**Series WX1YZ/2**

**SET~1**

प्रश्न–पत्र कोड
**Q.P. Code 30/2/1**

रोल नं.
*Roll No.*

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 (मानक)

# MATHEMATICS (STANDARD)

*

*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 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* ***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.** निम्नलिखित में से किस द्विघात समीकरण के मूलों का योगफल 4 है ?

(a) $2x^2 - 4x + 8 = 0$ (b) $-x^2 + 4x + 4 = 0$

(c) $\sqrt{2}\,x^2 - \frac{4}{\sqrt{2}}x + 1 = 0$ (d) $4x^2 - 4x + 4 = 0$

**2.** त्रिज्या 14 cm वाले एक वृत्त के त्रिज्यखंड, जिसका केन्द्रीय कोण 90° है, की संगत चाप की लम्बाई क्या है ?

(a) 22 cm (b) 44 cm

(c) 88 cm (d) 11 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.** Which of the following quadratic equations has sum of its roots as 4 ?

(a) $2x^2 - 4x + 8 = 0$ (b) $-x^2 + 4x + 4 = 0$

(c) $\sqrt{2}x^2 - \frac{4}{\sqrt{2}}x + 1 = 0$ (d) $4x^2 - 4x + 4 = 0$

**2.** What is the length of the arc of the sector of a circle with radius 14 cm and of central angle 90° ?

(a) 22 cm (b) 44 cm

(c) 88 cm (d) 11 cm

3. यदि $\Delta ABC \sim \Delta PQR$ में, $\angle A = 32°$ और $\angle R = 65°$ है, तो $\angle B$ की माप है :

(a) $32°$ (b) $65°$

(c) $83°$ (d) $97°$

4. यदि 'p' और 'q' प्राकृत संख्याएँ हैं और 'p' संख्या 'q' का गुणज है, तो 'p' और 'q' का HCF क्या होगा ?

(a) pq (b) p

(c) q (d) p + q

5. एक आयत ABCD जिसके तीन शीर्ष B(0, 0), C(3, 0) और D(0, 4) हैं, उसके शीर्ष A के निर्देशांक होंगे :

(a) (4, 0) (b) (0, 3)

(c) (3, 4) (d) (4, 3)

6. यदि समीकरण युग्म $3x - y + 8 = 0$ और $6x - ry + 16 = 0$ द्वारा निरूपित रेखाएँ संपाती हैं, तो 'r' का मान होगा :

(a) $-\frac{1}{2}$ (b) $\frac{1}{2}$

(c) $-2$ (d) 2

7. एक थैले में 100 पत्ते हैं जिन पर 1 से 100 तक की संख्याएँ अंकित हैं । इस थैले में से एक पत्ता यादृच्छया निकाला जाता है । इस पत्ते पर एक पूर्ण घन संख्या अंकित होने की प्रायिकता क्या होगी ?

(a) $\frac{1}{20}$ (b) $\frac{3}{50}$

(c) $\frac{1}{25}$ (d) $\frac{7}{100}$

8. समीकरण युग्म $x = a$ और $y = b$ द्वारा निरूपित रेखाएँ ग्राफीय रूप में :

(a) परस्पर समांतर होती हैं

(b) बिन्दु (b, a) पर प्रतिच्छेदी होती हैं

(c) संपाती होती हैं

(d) बिन्दु (a, b) पर प्रतिच्छेदी होती हैं

3. If $\Delta ABC \sim \Delta PQR$ with $\angle A = 32°$ and $\angle R = 65°$, then the measure of $\angle B$ is :

(a) $32°$ (b) $65°$

(c) $83°$ (d) $97°$

4. If 'p' and 'q' are natural numbers and 'p' is the multiple of 'q', then what is the HCF of 'p' and 'q' ?

(a) pq (b ) p

(c) q (d) p + q

5. The coordinates of the vertex A of a rectangle ABCD whose three vertices are given as B(0, 0), C(3, 0) and D(0, 4) are :

(a) (4, 0) (b) (0, 3)

(c) (3, 4) (d) (4, 3)

6. If the pair of equations $3x - y + 8 = 0$ and $6x - ry + 16 = 0$ represent coincident lines, then the value of 'r' is :

(a) $-\frac{1}{2}$ (b) $\frac{1}{2}$

(c) $-2$ (d) 2

7. A bag contains 100 cards numbered 1 to 100. A card is drawn at random from the bag. What is the probability that the number on the card is a perfect cube ?

(a) $\frac{1}{20}$ (b) $\frac{3}{50}$

(c) $\frac{1}{25}$ (d) $\frac{7}{100}$

8. The pair of equations x = a and y = b graphically represents lines which are :

(a) parallel

(b) intersecting at (b, a)

(c) coincident

(d) intersecting at (a, b)

9. यदि बहुपद $6x^2 + 37x - (k - 2)$ का एक शून्यक, दूसरे शून्यक का व्युत्क्रम हो, तो k का मान क्या होगा ?

(a) $-4$ (b) $-6$

(c) 6 (d) 4

10. एक ठोस अर्ध-गोले, जिसका व्यास 'd' है, का संपूर्ण पृष्ठीय क्षेत्रफल क्या होगा ?

(a) $3\pi d^2$ (b) $2\pi d^2$

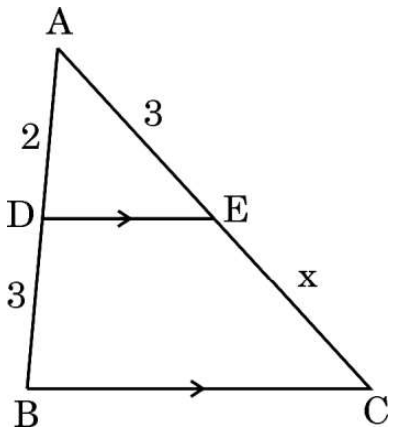
(c) $\frac{1}{2}\pi d^2$ (d) $\frac{3}{4}\pi d^2$

11. यदि तीन सिक्के एक साथ उछाले जाते हैं, तो अधिक-से-अधिक एक पट प्राप्त होने की प्रायिकता क्या होगी ?

(a) $\frac{3}{8}$ (b) $\frac{4}{8}$

(c) $\frac{5}{8}$ (d) $\frac{7}{8}$

12. दी गई आकृति में, DE || BC । यदि AD = 2 इकाई, DB = AE = 3 इकाई और EC = x इकाई है, तो x का मान होगा :




(a) 2 (b) 3

(c) 5 (d) $\frac{9}{2}$

**9.** If one zero of the polynomial $6x^2 + 37x - (k - 2)$ is reciprocal of the other, then what is the value of k ?

(a) $-4$ (b) $-6$

(c) 6 (d) 4

**10.** What is the total surface area of a solid hemisphere of diameter 'd' ?

(a) $3\pi d^2$ (b) $2\pi d^2$

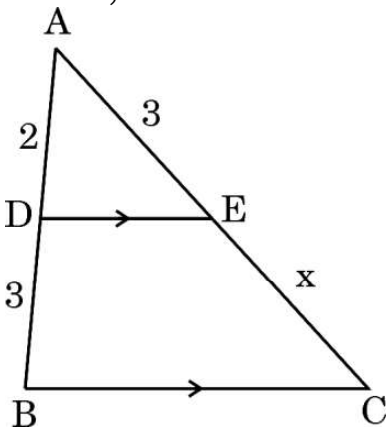
(c) $\frac{1}{2}\pi d^2$ (d) $\frac{3}{4}\pi d^2$

**11.** If three coins are tossed simultaneously, what is the probability of getting at most one tail ?

(a) $\frac{3}{8}$ (b) $\frac{4}{8}$

(c) $\frac{5}{8}$ (d) $\frac{7}{8}$

**12.** In the given figure, DE $\parallel$ BC. If AD = 2 units, DB = AE = 3 units and EC = x units, then the value of x is :




(a) 2 (b) 3

(c) 5 (d) $\frac{9}{2}$

13. एक घड़ी की घंटे की सुई 6 cm लंबी है । इस सुई द्वारा 7:20 a.m. और 7:55 a.m. के बीच जो कोण रचित होगा, वह है :

