\circ + \cot 45^\circ}$$

OR

(b) For $A = 30^\circ$ and $B = 60^\circ$, verify that :

$$\sin (A + B) = \sin A \cos B + \cos A \sin B.$$





24. 480 और 256 का LCM अभाज्य गुणनखण्ड विधि से ज्ञात कीजिए ।
25. (क) दर्शाइए कि $A(1, 2)$, $B(5, 4)$, $C(3, 8)$ और $D(-1, 6)$ एक समांतर चतुर्भुज ABCD के शीर्ष हैं ।

अथवा

- (ख) दर्शाइए कि बिन्दु $A(3, 0)$, $B(6, 4)$ और $C(-1, 3)$ एक समकोण त्रिभुज के शीर्ष हैं ।

खण्ड ग

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

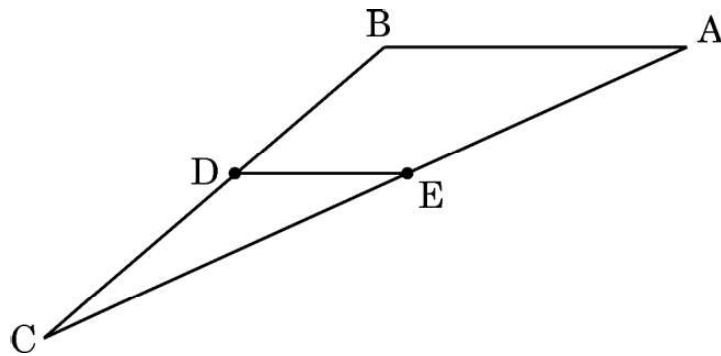
26. निम्न आँकड़ों का माध्य ज्ञात कीजिए :

वर्ग	0 – 15	15 – 30	30 – 45	45 – 60	60 – 75	75 – 90
बारंबारता	12	15	11	20	16	6

27. (क) अनुपात ज्ञात कीजिए जिसमें बिन्दु $P(a, -2)$, बिन्दुओं $A(-4, 3)$ और $B(2, -4)$ को जोड़ने वाले रेखाखंड को बाँटता है । 'a' का मान भी ज्ञात कीजिए ।

अथवा

- (ख) दी गई आकृति में, बिन्दु D तथा E क्रमशः ΔABC की भुजाओं BC तथा AC के मध्य-बिंदु हैं । यदि शीर्ष $A(4, -2)$, $B(2, -2)$ तथा $C(-6, -7)$ हैं, तो सत्यापित कीजिए कि $DE = \frac{1}{2} AB$.





24. Find LCM of 480 and 256 using prime factorization.

25. (a) Show that A(1, 2), B(5, 4), C(3, 8) and D(-1, 6) are vertices of a parallelogram ABCD.

OR

(b) Show that the points A(3, 0), B(6, 4) and C(-1, 3) are vertices of a right-angled triangle.

SECTION C

This section comprises short answer (SA) type questions of 3 marks each.

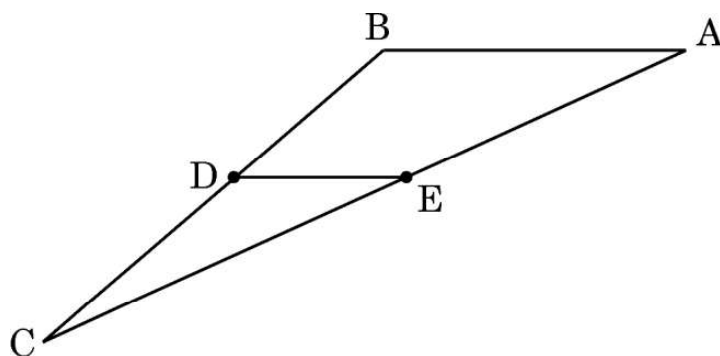
26. Find mean of the following data :

Class	0 – 15	15 – 30	30 – 45	45 – 60	60 – 75	75 – 90
Frequency	12	15	11	20	16	6

27. (a) Determine the ratio in which the point P(a, -2) divides the line segment joining the points A(-4, 3) and B(2, -4). Also, find the value of 'a'.

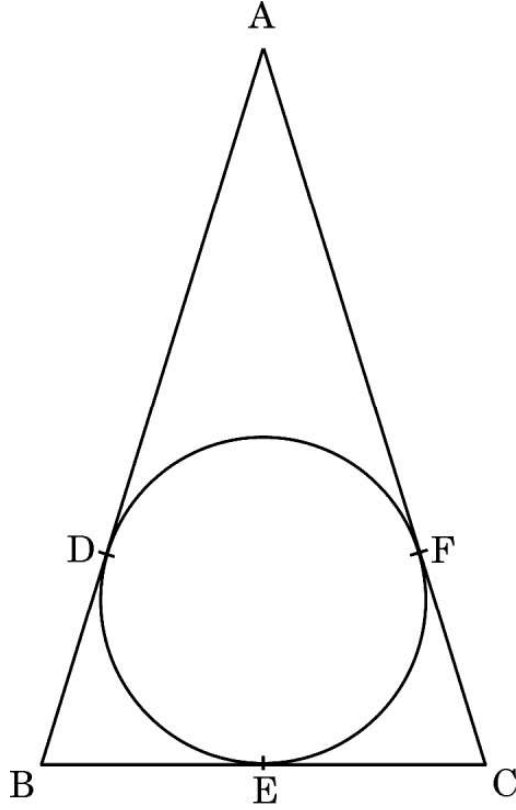
OR

(b) In the given figure, in ΔABC points D and E are mid-points of sides BC and AC respectively. If given vertices are A(4, -2), B(2, -2) and C(-6, -7), then verify the result $DE = \frac{1}{2} AB$.





28. एक वृत्त के परिगत ABC एक समद्विबाहु त्रिभुज है, जिसमें $AB = AC$ है। सिद्ध कीजिए कि स्पर्श बिंदु E द्वारा BC समद्विभाजित होती है।



29. सिद्ध कीजिए :

$$\sqrt{\frac{\sec \theta - 1}{\sec \theta + 1}} + \sqrt{\frac{\sec \theta + 1}{\sec \theta - 1}} = 2 \operatorname{cosec} \theta$$

30. (क) सबीना ₹ 2,000 निकालने के लिए एक बैंक के ATM गई। उसे केवल ₹ 50 और ₹ 100 के नोट ही प्राप्त हुए। यदि सबीना को कुल 25 नोट प्राप्त हुए हों, तो उसे ₹ 50 और ₹ 100 के कितने-कितने नोट प्राप्त हुए हैं ?

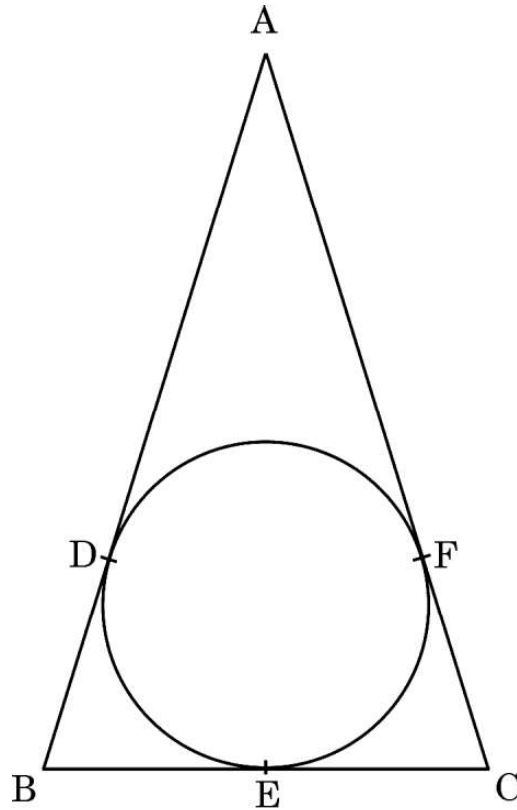
अथवा

- (ख) पाँच वर्ष पूर्व अमित की आयु बलजीत की आयु की तीन गुना थी। दस वर्ष पश्चात्, अमित की आयु बलजीत की आयु की दुगुनी हो जाएगी। उनकी वर्तमान आयु क्या हैं ?
31. सिद्ध कीजिए कि $11 + 3\sqrt{2}$ एक अपरिमेय संख्या है, दिया गया है कि $\sqrt{2}$ एक अपरिमेय संख्या है।





28. ABC is an isosceles triangle with $AB = AC$, circumscribed about a circle. Prove that BC is bisected at E.



29. Prove that :

$$\sqrt{\frac{\sec \theta - 1}{\sec \theta + 1}} + \sqrt{\frac{\sec \theta + 1}{\sec \theta - 1}} = 2 \operatorname{cosec} \theta$$

30. (a) Sabina went to a bank ATM to withdraw ₹ 2,000. She received ₹ 50 and ₹ 100 notes only. If Sabina got 25 notes in all, how many notes of ₹ 50 and ₹ 100 did she receive ?

OR

- (b) Five years ago, Amit was thrice as old as Baljeet. Ten years hence, Amit shall be twice as old as Baljeet. What are their present ages ?
31. Prove that $11 + 3\sqrt{2}$ is an irrational number, given that $\sqrt{2}$ is an irrational number.





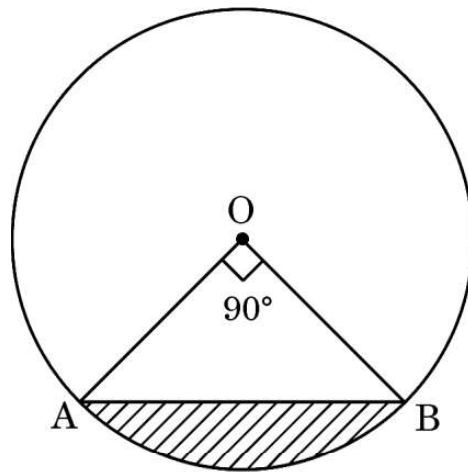
खण्ड घ

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

32. (क) 16 को दो भागों में इस प्रकार विभाजित कीजिए कि बड़े भाग के वर्ग का दुगुना, छोटे भाग के वर्ग से 164 अधिक हो।

अथवा

- (ख) एक नाव, जिसकी गति शांत जल में 18 km/h है, धारा के प्रतिकूल 24 km जाने में उसी बिंदु पर लौटने की तुलना में 1 घंटा अधिक समय लेती है। धारा की चाल और यात्रा का कुल समय ज्ञात कीजिए।
33. यदि किसी त्रिभुज की एक भुजा के समांतर अन्य दो भुजाओं को भिन्न-भिन्न बिन्दुओं पर प्रतिच्छेद करने के लिए एक रेखा खींची जाए, तो सिद्ध कीजिए कि अन्य दो भुजाएँ एक ही अनुपात में विभाजित हो जाती हैं।
34. 50 m ऊँचे भवन के शिखर से, एक टावर के शिखर और पाद के अवनमन कोण क्रमशः 30° और 60° हैं। टावर की ऊँचाई तथा भवन और टावर के बीच की दूरी ज्ञात कीजिए। ($\sqrt{3} = 1.73$ का प्रयोग कीजिए)
35. (क) दी गई आकृति में, केन्द्र O और त्रिज्या 7 cm वाले वृत्त की एक जीवा AB है। यदि $\angle AOB = 90^\circ$ है, तो छायांकित भाग का क्षेत्रफल ज्ञात कीजिए। लघु चाप AB की लम्बाई भी ज्ञात कीजिए।



अथवा





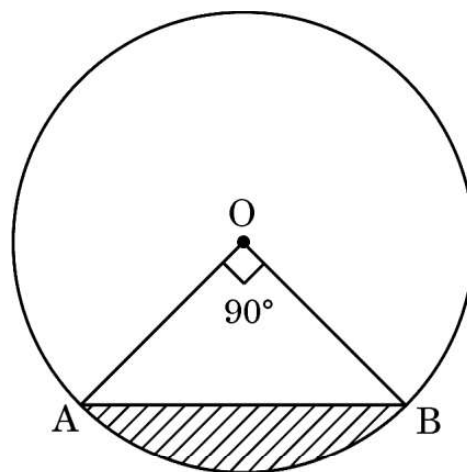
SECTION D

This section comprises long answer (LA) type questions of 5 marks each.

32. (a) Divide 16 into two parts such that twice the square of the greater part, exceeds the square of the smaller part by 164.

OR

- (b) A motor boat whose speed is 18 km/h in still water takes 1 hour more to go 24 km upstream, than to return to the same point. Find the speed of the stream and total time of the journey.
33. If a line is drawn parallel to one side of a triangle to intersect the other two sides at distinct points, then prove that the other two sides are divided in the same ratio.
34. From the top of a building 50 m high, the angles of depression of the top and bottom of a tower are observed to be 30° and 60° . Find the height of the tower and distance between the building and the tower. (Take $\sqrt{3} = 1.73$)
35. (a) In the given figure, AB is a chord of a circle of radius 7 cm and centred at O. Find the area of the shaded region if $\angle AOB = 90^\circ$. Also, find length of minor arc AB.