(a) $\left(\frac{35}{4}\right)^\circ$ (b) $\left(\frac{35}{2}\right)^\circ$

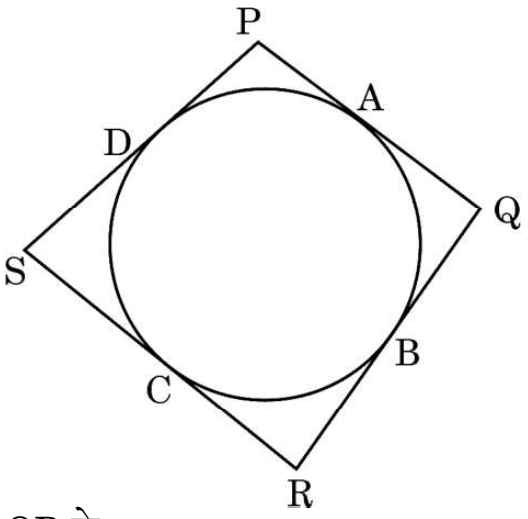
(c) $35^\circ$ (d) $70^\circ$

14. बहुपद $p(x) = x^2 + 4x + 3$ के शून्यक हैं :

(a) 1, 3 (b) $-1, 3$

(c) $1, -3$ (d) $-1, -3$

15. दी गई आकृति में, एक वृत्त के परिगत एक चतुर्भुज PQRS बना है । यहाँ PA + CS बराबर है :




(a) QR के (b) PR के

(c) PS के (d) PQ के

16. यदि $\alpha$ और $\beta$, द्विघात बहुपद $p(x) = x^2 - ax - b$ के शून्यक हैं, तो $\alpha^2 + \beta^2$ का मान होगा :

(a) $a^2 - 2b$ (b) $a^2 + 2b$

(c) $b^2 - 2a$ (d) $b^2 + 2a$

17. रेखा $\frac{x}{a} + \frac{y}{b} = 1$ तथा निर्देशांक अक्षों से बने त्रिभुज का क्षेत्रफल है :

(a) ab (b) $\frac{1}{2}ab$

(c) $\frac{1}{4}ab$ (d) 2ab

13. The hour-hand of a clock is 6 cm long. The angle swept by it between 7:20 a.m. and 7:55 a.m. is :

(a) $\left(\frac{35}{4}\right)^\circ$ (b) $\left(\frac{35}{2}\right)^\circ$

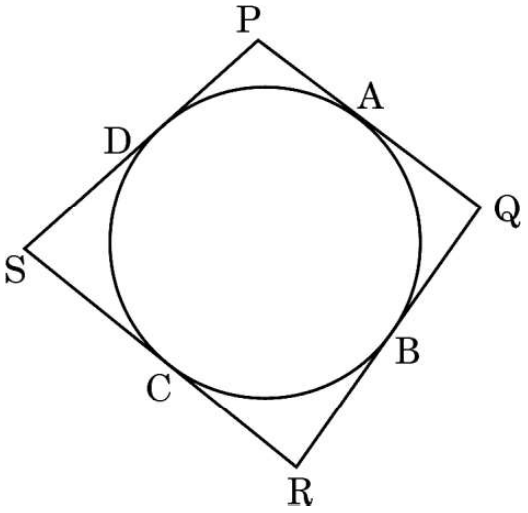
(c) $35^\circ$ (d) $70^\circ$

14. The zeroes of the polynomial $p(x) = x^2 + 4x + 3$ are given by :

(a) 1, 3 (b) $-1, 3$

(c) $1, -3$ (d) $-1, -3$

15. In the given figure, the quadrilateral PQRS circumscribes a circle. Here PA + CS is equal to :




(a) QR (b) PR

(c) PS (d) PQ

16. If $\alpha$ and $\beta$ are the zeroes of the quadratic polynomial $p(x) = x^2 - ax - b$, then the value of $\alpha^2 + \beta^2$ is :

(a) $a^2 - 2b$ (b) $a^2 + 2b$

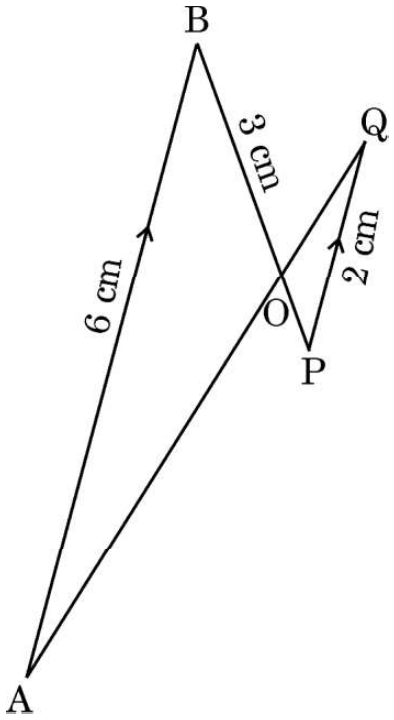
(c) $b^2 - 2a$ (d) $b^2 + 2a$

17. The area of the triangle formed by the line $\frac{x}{a} + \frac{y}{b} = 1$ with the coordinate axes is :

(a) $ab$ (b) $\frac{1}{2}ab$

(c) $\frac{1}{4}ab$ (d) $2ab$

**18.** दी गई आकृति में, AB || PQ । यदि AB = 6 cm, PQ = 2 cm और OB = 3 cm है, तो OP की लम्बाई होगी :




(a) 9 cm (b) 3 cm

(c) 4 cm (d) 1 cm

*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 ।

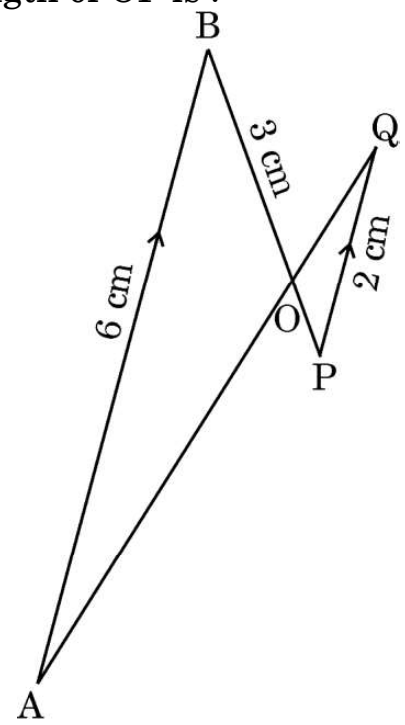
**19.** *अभिकथन (A) :* वृत्त के किसी बिंदु पर स्पर्श-रेखा स्पर्श बिंदु से जाने वाली त्रिज्या पर लम्ब होती है ।

*तर्क (R) :* बाह्य बिंदु से वृत्त पर खींची गई स्पर्श-रेखाओं की लम्बाइयाँ बराबर होती हैं ।

**20.** *अभिकथन (A) :* बहुपद $p(x) = x^2 + 3x + 3$ के दो वास्तविक शून्यक हैं ।

*तर्क (R) :* एक द्विघात बहुपद के अधिक-से-अधिक दो वास्तविक शून्यक हो सकते हैं ।

**18.** In the given figure, AB ∥ PQ. If AB = 6 cm, PQ = 2 cm and OB = 3 cm, then the length of OP is :




(a) 9 cm (b) 3 cm

(c) 4 cm (d) 1 cm

*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) :* A tangent to a circle is perpendicular to the radius through the point of contact.

*Reason (R) :* The lengths of tangents drawn from an external point to a circle are equal.

**20.** *Assertion (A) :* The polynomial $p(x) = x^2 + 3x + 3$ has two real zeroes.

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

## खण्ड ख

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

**21.** सिद्ध कीजिए कि $2 + \sqrt{3}$ एक अपरिमेय संख्या है, दिया गया है कि $\sqrt{3}$ एक अपरिमेय संख्या है ।

**22.** (क) यदि $4 \cot^2 45° - \sec^2 60° + \sin^2 60° + p = \frac{3}{4}$ है, तो p का मान ज्ञात कीजिए ।

**अथवा**

(ख) यदि $\cos A + \cos^2 A = 1$ है, तो $\sin^2 A + \sin^4 A$ का मान ज्ञात कीजिए ।

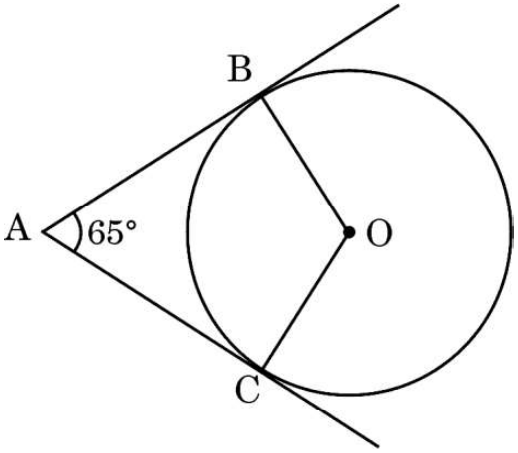
**23.** दर्शाइए कि बिंदु $(-2, 3)$, $(8, 3)$ और $(6, 7)$ एक समकोण त्रिभुज के शीर्ष हैं ।

**24.** (क) एक समतल जमीन पर खड़ी मीनार की छाया, मीनार की ऊँचाई की $\sqrt{3}$ गुनी लंबी है । सूर्य का उन्नतांश ज्ञात कीजिए ।

**अथवा**

(ख) भूमि के एक बिंदु से, जो मीनार के पाद-बिंदु से 30 m की दूरी पर है, मीनार के शिखर का उन्नयन कोण $30°$ है । मीनार की ऊँचाई ज्ञात कीजिए ।

**25.** दी गई आकृति में, वृत्त का केंद्र O है । बिंदु A से इस वृत्त पर AB और AC स्पर्श-रेखाएँ खींची गई हैं । यदि $\angle BAC = 65°$ है, तो $\angle BOC$ की माप ज्ञात कीजिए ।



## SECTION B

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

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

**22.** (a) If $4\cot^2 45° - \sec^2 60° + \sin^2 60° + p = \frac{3}{4}$, then find the value of p.

**OR**

(b) If $\cos A + \cos^2 A = 1$, then find the value of $\sin^2 A + \sin^4 A$.

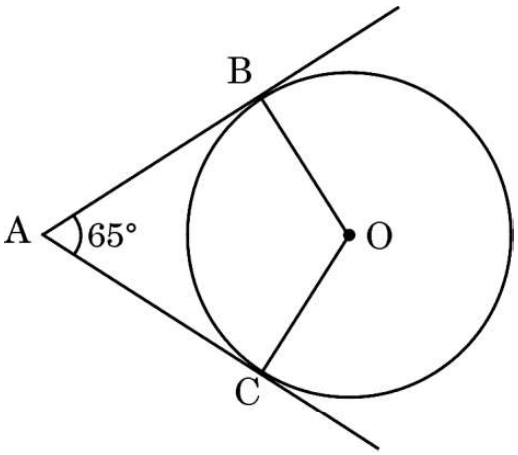
**23.** Show that the points $(-2, 3)$, $(8, 3)$ and $(6, 7)$ are the vertices of a right-angled triangle.

**24.** (a) The length of the shadow of a tower on the plane ground is $\sqrt{3}$ times the height of the tower. Find the angle of elevation of the sun.

**OR**

(b) The angle of elevation of the top of a tower from a point on the ground which is 30 m away from the foot of the tower, is 30°. Find the height of the tower.

**25.** In the given figure, O is the centre of the circle. AB and AC are tangents drawn to the circle from point A. If $\angle BAC = 65°$, then find the measure of $\angle BOC$.



## खण्ड ग

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

**26.** (क) संख्याओं 18180 और 7575 का अभाज्य गुणनखंडन विधि द्वारा LCM ज्ञात कीजिए । इन दो संख्याओं का HCF भी ज्ञात कीजिए ।

**अथवा**

(ख) तीन घंटियाँ 6, 12 और 18 मिनटों के अंतराल पर बजतीं हैं । यदि ये तीनों घंटियाँ एक साथ 6 a.m. पर बजीं हों, तो उसके पश्चात् वे तीनों एक साथ कब बजेंगी ?

**27.** सिद्ध कीजिए :

$$\left(\frac{1}{\cos\theta} - \cos\theta\right)\left(\frac{1}{\sin\theta} - \sin\theta\right) = \frac{1}{\tan\theta + \cot\theta}$$

**28.** यदि बिंदु Q(0, 1), बिंदुओं P(5, – 3) और R(x, 6) से एकसमान दूरी पर हो, तो x के मान ज्ञात कीजिए ।

**29.** एक कार के दो वाइपर (wipers) हैं, जो परस्पर कभी आच्छादिक नहीं होते हैं । प्रत्येक वाइपर की पत्ती की लंबाई 21 cm है और 120° के कोण तक घूम कर सफाई कर सकता है । दोनों पत्तियों की प्रत्येक बुहार के साथ जितना क्षेत्रफल साफ हो जाता है, वह ज्ञात कीजिए ।

**30.** (क) यदि रैखिक समीकरण निकाय

$$2x + 3y = 7 \quad \text{तथा} \quad 2ax + (a + b)y = 28$$

के अपरिमित रूप से अनेक हल हों, तो 'a' और 'b' के मान ज्ञात कीजिए ।

**अथवा**

(ख) यदि $217x + 131y = 913$ और $131x + 217y = 827$ हों, तो x और y के मान ज्ञात करने के लिए समीकरण हल कीजिए ।

## SECTION C

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

**26.** (a) Find by prime factorisation the LCM of the numbers 18180 and 7575. Also, find the HCF of the two numbers.

**OR**

(b) Three bells ring at intervals of 6, 12 and 18 minutes. If all the three bells rang at 6 a.m., when will they ring together again ?

**27.** Prove that :

$$\left(\frac{1}{\cos\theta} - \cos\theta\right)\left(\frac{1}{\sin\theta} - \sin\theta\right) = \frac{1}{\tan\theta + \cot\theta}.$$

**28.** If Q(0, 1) is equidistant from P(5, – 3) and R(x, 6), find the values of x.

**29.** A car has two wipers which do not overlap. Each wiper has a blade of length 21 cm sweeping through an angle of 120°. Find the total area cleaned at each sweep of the two blades.

**30.** (a) If the system of linear equations

$2x + 3y = 7$ and $2ax + (a + b)y = 28$

have infinite number of solutions, then find the values of 'a' and 'b'.

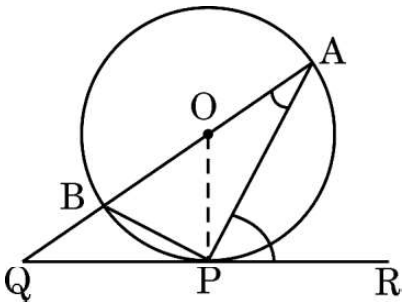
**OR**

(b) If $217x + 131y = 913$ and

$131x + 217y = 827$,

then solve the equations for the values of x and y.

**31.** दी गई आकृति में, वृत्त का केंद्र O तथा QPR वृत्त के बिंदु P पर स्पर्श-रेखा है । सिद्ध कीजिए कि $\angle QAP + \angle APR = 90°$.




## खण्ड घ

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

**32.** समांतर श्रेढ़ी 45, 39, 33, ..... के कितने पदों का योगफल 180 होगा ? दोहरे उत्तर की व्याख्या कीजिए ।

**33.** (क) समुद्र-तल से 75 m ऊँची लाइट-हाऊस के शिखर से देखने पर दो समुद्री जहाजों के अवनमन कोण 30° और 60° हैं । यदि लाइट-हाऊस के एक ही ओर एक जहाज दूसरे जहाज के ठीक पीछे हो, तो दो जहाजों के बीच की दूरी ज्ञात कीजिए । ($\sqrt{3}$ = 1·73 का प्रयोग कीजिए)

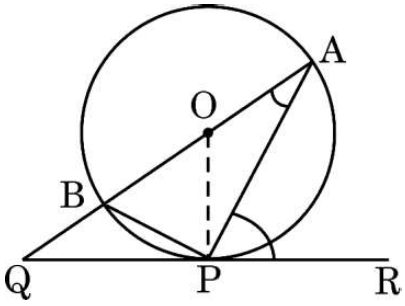
**अथवा**

(ख) भूमि के एक बिंदु से एक 30 m ऊँचे भवन के शिखर पर लगी एक संचार मीनार के तल और शिखर के उन्नयन कोण क्रमश: 30° और 60° हैं । संचार मीनार की ऊँचाई ज्ञात कीजिए । ($\sqrt{3}$ = 1·73 का प्रयोग कीजिए)

**34.** एक छात्र ने नोट किया कि एक सड़क पर एक स्थान से गुज़रने वाली कारों की संख्या प्रत्येक 3 मिनट की 100 अवधियों में कितनी हैं और इसे नीचे दी गई तालिका में सारांशित किया गया है । निम्नलिखित आँकड़ों का माध्य तथा माध्यक ज्ञात कीजिए ।

| कारों की संख्या | 0 – 10 | 10 – 20 | 20 – 30 | 30 – 40 | 40 – 50 | 50 – 60 | 60 – 70 | 70 – 80 |
|---|---|---|---|---|---|---|---|---|
| बारंबारता (अवधियाँ) | 7 | 14 | 13 | 12 | 20 | 11 | 15 | 8 |

**31.** In the given figure, O is the centre of the circle and QPR is a tangent to it at P. Prove that $\angle QAP + \angle APR = 90°$.




## SECTION D

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

**32.** How many terms of the arithmetic progression 45, 39, 33, ..... must be taken so that their sum is 180 ? Explain the double answer.