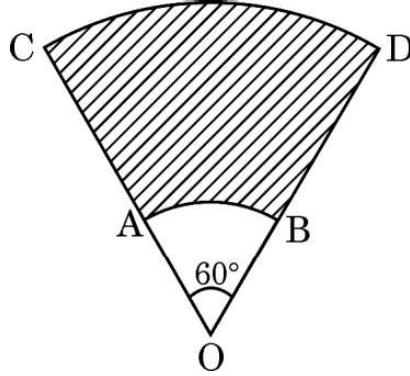


OR





- (ख) AB और CD केन्द्र O तथा त्रिज्याओं 3.5 cm और 10.5 cm वाले दो संकेन्द्रीय वृत्तों की क्रमशः दो चाप हैं। यदि $\angle AOB = 60^\circ$ है, तो छायांकित भाग का क्षेत्रफल ज्ञात कीजिए तथा चाप CD की लम्बाई भी ज्ञात कीजिए।



खण्ड ड

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

प्रकरण अध्ययन - 1

36. गायन के कटोरे (आकार में गोलाकार) आमतौर पर ध्वनि उपचार प्रथाओं में उपयोग किए जाते हैं। मैलेट (आकार में बेलनाकार) का उपयोग ध्वनि और कंपन उत्पन्न करने के क्रम में कटोरे पर प्रहार करने के लिए किया जाता है।



ऐसा ही एक कटोरा यहाँ दिखाया गया है जिसके आयाम हैं :

अर्धगोलाकार कटोरे की बाहरी त्रिज्या 6 cm और भीतरी त्रिज्या 5 cm है।

मैलेट की ऊँचाई 10 cm और त्रिज्या 2 cm है।

उपर्युक्त के आधार पर, निम्नलिखित प्रश्नों के उत्तर दीजिए :

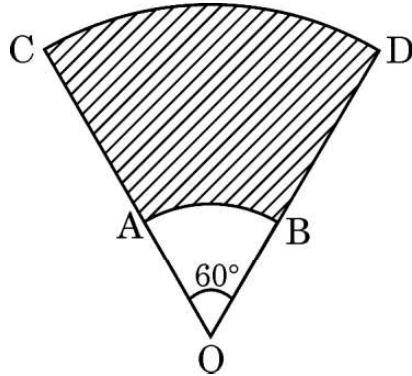
- (i) मैलेट में प्रयुक्त सामग्री का आयतन कितना है ?

1





- (b) AB and CD are arcs of two concentric circles of radii 3.5 cm and 10.5 cm respectively and centred at O. Find the area of the shaded region if $\angle AOB = 60^\circ$. Also, find the length of arc CD.



SECTION E

This section comprises 3 case study based questions of 4 marks each.

Case Study – 1

- 36.** Singing bowls (hemispherical in shape) are commonly used in sound healing practices. Mallet (cylindrical in shape) is used to strike the bowl in a sequence to produce sound and vibration.



One such bowl is shown here whose dimensions are :

Hemispherical bowl has outer radius 6 cm and inner radius 5 cm.

Mallet has height of 10 cm and radius 2 cm.

Based on the above, answer the following questions :

- (i) What is the volume of the material used in making the mallet ? 1





(ii) कटोरे को अन्दर से पॉलिश किया गया है। कटोरे का भीतरी पृष्ठीय क्षेत्रफल ज्ञात कीजिए। 1

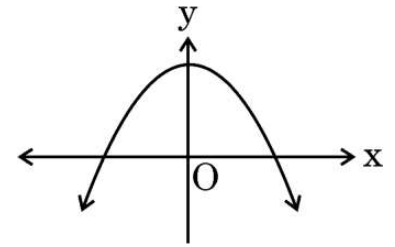
(iii) (क) कटोरे को बनाने में प्रयोग होने वाली धातु का आयतन ज्ञात कीजिए। 2

अथवा

(iii) (ख) मैलेट का कुल पृष्ठीय क्षेत्रफल ज्ञात कीजिए। ($\pi = 3.14$ का प्रयोग कीजिए) 2

प्रकरण अध्ययन - 2

37. इंद्रधनुष आकाश में दिखाई देने वाली रंगों की एक मेहराब है जो बारिश के बाद या जब आकाश में पानी की बूंदें हों, तब दिखाई देती है। इंद्रधनुष में अक्सर लाल, संतरी, पीला, हरा, नीला, जामुनी तथा बैंगनी रंग होते हैं। इंद्रधनुष का प्रत्येक रंग एक परवलय बनाता है। हम जानते हैं कि द्विघात बहुपद $p(x) = ax^2 + bx + c$ ($a \neq 0$) ग्राफ पेपर पर एक परवलय को निरूपित करता है।



उपर्युक्त के आधार पर, निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) दर्शायी गई आकृति में एक इंद्रधनुष $y = f(x)$ का आलेख दिया है। इस वक्र के शून्यकों की संख्या लिखिए। 1

(ii) यदि एक इंद्रधनुष का आलेख x -अक्ष को प्रतिच्छेद नहीं करता है, परन्तु y -अक्ष को एक बिंदु पर प्रतिच्छेद करता है, तो इसके शून्यकों की संख्या कितनी है? 1

(iii) (क) यदि द्विघात बहुपद $p(x) = x^2 + (a + 1)x + b$ द्वारा निरूपित एक इंद्रधनुष के शून्यक 2 तथा -3 हैं, तो a तथा b के मान ज्ञात कीजिए। 2

अथवा

(iii) (ख) बहुपद $x^2 - 2x - (7p + 3)$ एक इंद्रधनुष को निरूपित करता है। यदि -4 इसका एक शून्यक है, तो p का मान ज्ञात कीजिए। 2





(ii) The bowl is to be polished from inside. Find the inner surface area of the bowl. 1

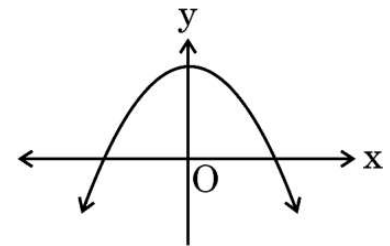
(iii) (a) Find the volume of metal used to make the bowl. 2

OR

(iii) (b) Find total surface area of the mallet. (Use $\pi = 3.14$) 2

Case Study - 2

37. Rainbow is an arch of colours that is visible in the sky after rain or when water droplets are present in the atmosphere. The colours of the rainbow are generally, red, orange, yellow, green, blue, indigo and violet. Each colour of the rainbow makes a parabola. We know that any quadratic polynomial $p(x) = ax^2 + bx + c$ ($a \neq 0$) represents a parabola on the graph paper.