**33.** (a) As observed from the top of a 75 m high lighthouse from the sea-level, the angles of depression of two ships are 30° and 60°. If one ship is exactly behind the other on the same side of the lighthouse, find the distance between the two ships.
(Use $\sqrt{3} = 1{\cdot}73$)

**OR**

(b) From a point on the ground, the angle of elevation of the bottom and top of a transmission tower fixed at the top of 30 m high building are 30° and 60°, respectively. Find the height of the transmission tower. (Use $\sqrt{3} = 1{\cdot}73$)

**34.** A student noted the number of cars passing through a spot on a road for 100 periods each of 3 minutes and summarised it in the table given below. Find the mean and median of the following data.

| Number of cars | 0 – 10 | 10 – 20 | 20 – 30 | 30 – 40 | 40 – 50 | 50 – 60 | 60 – 70 | 70 – 80 |
|---|---|---|---|---|---|---|---|---|
| Frequency (periods) | 7 | 14 | 13 | 12 | 20 | 11 | 15 | 8 |

**35.** (क) एक त्रिभुज ABC की भुजाएँ AB और BC तथा माध्यिका AD एक अन्य त्रिभुज PQR की क्रमशः भुजाओं PQ और QR तथा माध्यिका PM के समानुपाती हैं । दर्शाइए कि $\Delta ABC \sim \Delta PQR$ है ।

**अथवा**

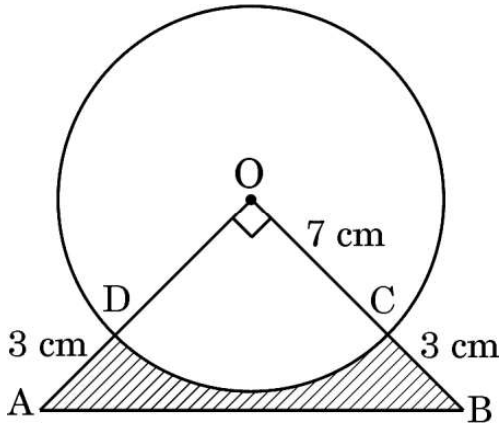
(ख) समांतर चतुर्भुज ABCD की भुजा CD के मध्य-बिंदु M से एक रेखा BM खींची गई जो विकर्ण AC को बिंदु L पर और बढ़ाई गई भुजा AD को बिंदु E पर काटती है । सिद्ध कीजिए कि EL = 2BL.

## खण्ड ङ

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

### प्रकरण अध्ययन – 1

**36.** एक विद्यालय के वार्षिक दिवस पर प्रबंधकों ने अपने सबसे होनहार विद्यार्थियों को नकद पुरस्कार के साथ-साथ स्मृति-चिह्न भी देना चाहा । प्रत्येक स्मृति चिह्न दिखाई गई आकृति के जैसा बनवाया गया तथा इसका आधार ABCD सामने की ओर से दिखता था । सिल्वर प्लेटिंग का खर्च ₹ 20 प्रति वर्ग सेमी है ।




उपर्युक्त के आधार पर, निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) चतुर्थांश ODCO का क्षेत्रफल क्या है ? *1*

(ii) $\Delta AOB$ का क्षेत्रफल ज्ञात कीजिए । *1*

(iii) (क) ABCD छायांकित भाग का सिल्वर प्लेटिंग का कुल खर्च क्या है ? *2*

**अथवा**

(iii) (ख) चाप CD की लंबाई क्या है ? *2*

**35.** (a) Sides AB and BC and median AD of a triangle ABC are respectively proportional to sides PQ and QR and median PM of Δ PQR. Show that Δ ABC ~ Δ PQR.

**OR**

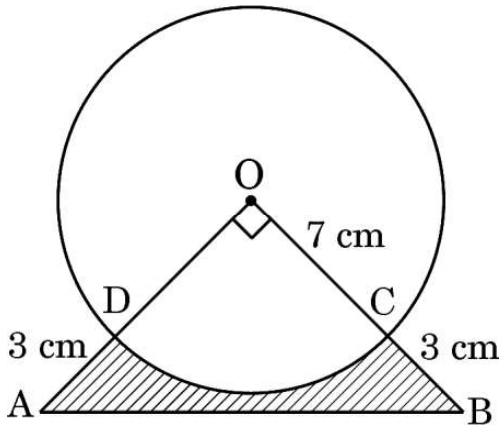
(b) Through the mid-point M of the side CD of a parallelogram ABCD, the line BM is drawn intersecting AC in L and AD (produced) in E. Prove that EL = 2BL.

## SECTION E

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

### Case Study – 1

**36.** In an annual day function of a school, the organizers wanted to give a cash prize along with a memento to their best students. Each memento is made as shown in the figure and its base ABCD is shown from the front side. The rate of silver plating is ₹ 20 per $cm^2$.




Based on the above, answer the following questions :

(i) What is the area of the quadrant ODCO ? *1*

(ii) Find the area of Δ AOB. *1*

(iii) (a) What is the total cost of silver plating the shaded part ABCD ? *2*

**OR**

(iii) (b) What is the length of arc CD ? *2*

## प्रकरण अध्ययन – 2

**37.** एक कॉफी दुकान में कॉफी दो तरह के कप में परोसी जाती है । एक कप बेलनाकार है जिसका व्यास 7 cm तथा ऊँचाई 14 cm है और दूसरा कप अर्धगोलीय आकार का है जिसका व्यास 21 cm है ।

उपर्युक्त के आधार पर, निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) बेलनाकार कप के आधार का क्षेत्रफल ज्ञात कीजिए । *1*

(ii) (क) अर्धगोलीय कप की क्षमता क्या है ? *2*

**अथवा**

(ii) (ख) बेलनाकार कप की क्षमता ज्ञात कीजिए । *2*

(iii) बेलनाकार कप का वक्र पृष्ठीय क्षेत्रफल क्या है ? *1*

## Case Study – 2

**37.** In a coffee shop, coffee is served in two types of cups. One is cylindrical in shape with diameter 7 cm and height 14 cm and the other is hemispherical with diameter 21 cm.

Based on the above, answer the following questions :

(i) Find the area of the base of the cylindrical cup. *1*

(ii) (a) What is the capacity of the hemispherical cup ? *2*

**OR**

(ii) (b) Find the capacity of the cylindrical cup. *2*

(iii) What is the curved surface area of the cylindrical cup ? *1*

## प्रकरण अध्ययन – 3

**38.** कंप्यूटर-आधारित शिक्षण किसी भी ऐसी शिक्षण पद्धति को संदर्भित करता है जो सूचना प्रसारण के लिए कंप्यूटरों का उपयोग करती है । प्राथमिक विद्यालय स्तर पर, मल्टीमीडिया पाठ योजनाओं को प्रदर्शित करने के लिए कंप्यूटर अनुप्रयोगों का उपयोग किया जा सकता है । असम के 1000 प्राथमिक और माध्यमिक विद्यालयों पर एक सर्वेक्षण किया गया था और उनके पास जितने कंप्यूटर थे, उनके आधार पर उन्हें वर्गीकृत किया गया था ।

| कंप्यूटरों की संख्या | 1 – 10 | 11 – 20 | 21 – 50 | 51 – 100 | 101 और इससे अधिक |
|---|---|---|---|---|---|
| विद्यालयों की संख्या | 250 | 200 | 290 | 180 | 80 |

एक विद्यालय का यादृच्छया चयन किया गया । तो :

(i) यादृच्छया चयन किए गए विद्यालय में 100 से अधिक कंप्यूटर होने की प्रायिकता ज्ञात कीजिए । *1*

(ii) (क) यादृच्छया चयन किए गए विद्यालय में 50 या 50 से कम कंप्यूटर होने की प्रायिकता ज्ञात कीजिए । *2*

**अथवा**

(ii) (ख) यादृच्छया चयन किए गए विद्यालय में 20 से अधिक कंप्यूटर न होने की प्रायिकता ज्ञात कीजिए । *2*

(iii) यादृच्छया चयन किए गए विद्यालय में 10 या 10 से कम कंप्यूटर होने की प्रायिकता ज्ञात कीजिए । *1*

## Case Study – 3

**38.** Computer-based learning (CBL) refers to any teaching methodology that makes use of computers for information transmission. At an elementary school level, computer applications can be used to display multimedia lesson plans. A survey was done on 1000 elementary and secondary schools of Assam and they were classified by the number of computers they had.

| Number of Computers | 1 – 10 | 11 – 20 | 21 – 50 | 51 – 100 | 101 and more |
|---|---|---|---|---|---|
| Number of Schools | 250 | 200 | 290 | 180 | 80 |

One school is chosen at random. Then :

(i) Find the probability that the school chosen at random has more than 100 computers. *1*

(ii) (a) Find the probability that the school chosen at random has 50 or fewer computers. *2*

**OR**

(ii) (b) Find the probability that the school chosen at random has no more than 20 computers. *2*

(iii) Find the probability that the school chosen at random has 10 or less than 10 computers. *1*

**Marking Scheme**
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**MATHEMATICS PAPER CODE 30/2/1**

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| **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.** |
| **4** | The Marking scheme carries only suggested value points for the answers.<br>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 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. |

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| **9** | **<u>In Q1-Q20, if a candidate attempts the question more than once (without canceling the previous attempt), marks shall be awarded for the first attempt only and the other answer scored out with a note "Extra Question".</u>** |
| **10** | **<u>In Q21-Q38, 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".</u>** |
| **11** | No marks to be deducted for the cumulative effect of an error. It should be penalized only once. |
| **12** | 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. |
| **13** | 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. |
| **14** | Ensure that you do not make the following common types of errors committed by the Examiner in the past:-<br>● Leaving answer or part thereof unassessed in an answer book.<br>● Giving more marks for an answer than assigned to it.<br>● Wrong totaling of marks awarded on an answer.<br>● Wrong transfer of marks from the inside pages of the answer book to the title page.<br>● Wrong question wise totaling on the title page.<br>● Wrong totaling of marks of the two columns on the title page.<br>● Wrong grand total.<br>● Marks in words and figures not tallying/not same.<br>● Wrong transfer of marks from the answer book to online award list.<br>● 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.)<br>● Half or a part of answer marked correct and the rest as wrong, but no marks awarded. |
| **15** | 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. |
| **16** | 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. |
| **17** | The Examiners should acquaint themselves with the guidelines given in the "**Guidelines for spot Evaluation**" before starting the actual evaluation. |
| **18** | 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. |
| **19** | 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: 30/2/1)**

| Q. No. | EXPECTED OUTCOMES/VALUE POINTS | Marks |
|---|---|---|
| | **SECTION A**<br>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 | |
| 1. | Which of the following quadratic equations has sum of its roots as 4 ?<br>(a) $2x^2 - 4x + 8 = 0$ (b) $-x^2 + 4x + 4 = 0$<br>(c) $\sqrt{2}x^2 - \frac{4}{\sqrt{2}}x + 1 = 0$ (d) $4x^2 - 4x + 4 = 0$ | |
| Sol. | (b) $-x^2 + 4x + 4 = 0$ | 1 |
| 2. | What is the length of the arc of the sector of a circle with radius 14 cm and of central angle 90° ?<br>(a) 22 cm (b) 44 cm<br>(c) 88 cm (d) 11 cm | |
| Sol. | (a) 22 cm | 1 |
| 3. | If $\Delta ABC \sim \Delta PQR$ with $\angle A = 32°$ and $\angle R = 65°$, then the measure of $\angle B$ is :<br>(a) 32° (b) 65°<br>(c) 83° (d) 97° | |
| Sol. | (c) 83° | 1 |
| 4. | If 'p' and 'q' are natural numbers and 'p' is the multiple of 'q', then what is the HCF of 'p' and 'q' ?<br>(a) pq (b) p<br>(c) q (d) p + q | |
| Sol. | (c) q | 1 |
| 5. | The coordinates of the vertex A of a rectangle ABCD whose three vertices are given as B(0, 0), C(3, 0) and D(0, 4) are :<br>(a) (4, 0) (b) (0, 3)<br>(c) (3, 4) (d) (4, 3) | |
| Sol. | (c) (3, 4) | 1 |

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| 6. | If the pair of equations $3x - y + 8 = 0$ and $6x - ry + 16 = 0$ represent coincident lines, then the value of 'r' is :<br>(a) $-\frac{1}{2}$ (b) $\frac{1}{2}$<br>(c) $-2$ (d) $2$ | |
| Sol. | (d) 2 | 1 |
| 7. | A bag contains 100 cards numbered 1 to 100. A card is drawn at random from the bag. What is the probability that the number on the card is a perfect cube ?<br>(a) $\frac{1}{20}$ (b) $\frac{3}{50}$<br>(c) $\frac{1}{25}$ (d) $\frac{7}{100}$ | |
| Sol. | (c) $\frac{1}{25}$ | 1 |
| 8. | The pair of equations $x = a$ and $y = b$ graphically represents lines which are :<br>(a) parallel<br>(b) intersecting at (b, a)<br>(c) coincident<br>(d) intersecting at (a, b) | |
| Sol. | (d) intersecting at (a, b) | 1 |
| 9. | If one zero of the polynomial $6x^2 + 37x - (k - 2)$ is reciprocal of the other, then what is the value of k ?<br>(a) $-4$ (b) $-6$<br>(c) 6 (d) 4 | |
| Sol. | (a) $-4$ | 1 |
| 10. | What is the total surface area of a solid hemisphere of diameter 'd' ?<br>(a) $3\pi d^2$ (b) $2\pi d^2$<br>(c) $\frac{1}{2}\pi d^2$ (d) $\frac{3}{4}\pi d^2$ | |
| Sol. | (d) $\frac{3}{4}\pi d^2$ | 1 |

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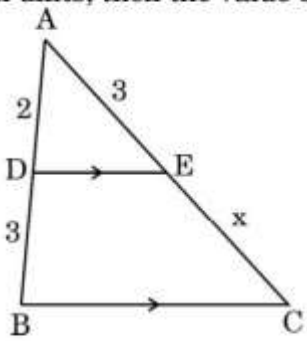
| 11. | If three coins are tossed simultaneously, what is the probability of getting at most one tail ?<br>(a) $\frac{3}{8}$ (b) $\frac{4}{8}$<br>(c) $\frac{5}{8}$ (d) $\frac{7}{8}$ | |
| Sol. | (b) $\frac{4}{8}$ | 1 |
| 12. | In the given figure, DE ∥ BC. If AD = 2 units, DB = AE = 3 units and EC = x units, then the value of x is :<br>  <br><br>(a) 2 (b) 3<br>(c) 5 (d) $\frac{9}{2}$ | |
| Sol. | (d) $\frac{9}{2}$ | 1 |
| 13. | The hour-hand of a clock is 6 cm long. The angle swept by it between 7:20 a.m. and 7:55 a.m. is :<br>(a) $\left(\frac{35}{4}\right)^\circ$ (b) $\left(\frac{35}{2}\right)^\circ$<br>(c) $35^\circ$ (d) $70^\circ$ | |
| Sol. | (b) $\left(\frac{35}{2}\right)^\circ$ | 1 |
| 14. | The zeroes of the polynomial $p(x) = x^2 + 4x + 3$ are given by :<br>(a) 1, 3 (b) −1, 3<br>(c) 1, − 3 (d) −1, − 3 | |
| Sol. | (d) − 1, − 3 | 1 |

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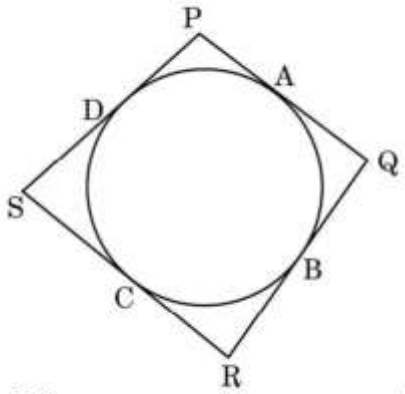
| 15. | In the given figure, the quadrilateral PQRS circumscribes a circle. Here PA + CS is equal to :<br>  <br><br>(a) QR (b) PR<br>(c) PS (d) PQ | |
| Sol. | (c) PS | 1 |
| 16. | If $\alpha$ and $\beta$ are the zeroes of the quadratic polynomial $p(x) = x^2 - ax - b$, then the value of $\alpha^2 + \beta^2$ is :<br>(a) $a^2 - 2b$ (b) $a^2 + 2b$<br>(c) $b^2 - 2a$ (d) $b^2 + 2a$ | |
| Sol. | (b) $a^2 + 2b$ | 1 |
| 17. | The area of the triangle formed by the line $\frac{x}{a} + \frac{y}{b} = 1$ with the coordinate axes is :<br>(a) ab (b) $\frac{1}{2}ab$<br>(c) $\frac{1}{4}ab$ (d) 2ab | |
| Sol. | (b) $\frac{1}{2}$ ab | 1 |