Based on the above, answer the following questions :

(i) The graph of a rainbow $y = f(x)$ is shown in the figure. Write the number of zeroes of the curve. 1

(ii) If the graph of a rainbow does not intersect the x-axis but intersects y-axis at one point, then how many zeroes will it have ? 1

(iii) (a) If a rainbow is represented by the quadratic polynomial $p(x) = x^2 + (a + 1)x + b$, whose zeroes are 2 and -3 , find the value of a and b. 2

OR

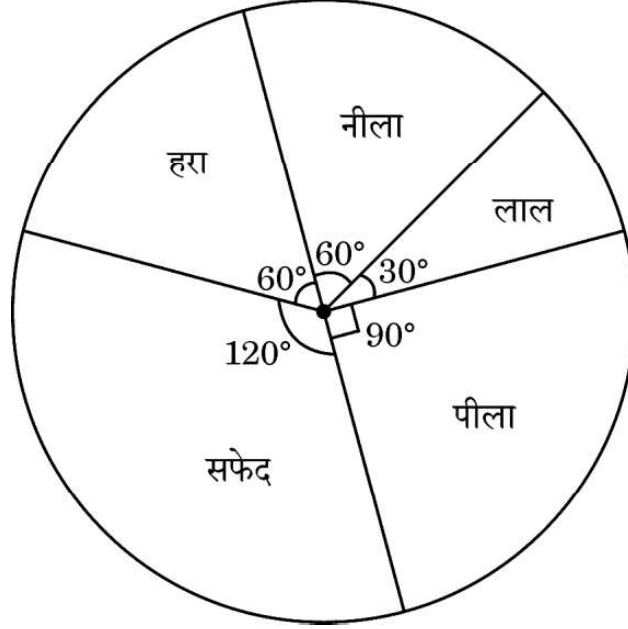
(iii) (b) The polynomial $x^2 - 2x - (7p + 3)$ represents a rainbow. If -4 is a zero of it, find the value of p. 2





प्रकरण अध्ययन - 3

38. कुछ छात्रों को अपने पसंदीदा रंग की सूची बनाने के लिए कहा गया। प्रत्येक रंग का माप दिए गए पाई चार्ट के केंद्रीय कोण द्वारा दिखाया गया है :



पाई चार्ट का अध्ययन कीजिए तथा निम्नलिखित प्रश्नों के उत्तर दीजिए :

- (i) यदि एक छात्र का यादृच्छया चयन किया गया हो, तो उसका पसंदीदा रंग सफेद होने की प्रायिकता ज्ञात कीजिए। 1
- (ii) उसका पसंदीदा रंग नीला या हरा होने की प्रायिकता क्या है? 1
- (iii) (क) यदि 15 छात्रों का पसंदीदा रंग पीला है, तो कितने छात्रों ने सर्वेक्षण में भाग लिया? 2

अथवा

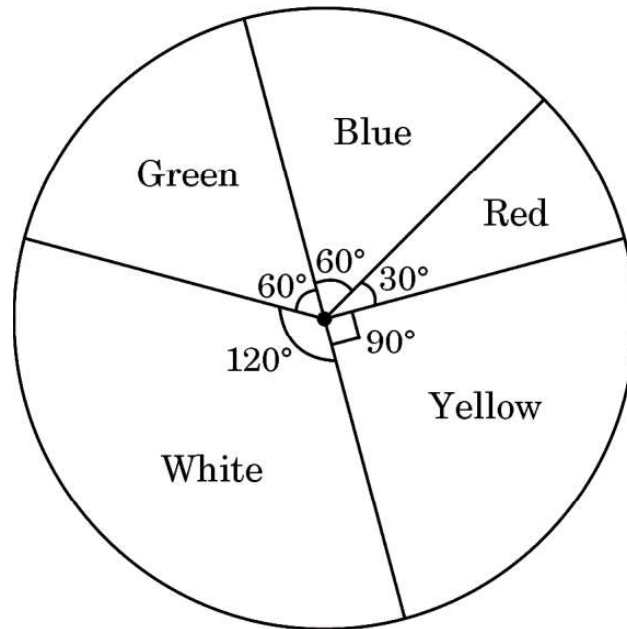
- (iii) (ख) पसंदीदा रंग लाल या नीला होने की प्रायिकता क्या है? 2





Case Study – 3

38. Some students were asked to list their favourite colour. The measure of each colour is shown by the central angle of a pie chart given below :



Study the pie chart and answer the following questions :

- (i) If a student is chosen at random, then find the probability of his/her favourite colour being white ? 1
- (ii) What is the probability of his/her favourite colour being blue or green ? 1
- (iii) (a) If 15 students liked the colour yellow, how many students participated in the survey ? 2
- OR**
- (iii) (b) What is the probability of the favourite colour being red or blue ? 2



Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2023
SUBJECT NAME: MATHEMATICS (BASIC)
(PAPER CODE 430/5/3)

General Instructions: -

1	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully.
2	“Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, Evaluation done and several other aspects. Its’ 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 IPC.”
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 two 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 the 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 totaled up and written in the left-hand margin and encircled. This may be followed strictly.
8	If a question does not have any parts, marks must be awarded in 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” . However, for MCQs(Q1 – Q20), only first attempt to be evaluated.
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 _____(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).
13	Ensure that you do not make the following common types of errors committed by the Examiner in the past:- <ul style="list-style-type: none"> ● Leaving answer or part thereof unassessed in an answer book. ● Giving more marks for an answer than assigned to it. ● Wrong totaling of marks awarded on an answer. ● Wrong transfer of marks from the inside pages of the answer book to the title page. ● Wrong question wise totaling on the title page. ● Wrong totaling of marks of the two columns on the title page. ● Wrong grand total. ● Marks in words and figures not tallying/not same. ● Wrong transfer of marks from the answer book to online award list. ● Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.) ● Half or a part of answer marked correct and the rest as wrong, but no marks awarded.
14	While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0)Marks.
15	Any un assessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.
16	The Examiners should acquaint themselves with the guidelines given in the “ Guidelines for spot Evaluation ” before starting the actual evaluation.
17	Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totaled 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.

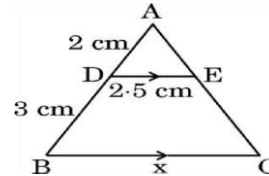
MARKING SCHEME (430/5/3)
MATHEMATICS (BASIC)

1. The sum of the first 50 odd natural numbers is :
 (a) 5000 (b) 2500
 (c) 2550 (d) 5050

Answer : (b) 2500

1

2. In the given figure, $AD = 2$ cm, $DB = 3$ cm, $DE = 2.5$ cm and $DE \parallel BC$. The value of x is:
 (a) 6cm (b) 3.75 cm
 (c) 6.25 cm (d) 7.5 cm



Answer : (c) 6.25 cm

1

3. A circle is of radius 3 cm. The distance between two of its parallel tangents is:
 (a) 12 cm (b) 6 cm
 (c) 3 cm (d) 4.5 cm

Answer: (b) 6 cm

1

4. The median class for the data given below is :

Class	20 – 40	40 – 60	60 – 80	80 – 100	100 – 120
Frequency	10	12	14	13	17

- (a) 80 – 100 (b) 20 – 40
 (c) 40 – 60 (d) 60 – 80

Answer: (d) 60 – 80

1

5. Mean and median of some data are 32 and 30 respectively. Using empirical relation, mode of the data is :

- (a) 36 (b) 26
 (c) 30 (d) 20

Answer : (b) 26

1

6. In two triangles ΔPQR and ΔABC , it is given that $\frac{AB}{BC} = \frac{PQ}{PR}$. For these two triangles to be similar, which of the following should be true ?

- (a) $\angle A = \angle P$ (b) $\angle B = \angle Q$
 (c) $\angle B = \angle P$ (d) $CA = QR$

Answer: (c) $\angle B = \angle P$

1

7. If $\sin \theta = \frac{3}{4}$, then $\frac{(\sec^2 \theta - 1) \cos^2 \theta}{\sin \theta}$ equals :

- (a) $\frac{3}{4}$ (b) $\frac{3}{4}$
 (c) $\frac{5}{4}$ (d) $\frac{9}{16}$
 (e) $\frac{3}{4}$

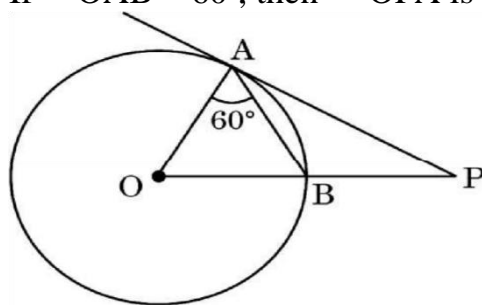
Answer : (b) $\frac{3}{4}$ 1

8. The 8th term of an A.P. is 17 and its 14th term is 29. The common difference of this A.P. is :

- (a) 3 (b) 2
 (c) 5 (d) -2

Answer : (b) 2 1

9. In the given figure, O is the centre of the circle and PA is a tangent to the circle. If $\angle OAB = 60^\circ$, then $\angle OPA$ is equal to :



- (a) 60° (b) 30°
 (c) 15° (d) 20°

Answer : (b) 30° 1

10. One card is drawn at random from a well shuffled deck of 52 playing cards. The probability that it is a red king is :

- (a) $\frac{1}{52}$ (b) $\frac{1}{26}$
 (c) $\frac{2}{26}$ (d) $\frac{2}{13}$

Answer: (b) $\frac{1}{26}$ 1

11. If the lines represented by equations $3x + 2my = 2$ and $2x + 5y + 1 = 0$ are parallel, then the value of m is :

- (a) $\frac{2}{5}$ (b) $-\frac{5}{4}$
 (c) $\frac{3}{2}$ (d) $\frac{15}{4}$



Answer: (d) $\frac{15}{4}$

1

12. $\triangle ABC \sim \triangle DEF$ and their perimeter are 32 cm and 24 cm respectively.

If $AB = 10$ cm, then DE equals :

(a) 8 cm

(d) 7.5 cm

(c) 15 cm

(d) $5\sqrt{3}$ cm

Answer: (b) 7.5 cm

1

13. The two roots of the equation $3x^2 - 2\sqrt{6}x + 2 = 0$ are:

(a) real and distinct

(b) not real

(c) real and equal

(d) rational

Answer: (c) real and equal

1

14. If $\sin \theta = \frac{a}{b}$, then $\sec \theta$ is equal to ($0 \leq \theta \leq 90^\circ$):

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

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

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

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

Answer: (b) $\frac{b}{\sqrt{b^2 - a^2}}$

1

15. The distance between the points A (0, 6) and B (-6, 2) is :

(a) 6 units

(b) $2\sqrt{6}$ units

(c) $2\sqrt{13}$ units

(d) $13\sqrt{2}$ units

Answer : (c) $2\sqrt{13}$ units

1

16. The value(s) of k for which the roots of quadratic equation $x^2 + 4x + k = 0$ are real, is :

(a) $k \geq 4$

(b) $k \leq 4$

(c) $k \geq -4$

(d) $k \leq -4$

Answer: (b) $k \leq 4$

1

17. HCF of $(3^4 \times 2^2 \times 7^3)$ and $(3^2 \times 5 \times 7)$ is :

(a) 630

(b) 63

(c) 729

(d) 567

Answer: (b) 63

1

18. If one zero of the quadratic polynomial $kx^2 + 3x + k$ is 2, then the value of k is:

(a) $-\frac{6}{5}$

(b) $\frac{6}{5}$

(b) $\frac{5}{6}$

(d) $-\frac{5}{6}$



Answer: (a) $-\frac{6}{5}$

1

Questions number 19 and 20 are Assertion and Reason based questions carrying 1 mark each. 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 largest sphere that can be inscribed in a hollow cube of side 'a' cm is $\pi a^2 \text{ cm}^2$.

Reason (R) : The surface area of a sphere of radius 'r' is $\frac{4}{3} \pi r^3$.

Answer: (c) Assertion (A) is true, but Reason (R) is false.

1

20. **Assertion (A)** : When two coins are tossed together, the probability of getting no tail is $\frac{1}{4}$.

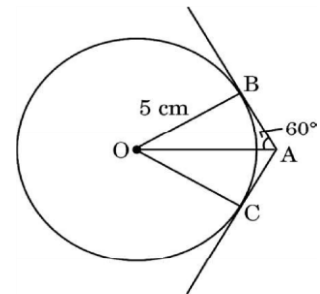
Reason (R) : The probability P(E) of an event E satisfies $0 \leq P(E) \leq 1$.

Answer: (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is **not** the correct explanation of the Assertion (A).

1

SECTION B

21. In the given figure, tangents AB and AC are drawn to a circle centred at O. If $\angle OAB = 60^\circ$ and $OB = 5 \text{ cm}$, find lengths OA and AC.