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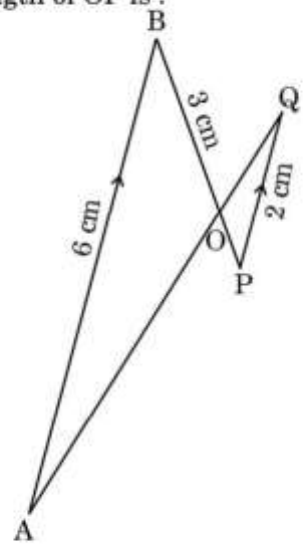
| 18. | In the given figure, AB ∥ PQ. If AB = 6 cm, PQ = 2 cm and OB = 3 cm, then the length of OP is :<br>  <br><br>(a) 9 cm (b) 3 cm<br>(c) 4 cm (d) 1 cm | |
| Sol. | (d) 1 cm | 1 |
| | *Questions number **19** and **20** are Assertion and Reason based questions carrying 1 mark each. Two statements 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.*<br>(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).<br>(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is ***not*** the correct explanation of the Assertion (A).<br>(c) Assertion (A) is true, but Reason (R) is false.<br>(d) Assertion (A) is false, but Reason (R) is true. | |
| 19. | *Assertion (A) :* A tangent to a circle is perpendicular to the radius through the point of contact.<br>*Reason (R) :* The lengths of tangents drawn from an external point to a circle are equal. | |
| Sol. | (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A). | 1 |
| 20. | *Assertion (A) :* The polynomial $p(x) = x^2 + 3x + 3$ has two real zeroes.<br>*Reason (R):* A quadratic polynomial can have at most two real zeroes. | |
| Sol. | (d) Assertion (A) is false, but Reason (R) is true. | 1 |

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| | SECTION B<br>This section comprises of Very Short Answer (VSA) type questions of 2 marks each. | |
| 21. | Prove that $2 + \sqrt{3}$ is an irrational number, given that $\sqrt{3}$ is an irrational number. | |
| Sol. | Let us assume that $2 + \sqrt{3}$ is rational<br>Let $2 + \sqrt{3} = \frac{p}{q}$; $q \neq 0$ and p, q are integers<br>$\Rightarrow \sqrt{3} = \frac{p - 2q}{q}$<br>p and q are integers, $\therefore$ $p - 2q$ is an integer<br>$\Rightarrow \frac{p - 2q}{q}$ is a rational number<br>$\Rightarrow \sqrt{3}$ is a rational number which contradicts our assumption that $\sqrt{3}$ is an irrational number.<br>$\Rightarrow 2 + \sqrt{3}$ is an irrational number | ½<br>½<br>½<br>½ |
| 22(a). | If $4\cot^2 45° - \sec^2 60° + \sin^2 60° + p = \frac{3}{4}$, then find the value of p. | |
| Sol. | $4\cot^2 45° - \sec^2 60° + \sin^2 60° + p = \frac{3}{4}$<br>$\Rightarrow 4(1)^2 - (2)^2 + \left(\frac{\sqrt{3}}{2}\right)^2 + p = \frac{3}{4}$<br>$\Rightarrow 4 - 4 + \frac{3}{4} + p = \frac{3}{4}$<br>$\Rightarrow p = 0$ | 1<br>½<br>½ |
| | OR | |
| 22(b). | If $\cos A + \cos^2 A = 1$, then find the value of $\sin^2 A + \sin^4 A$. | |
| Sol. | $\cos A + \cos^2 A = 1 \Rightarrow \cos A = 1 - \cos^2 A = \sin^2 A$<br>$\therefore \sin^2 A + \sin^4 A = \cos A + \cos^2 A$ ($\because \sin^2 A = \cos A$)<br>$= 1$ | 1<br>1 |
| 23. | Show that the points (– 2, 3), (8, 3) and (6, 7) are the vertices of a right-angled triangle. | |
| Sol. | Let the given points be A (– 2, 3), B (8, 3) and C (6, 7)<br>Then, AB = 10, BC = $\sqrt{4 + 16} = \sqrt{20}$,<br>AC = $\sqrt{64 + 16} = \sqrt{80}$ | 1<br>½ |

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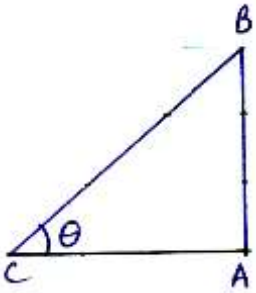
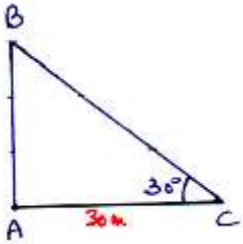
| | $\therefore AB^2 = BC^2 + AC^2$<br>$\therefore$ the given points are the vertices of a right angled triangle. | ½ |
| 24(a). | The length of the shadow of a tower on the plane ground is $\sqrt{3}$ times the height of the tower. Find the angle of elevation of the sun. | |
| Sol. |  <br>Let AB be the tower of height 'h'.<br>$\therefore AC = \sqrt{3}\ h$<br>In $\Delta ABC$, $\tan\theta = \frac{AB}{AC} = \frac{h}{\sqrt{3}\ h}$<br>$\Rightarrow \tan\theta = \frac{1}{\sqrt{3}}$<br>$\Rightarrow \theta = 30°$ | 1<br>½<br>½ |
| | **OR** | |
| 24(b). | The angle of elevation of the top of a tower from a point on the ground which is 30 m away from the foot of the tower, is 30°. Find the height of the tower. | |
| Sol. |  <br>Height of tower = AB<br>In $\Delta ABC$, $\tan 30° = \frac{AB}{30}$<br>$\Rightarrow AB = \frac{30}{\sqrt{3}} = 10\sqrt{3}$<br>$\therefore$ Height of Tower is $10\sqrt{3}$ m | 1<br>1 |

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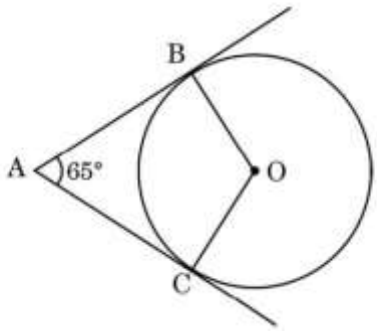
| 25. | In the given figure, O is the centre of the circle. AB and AC are tangents drawn to the circle from point A. If $\angle BAC = 65°$, then find the measure of $\angle BOC$.<br>  <br> | |
| Sol. | $\angle BAC + \angle BOC = 180°$<br>$\Rightarrow \angle BOC = 180° - 65°$<br>$\Rightarrow \angle BOC = 115°$ | 1<br><br>1 |
| | SECTION C<br>This section comprises of Short Answer (SA) type questions of 3 marks each. | |
| 26(a). | Find by prime factorisation the LCM of the numbers 18180 and 7575. Also, find the HCF of the two numbers. | |
| Sol. | $18180 = 2^2 \times 3^2 \times 5 \times 101$<br>$7575 = 3 \times 5^2 \times 101$<br>LCM $= 2^2 \times 3^2 \times 5^2 \times 101 = 90900$<br>HCF $= 3 \times 5 \times 101 = 1515$ | ½<br>½<br>1<br>1 |
| | OR | |
| 26(b). | Three bells ring at intervals of 6, 12 and 18 minutes. If all the three bells rang at 6 a.m., when will they ring together again ? | |
| Sol. | LCM of 6, 12, 18 = 36<br>So, all the three bells ring together after 36 minutes at 6 : 36 AM | 2<br><br>1 |
| 27. | Prove that :<br>$\left(\frac{1}{\cos\theta} - \cos\theta\right)\left(\frac{1}{\sin\theta} - \sin\theta\right) = \frac{1}{\tan\theta + \cot\theta}$. | |
| Sol. | LHS $= \left(\frac{1}{cos\ \theta} - cos\ \theta\right)\left(\frac{1}{sin\ \theta} - sin\ \theta\right)$ | |

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| | $= \left(\frac{1 - \cos^2 \theta}{\cos \theta}\right)\left(\frac{1 - \sin^2 \theta}{\sin \theta}\right)$<br>$= \frac{\sin^2 \theta}{\cos \theta} \times \frac{\cos^2 \theta}{\sin \theta}$<br>$= \sin \theta \cos \theta$<br>RHS $= \frac{1}{\tan \theta + \cot \theta} = \frac{1}{\frac{\sin \theta}{\cos \theta} + \frac{\cos \theta}{\sin \theta}}$<br>$= \frac{\cos \theta \sin \theta}{\sin^2 \theta + \cos^2 \theta}$<br>$= \sin \theta \cos \theta$<br>$\therefore$ LHS = RHS | ½<br>1<br>½<br>1 |
| 28. | If Q(0, 1) is equidistant from P(5, – 3) and R(x, 6), find the values of x. | |
| Sol. | PQ = QR $\Rightarrow$ $PQ^2 = QR^2$<br>$(5 - 0)^2 + (-3 - 1)^2 = (x - 0)^2 + (6 - 1)^2$<br>$\Rightarrow 25 + 16 = x^2 + 25$<br>$\Rightarrow x^2 = 16$<br>$\Rightarrow x = 4, x = -4$ | 1<br>1<br>½ + ½ |
| 29. | A car has two wipers which do not overlap. Each wiper has a blade of length 21 cm sweeping through an angle of 120°. Find the total area cleaned at each sweep of the two blades. | |
| Sol. | Area cleaned by 1 blade $= \frac{22}{7} \times 21 \times 21 \times \frac{120^\circ}{360^\circ}$<br>$= 462$<br>$\Rightarrow$ Total area cleaned = 2 × 462 = 924<br>$\therefore$ Total area cleaned is 924 $cm^2$ | 1½<br>1<br>½ |
| 30 (a). | If the system of linear equations<br>$2x + 3y = 7$ and $2ax + (a + b)y = 28$<br>have infinite number of solutions, then find the values of 'a' and 'b'. | |
| Sol. | system has infinite number of solutions<br>$\therefore \frac{2}{2a} = \frac{3}{a + b} = \frac{7}{28}$<br>$\Rightarrow \frac{1}{a} = \frac{1}{4} \Rightarrow a = 4$<br>and a + b = 12 $\Rightarrow$ b = 8 | 1<br>1<br>1 |
| | OR | |

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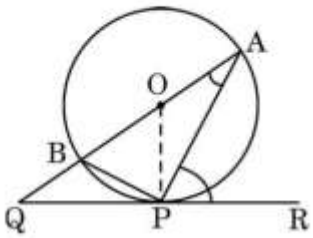
| 30(b). | If $217x + 131y = 913$ and<br>$131x + 217y = 827$,<br>then solve the equations for the values of x and y. | |
| Sol. | $\left.\begin{matrix} 217x + 131y = 913 \\ 131x + 217y = 827 \end{matrix}\right]$ Adding $348(x + y) = 1740$<br>$x + y = 5$<br>Subtracting, $86(x - y) = 86$<br>$x - y = 1$<br>$\Rightarrow x = 3, y = 2$ | <br>1<br><br>1<br>½ + ½ |
| 31. | In the given figure, O is the centre of the circle and QPR is a tangent to it at P. Prove that $\angle QAP + \angle APR = 90°$.<br>  <br> | |
| Sol. | OA = OP<br>$\therefore$ In $\Delta$ OAP, $\angle OPA = \angle OAP$ ... (i)<br>$\Rightarrow \angle OPA + \angle APR = 90°$<br>$\Rightarrow \angle OAP + \angle APR = 90°$ Using (i)<br>$\Rightarrow \angle QAP + \angle APR = 90°$ | <br>1<br>1<br>½<br>½ |
| | SECTION D<br>This section comprises of Long Answer (LA) type questions of 5 marks each. | |
| 32. | How many terms of the arithmetic progression 45, 39, 33, ..... must be taken so that their sum is 180 ? Explain the double answer. | |
| Sol. | 45, 39, 33, .....<br>$a = 45, d = -6$<br>$S_n = 180$<br>$180 = \frac{n}{2}[2 \times 45 + (n - 1)(-6)]$<br>$\Rightarrow 180 = \frac{n}{2}[90 - 6n + 6]$ | <br>½<br><br><br>1 |

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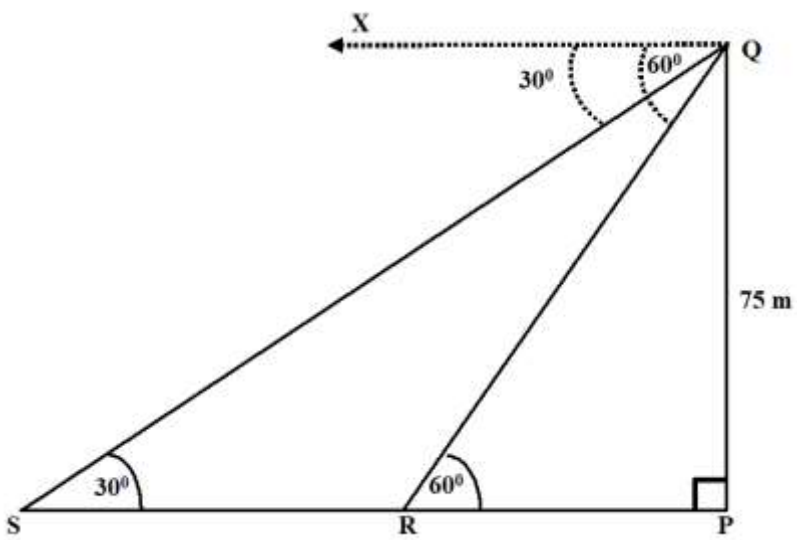
| | $\Rightarrow 360 = 96n - 6n^2$<br>$\Rightarrow 6n^2 - 96n + 360 = 0$<br>$\Rightarrow n^2 - 16n + 60 = 0 \Rightarrow (n - 10)(n - 6) = 0$<br>$n - 10 = 0, n - 6 = 0 \Rightarrow n = 10, 6$<br>We get two values of 'n' as sum of $7^{th}$ term to $10^{th}$ term is zero as some terms are negative and some are positive. | 1<br>1<br>1<br>½ |
| 33(a). | As observed from the top of a 75 m high lighthouse from the sea-level, the angles of depression of two ships are 30° and 60°. If one ship is exactly behind the other on the same side of the lighthouse, find the distance between the two ships.<br>(Use $\sqrt{3} = 1{\cdot}73$) | |
| Sol. |  <br><br>PQ = Height of Light house = 75 m<br>$\angle XQS = \angle QSP = 30°$<br>$\angle XQR = \angle QRP = 60°$<br>R and S are position of ships.<br>In Δ PQR,<br>$\frac{75}{PR} = \tan 60° = \sqrt{3} \Rightarrow PR = \frac{75}{\sqrt{3}} = 25\sqrt{3}$<br>In Δ PQS, $\frac{75}{PS} = \tan 30°$<br>$\Rightarrow PS = 75\sqrt{3}$ | 1 for correct figure<br>1½<br>1 |

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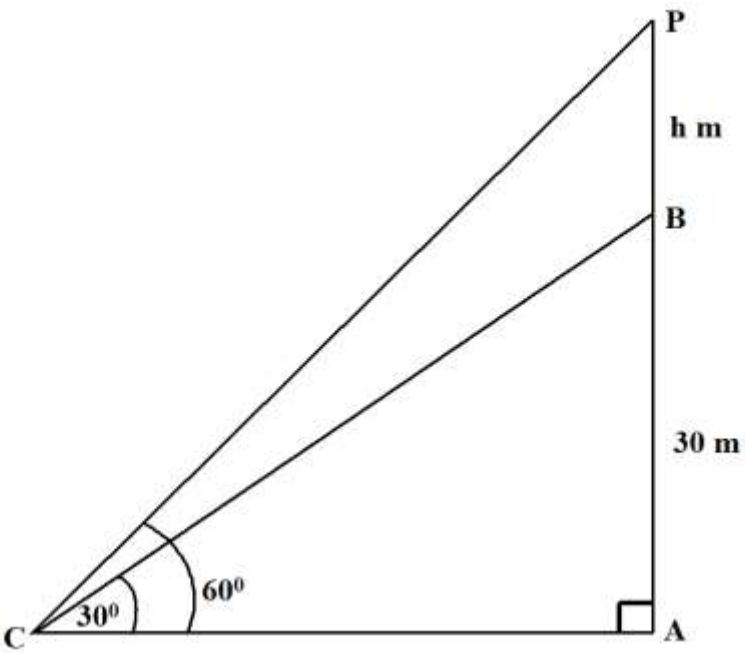
| | ∴ Distance between the ships, RS = PS – PR<br>$= 75\sqrt{3} - 25\sqrt{3} = 50\sqrt{3}$<br>$= 50 \times 1{\cdot}73 = 86{\cdot}5$<br>∴ Distance between the ships is 86.5 m | 1<br>½ |
| | OR | |
| 33(b). | From a point on the ground, the angle of elevation of the bottom and top of a transmission tower fixed at the top of 30 m high building are 30° and 60°, respectively. Find the height of the transmission tower. (Use $\sqrt{3} = 1{\cdot}73$) | |
| Sol. |  <br><br>Height of building AB = 30 m<br>BP = transmission tower = h(say)<br>∠ ACB = 30°, ∠ ACP = 60°<br>In Δ ABC, $\tan 30^\circ = \frac{AB}{AC}$<br>$\Rightarrow \frac{1}{\sqrt{3}} = \frac{30}{AC} \Rightarrow AC = 30\sqrt{3}$<br>In Δ APC, $\tan 60^\circ = \frac{AP}{AC}$ | 1 for correct figure<br>1½ |