Solution. $\sin 60^\circ = \frac{\sqrt{3}}{2} = \frac{5}{OA} \Rightarrow OA = \frac{10\sqrt{3}}{3} \text{ cm}$ $\frac{1}{2} + \frac{1}{2}$

$\tan 60^\circ = \sqrt{3} = \frac{5}{AB} \Rightarrow AB = \frac{5\sqrt{3}}{3} \text{ cm} = AC$ $\frac{1}{2} + \frac{1}{2}$

22. Find the sum of the first 20 terms of the A.P. : $-\frac{29}{3}, -9, -\frac{25}{3}, -\frac{23}{3}, \dots$

Solution: $d = \frac{2}{3}$ $\frac{1}{2}$

$\therefore S_{20} = \frac{20}{2} \left[-\frac{58}{3} + 19 \times \frac{2}{3} \right]$ 1

$= -\frac{200}{3}$ $\frac{1}{2}$

23. (a) Evaluate: $\frac{\sin 30^\circ + \tan 45^\circ}{\sec 30^\circ + \cot 45^\circ}$

Solution: (a) Required value is $\frac{\frac{1}{2} + 1}{\frac{2}{\sqrt{3}} + 1} = \frac{3\sqrt{3}}{2(2 + \sqrt{3})}$ $1 \frac{1}{2}$
 $\frac{1}{2}$

OR

(b) For $A = 30^\circ$ and $B = 60^\circ$, verify that :

$$\sin(A + B) = \sin A \cos B + \cos A \sin B.$$

Solution (b) LHS = $\sin 90^\circ = 1$ $\frac{1}{2}$

$$\text{RHS} = \frac{1}{2} \times \frac{1}{2} + \frac{\sqrt{3}}{2} \times \frac{\sqrt{3}}{2} = 1$$

$\frac{1}{2}$

LHS = RHS

24. Find LCM of 480 and 256 using prime factorization.

Solution: $480 = 2^5 \times 3 \times 5$ $\frac{1}{2}$

$$256 = 2^8$$

$\frac{1}{2}$

$$\text{LCM}(480, 256) = 2^8 \times 3 \times 5 = 3840$$

1

25. (a) Show that A(1, 2), B(5, 4), C(3, 8) and D(-1, 6) are vertices of a parallelogram ABCD.

Solution: Mid-point of AC = $\left(\frac{3+1}{2}, \frac{8+2}{2}\right) = (2, 5)$ 1

Mid-point of BD = $\left(\frac{5-1}{2}, \frac{4+6}{2}\right) = (2, 5)$ $\frac{1}{2}$

\therefore Mid-point of AC = Mid-point of BD $\frac{1}{2}$

Hence, ABCD is a parallelogram

OR

(b) Show that the points A(3, 0), B(6, 4) and C(-1, 3) are the vertices of a right angled triangle.

Solution: $AB^2 = 3^2 + 4^2 = 25$ $\frac{1}{2}$

$BC^2 = 7^2 + 1^2 = 50$ $\frac{1}{2}$



$$AC^2 = 4^2 + 3^2 = 25$$

$$\frac{1}{2}$$

$$\therefore BC^2 = AB^2 + AC^2$$

$$\frac{1}{2}$$

$\therefore \Delta ABC$ is right-angled triangle.

SECTION C

26. Find mean of the following data :

Class	0 – 15	15 – 30	30 – 45	45 – 60	60 – 75	75 – 90
Frequency	12	15	11	20	16	6

Solution.

Class	x	f	$u = \frac{x - 37.5}{15}$	fu
0 – 15	7.5	12	-2	-24
15 – 30	22.5	15	-1	-15
30 – 45	37.5	11	0	0
45 – 60	52.5	20	1	20
60 – 75	67.5	16	2	32
75 – 90	82.5	6	3	18
		80		31

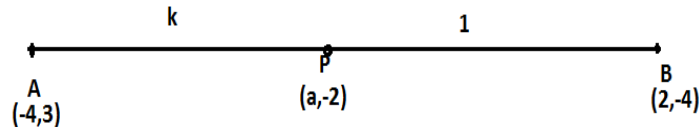
For Correct Table: 2 Marks

$$\begin{aligned} \text{Mean} &= a + \frac{\sum fu}{\sum f} \times h \\ &= 37.5 + 15 \times \frac{31}{80} = 43.3 \end{aligned}$$

1

27. (a) Determine the ratio in which the point P(a, -2) divides the line segment joining the points A(-4, 3) and B(2, -4). Also, find the value of 'a'.

Solution:



$$\text{Let } AP : PB = k : 1$$

$$\therefore \frac{-4k + 3}{k + 1} = -2 \Rightarrow k = \frac{5}{2}$$

$$1 + \frac{1}{2}$$

$$\text{So, } AP : PB = 5 : 2$$

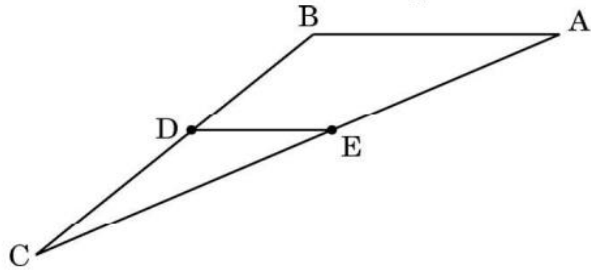
$$\text{Hence, } \frac{10 - 8}{7} = a \Rightarrow a = \frac{2}{7}$$

1

OR



- (b) In the given figure, in ΔABC points D and E are mid-points of sides BC and AC respectively. If given vertices are $A(4, -2)$, $B(2, -2)$ and $C(-6, -7)$, then verify the result $DE = \frac{1}{2} AB$.



Solution: Point D is $\left(-2, \frac{-9}{2}\right)$ 1

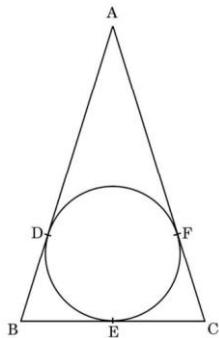
Point E is $\left(-1, \frac{-9}{2}\right)$ 1

$\therefore DE = \sqrt{1^2 + 0^2} = 1$ and $AB = \sqrt{2^2 + 0^2} = 2$ $\frac{1}{2} + \frac{1}{2}$

$\therefore DE = \frac{1}{2} AB$

28. ABC is an isosceles triangle with $AB = AC$, circumscribed about a circle. Prove that BC is bisected at E.

Solution. $AD = AF$, $BD = BE$ and $CE = CF$ (tangents from external point) 1



$AB = AC \Rightarrow AD + DB = AF + FC$ $\frac{1}{2}$

$\Rightarrow AF + DB = AF + FC$ $\frac{1}{2}$

$\Rightarrow DB = FC$ $\frac{1}{2}$

$\Rightarrow BE = EC$ or BC is bisected at E. $\frac{1}{2}$

29. Prove that : $\sqrt{\frac{\sec\theta-1}{\sec\theta+1}} + \sqrt{\frac{\sec\theta+1}{\sec\theta-1}} = 2\operatorname{cosec} \theta$

Solution: LHS = $\frac{\sqrt{\sec\theta-1}}{\sqrt{\sec\theta+1}} + \frac{\sqrt{\sec\theta+1}}{\sqrt{\sec\theta-1}} = \frac{2 \sec \theta}{\sqrt{\sec^2 \theta - 1}}$ 1

= $\frac{2 \sec \theta}{\tan \theta}$ 1

= $\frac{2 \cos \theta}{\cos \theta \cdot \sin \theta} = 2 \operatorname{cosec} \theta = \text{RHS}$ 1

30. (a) Sabina went to a bank ATM to withdraw ₹2,000. She received ₹ 50 and ₹ 100 notes only. If Sabina got 25 notes in all, how many notes of ₹ 50 and ₹ 100 did she receive?

Solution: (a) Let number of ₹50 notes be x and number of ₹100 notes be y .

ATQ, $x + y = 25$ _____ (i) 1

And, $50x + 100y = 2000$ _____ (ii) 1

Solving (i) and (ii), $x = 10$, $y = 15$ 1

Number of ₹50 notes = 10 and Number of ₹100 notes = 15

OR

- (b) Five years ago, Amit was thrice as old as Baljeet. Ten years hence, Amit shall be twice as old as Baljeet. What are their present ages?

Solution : (b) Let Amit's present age be x years and Baljeet's present age be y years.

ATQ, $(x - 5) = 3(y - 5) \Rightarrow x - 3y = -10$ 1

And $(x + 10) = 2(y + 10) \Rightarrow x - 2y = 10$ 1

Solving equations to get, $y = 20$, $x = 50$ 1

Amit's present age = 50 years and Baljeet's present age = 20 years

31. Prove that $11 + 3\sqrt{2}$ is an irrational number, given that $\sqrt{2}$ is an irrational number.

Solution: Let us assume that $11 + 3\sqrt{2}$ be a rational number.

$\Rightarrow 11 + 3\sqrt{2} = \frac{a}{b}$, where a and b are integers, $b \neq 0$ 1

$\Rightarrow \sqrt{2} = \frac{a - 11b}{3b}$ 1

RHS is a rational number but LHS is irrational. 1

\therefore Our assumption was wrong. Hence, $11 + 3\sqrt{2}$ is irrational. } 1

SECTION D

32. (a) Divide 16 into two parts such that twice the square of the greater part, exceeds the square of the smaller part by 164

Solution: (a) Let the greater part be x then the other part is $16 - x$

ATQ, $2x^2 = (16 - x)^2 + 164$ 1

$\Rightarrow x^2 + 32x - 420 = 0$ 1

$\Rightarrow (x + 42)(x - 10) = 0$ 1

$\Rightarrow x = -42, x = 10$ 1

$\Rightarrow x = 10$ ($x \neq -42$) 1

\therefore Two parts are 10 and 6. 1

OR

- (b) A motor boat whose speed is 18 km/h in still water takes 1 hour more to go 24 km upstream, than to return to the same point. Find the speed of the stream and total time of the journey.

Solution: Let the speed of the stream be x km/hour.

ATQ, $\frac{24}{18 - x} - \frac{24}{18 + x} = 1$ 2

$$\Rightarrow x^2 + 48x - 324 = 0 \quad 1$$

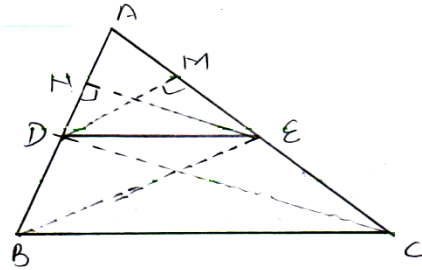
$$\Rightarrow (x + 54)(x - 6) = 0$$

$$\Rightarrow x = 6 \quad (x \neq -54) \quad 1$$

$$\text{Total time of journey} = \frac{24}{12} + \frac{24}{24} = 3 \text{ hours} \quad 1$$

33. If a line is drawn parallel to one side of a triangle to intersect the other two sides at distinct points, then prove that the other two sides are divided in the same ratio.

Solution.



For figure:
1 mark

Given: In $\triangle ABC$, $DE \parallel BC$

$\frac{1}{2}$

To prove: $\frac{AD}{DB} = \frac{AE}{EC}$

$\frac{1}{2}$

Const.: Join BE, CD. Draw $DM \perp AC$, $EN \perp AB$

$\frac{1}{2}$

Proof: $\frac{\text{ar}(\triangle ADE)}{\text{ar}(\triangle BDE)} = \frac{\frac{1}{2} \times AD \times EN}{\frac{1}{2} \times DB \times EN} = \frac{AD}{DB}$ (i)

1

Similarly, $\frac{\text{ar}(\triangle ADE)}{\text{ar}(\triangle CDE)} = \frac{AE}{EC}$ (ii)

$\frac{1}{2}$

$\triangle BDE$ and $\triangle CDE$ are on the same base DE and between the same parallel lines BC and DE.

$\text{ar}(\triangle BDE) = \text{ar}(\triangle CDE)$ (iii)

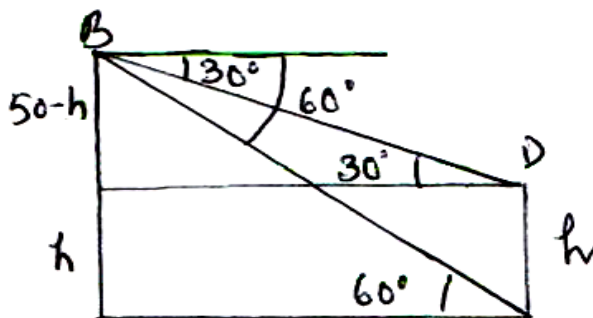
$\frac{1}{2}$

From (i), (ii) and (iii) $\frac{AD}{DB} = \frac{AE}{EC}$

$\frac{1}{2}$

34. From the top of a building 50 m high, the angles of depression of the top and bottom of a tower are observed to be 30° and 60° . Find the height of the tower and distance between the building and the tower. (Take $\sqrt{3} = 1.73$)

Solution:



For Figure:
1 mark

Let AB be the building and CD be the tower.

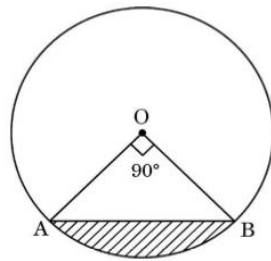
$$\text{In } \triangle BED, \quad \tan 30^\circ = \frac{50-h}{x} \Rightarrow 50-h = \frac{x}{\sqrt{3}} \quad \text{----- (i)} \quad 1 + \frac{1}{2}$$

$$\text{In } \triangle BAC, \quad \tan 60^\circ = \frac{50}{x} \Rightarrow x = \frac{50}{\sqrt{3}} \quad \text{----- (ii)} \quad 1 + \frac{1}{2}$$

$$\text{Solving (i) and (ii) to get } h = \frac{100}{3} \text{ or } 33.33 \text{ m} \quad \frac{1}{2}$$

$$\text{and } x = 28.83 \text{ m} \quad \frac{1}{2}$$

35. (a) In the given figure, AB is a chord of a circle of radius 7 cm and centred at O. Find the area of the shaded region if $\angle AOB = 90^\circ$. Also, find length of minor arc AB.



$$\begin{aligned} \text{Solution: Area of sector AOB} &= \frac{22}{7} \times 7 \times 7 \times \frac{90}{360} && 1 \\ &= \frac{77}{2} \text{ cm}^2 && \frac{1}{2} \end{aligned}$$

$$\text{Area of } \triangle AOB = \frac{1}{2} \times 7 \times 7 = \frac{49}{2} \text{ cm}^2 \quad 1$$

$$\therefore \text{Shaded area} = \frac{77}{2} - \frac{49}{2} = \frac{28}{2} = 14 \text{ cm}^2 \quad 1$$

$$\text{Length of arc AB} = 2 \times \frac{22}{7} \times 7 \times \frac{90}{360} = 11 \text{ cm} \quad 1 + \frac{1}{2}$$

OR

- (b) AB and CD are arcs of two concentric circles of radii 3.5 cm and 10.5 cm respectively and centered at O. Find the area of the shaded region if $\angle AOB = 60^\circ$. Also, find the length of arc CD.

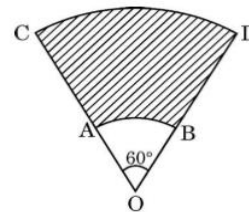
Solution: (b) Here OA = 3.5 cm, OC = 10.5 cm

$$\begin{aligned} \text{Shaded area} &= \pi \times \frac{60}{360} (10.5^2 - 3.5^2) && 2 \\ &= \frac{22}{7} \times \frac{1}{6} \times 98 && 1 \end{aligned}$$

$$= \frac{154}{3} \text{ cm}^2 \text{ or } 51.3 \text{ cm}^2 \quad \frac{1}{2}$$

$$\text{Length of arc CD} = 2 \times \frac{22}{7} \times 10.5 \times \frac{60}{360} \quad 1$$

$$= 11 \text{ cm} \quad \frac{1}{2}$$



SECTION E

36. Singing bowls (hemispherical in shape) are commonly used in sound healing practices. Mallet (cylindrical in shape) is used to strike the bowl in a sequence to produce sound and vibration.



One such bowl is shown here whose dimensions are :

Hemispherical bowl has outer radius 6 cm and inner radius 5 cm.

Mallet has height of 10 cm and radius 2 cm.

Based on the above, answer the following questions :

- (i) What is the volume of the material used in making the mallet ?
- (ii) The bowl is to be polished from inside. Find the inner surface area of the bowl.
- (iii) (a) Find the volume of metal used to make the bowl.

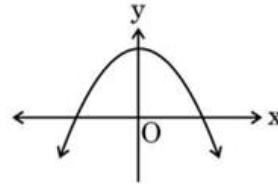
OR

- (iii) (b) Find total surface area of the mallet. (Use $\pi = 3.14$)

Solution:	(i) Volume of material = $3.14 \times 2 \times 2 \times 10 = 125.6 \text{ cm}^3$	1
	(ii) Inner SA of the bowl = $2 \times 3.14 \times 25 = 157 \text{ cm}^2$	1
	(iii) (a) Volume of the metal = $\frac{2}{3} \times 3.14 \times (6^3 - 5^3)$	1
	$= 190.5 \text{ cm}^3$	1
	OR	
	(iii) (b) Total SA of mallet = $2 \times 3.14 \times 2 (2 + 10)$	1
	$= 150.7 \text{ cm}^2$	1



37. Rainbow is an arch of colours that is visible in the sky after rain or when water droplets are present in the atmosphere. The colours of the rainbow are generally, red, orange, yellow, green, blue, indigo and violet. Each colour of the rainbow makes a parabola. We know that any quadratic polynomial $p(x) = ax^2 + bx + c$ ($a \neq 0$) represents a parabola on the graph paper.



Based on the above, answer the following questions :

- (i) The graph of a rainbow $y = f(x)$ is shown in the figure. Write the number of zeroes of the curve.
- (ii) If the graph of a rainbow does not intersect the x-axis but intersects y-axis at one point, then how many zeroes will it have ?
- (iii) (a) If a rainbow is represented by the quadratic polynomial $p(x) = x^2 + (a + 1)x + b$, whose zeroes are 2 and -3 , find the value of a and b .

OR

- (iii) (b) The polynomial $x^2 - 2x - (7p + 3)$ represents a rainbow. If -4 is a zero of it, find the value of p .

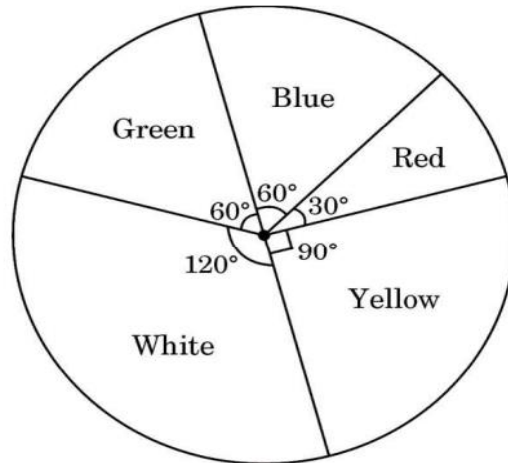
Solution.

	(i) Two zeroes	1
	(ii) 0 or no zero	1
	(iii) (a) Getting $2a+b = -6$ and $-3a+b = -6$	$\frac{1}{2} + \frac{1}{2}$
	Solving to get $a = 0$ and $b = -6$	$\frac{1}{2} + \frac{1}{2}$

OR

	(iii) (b) -4 is a zero of the given polynomial $\Rightarrow 21-7p = 0$	1
	$\Rightarrow p = 3$	1

38. Some students were asked to list their favourite colour. The measure of each colour is shown by the central angle of a pie chart given below :



Study the pie chart and answer the following questions :

- (i) If a student is chosen at random, then find the probability of his/her favourite colour being white ?
- (ii) What is the probability of his/her favourite colour being blue or green ?
- (iii) (a) If 15 students liked the colour yellow, how many students participated in the survey ?

OR

- (iii) (b) What is the probability of the favourite colour being red or blue ?

Solution. (i) $P(\text{favourite colour being white}) = \frac{120}{360}$ or $\frac{1}{3}$ 1

(ii) $P(\text{favourite colour being blue or green}) = \frac{60 + 60}{360}$ or $\frac{1}{3}$ 1

(iii) (a) Let total number of students be x

$$\Rightarrow \frac{15}{x} = \frac{1}{4} \quad \text{1} \frac{1}{2}$$

$$\Rightarrow x = 60 \quad \frac{1}{2}$$

OR

(iii)(b) $P(\text{favourite colour being red or blue}) = \frac{60 + 30}{360} = \frac{1}{4}$ $1+1$