$\sqrt{3} = \frac{30 + h}{30\sqrt{3}} \Rightarrow 30\sqrt{3} \times \sqrt{3} = 30 + h$ — 1½

$\Rightarrow h = 30\,(3 - 1)$

$\Rightarrow h = 60$ — 1

$\therefore$ Height of transmission tower = 60 m

34. A student noted the number of cars passing through a spot on a road for 100 periods each of 3 minutes and summarised it in the table given below. Find the mean and median of the following data.

| Number of cars | 0 – 10 | 10 – 20 | 20 – 30 | 30 – 40 | 40 – 50 | 50 – 60 | 60 – 70 | 70 – 80 |
|---|---|---|---|---|---|---|---|---|
| Frequency (periods) | 7 | 14 | 13 | 12 | 20 | 11 | 15 | 8 |

Sol.

| Number of cars | $x_i$ | $f_i$ | $x_i f_i$ | c.f. |
|---|---|---|---|---|
| 0 – 10 | 5 | 7 | 35 | 7 |
| 10 – 20 | 15 | 14 | 210 | 21 |
| 20 – 30 | 25 | 13 | 325 | 34 |
| 30 – 40 | 35 | 12 | 420 | 46 |
| 40 – 50 | 45 | 20 | 900 | 66 |
| 50 – 60 | 55 | 11 | 605 | 77 |
| 60 – 70 | 65 | 15 | 975 | 92 |
| 70 – 80 | 75 | 8 | 600 | 100 |
| Total | | 100 | 4070 | |

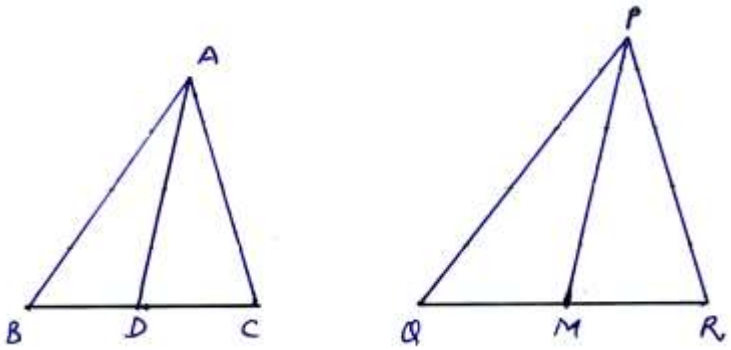
Correct table — 2

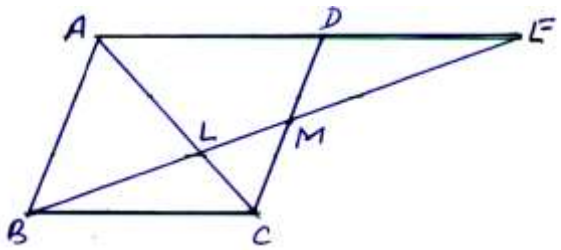
Mean $= \frac{\sum x_i f_i}{\sum f_i} = \frac{4070}{100} = 40{\cdot}7$ — 1

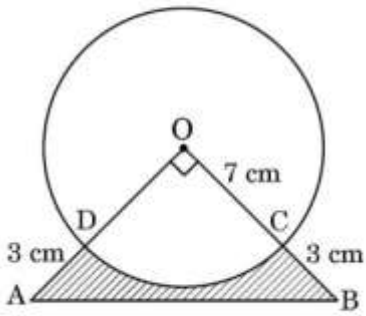
Median class : 40 – 50 — ½

Median $= 40 + \frac{50 - 46}{20} \times 10 = 42$ — 1½

35(a). Sides AB and BC and median AD of a triangle ABC are respectively proportional to sides PQ and QR and median PM of $\Delta$ PQR. Show that $\Delta$ ABC ~ $\Delta$ PQR.

| | | |
|---|---|---|
| Sol. |  <br>In Δ ABC and Δ PQR<br>$\frac{AB}{PQ} = \frac{BC}{QR} = \frac{AD}{PM}$<br>$\frac{AB}{PQ} = \frac{2\,BD}{2\,QM} = \frac{AD}{PM}$<br>(∵ D is midpoint of BC and M is midpoint of QR)<br>$\frac{AB}{PQ} = \frac{BD}{QM} = \frac{AD}{PM} \Rightarrow \Delta ABD \sim \Delta PQM$<br>$\Rightarrow \angle B = \angle Q$ — (i)<br>Now, In Δ ABC and Δ PQR<br>$\frac{AB}{PQ} = \frac{BC}{QR}$ (given)<br>$\angle B = \angle Q$ from (i)<br>∴ Δ ABC ~ Δ PQR | 1 for correct figure<br><br>1<br><br>1<br><br>½<br><br>½<br>1 |
| | OR | |
| 35(b). | Through the mid-point M of the side CD of a parallelogram ABCD, the line BM is drawn intersecting AC in L and AD (produced) in E. Prove that EL = 2BL. | |

| | | |
|---|---|---|
| Sol. |  | 1 for correct figure |
| | In Δ BMC and Δ EMD | |
| | MC = MD | |
| | ∠ CMB = ∠ EMD | |
| | ∠ MBC = ∠ MED | |
| | ∴ Δ BMC ≅ Δ EMD | 1 |
| | ⇒ BC = DE | |
| | But AD = BC | |
| | ∴ AD = DE | |
| | ⇒ AE = 2 BC | 1 |
| | Δ AEL ~ Δ CBL | ½ |
| | $\therefore \frac{EL}{BL} = \frac{AE}{BC}$ | |
| | $\Rightarrow \frac{EL}{BL} = \frac{2BC}{BC}$ | ½ |
| | $\Rightarrow \frac{EL}{BL} = 2$ | |
| | ⇒ EL = 2 BL | 1 |

| | | |
|---|---|---|
| | SECTION E<br>This section comprises of 3 case-study based questions of 4 marks each. | |
| 36. | **Case Study – 1**<br>In an annual day function of a school, the organizers wanted to give a cash prize along with a memento to their best students. Each memento is made as shown in the figure and its base ABCD is shown from the front side. The rate of silver plating is ₹ 20 per $cm^2$.<br>  <br><br>Based on the above, answer the following questions :<br>(i) What is the area of the quadrant ODCO ?<br>(ii) Find the area of Δ AOB.<br>(iii) (a) What is the total cost of silver plating the shaded part ABCD ?<br>**OR**<br>(iii) (b) What is the length of arc CD ? | |
| Sol. | (i)Area of sector ODCO $= \frac{22}{7} \times 7 \times 7 \times \frac{90}{360} = \frac{77}{2}$ or 38·5<br>∴ Area of sector ODCO is $\frac{77}{2}$ or 38·5 $cm^2$<br>(ii) ar (Δ AOB) $= \frac{1}{2} \times 10 \times 10 = 50$<br>∴ ar (Δ AOB) is 50 $cm^2$<br>(iii) (a) Required cost = (50 – 38·5) × 20<br>= 230<br>∴ required cost is ₹ 230.<br>OR<br>(iii) (b) Length of arc CD $= \frac{90}{360} \times 2 \times \frac{22}{7} \times 7$<br>= 11<br>∴ Length of arc CD is 11 cm. | ½ + ½<br>1<br>1<br>1<br>1<br>1 |

| | | |
|---|---|---|
| 37. | **Case Study – 2**<br>In a coffee shop, coffee is served in two types of cups. One is cylindrical i shape with diameter 7 cm and height 14 cm and the other i hemispherical with diameter 21 cm.<br>  <br>Based on the above, answer the following questions :<br>(i) Find the area of the base of the cylindrical cup.<br>(ii) (a) What is the capacity of the hemispherical cup ?<br>**OR**<br>(ii) (b) Find the capacity of the cylindrical cup.<br>(iii) What is the curved surface area of the cylindrical cup ? | |
| Sol. | (i) Area of base of the cylindrical cup $= \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} = \frac{77}{2}$ or 38.5<br>$\therefore$ Area of base of the cylindrical cup is $\frac{77}{2}$ or 38.5 $cm^2$<br>(ii) (a) Capacity of hemispherical cup $= \frac{2}{3} \times \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2} \times \frac{21}{2}$<br>$= \frac{4851}{2}$ or 2425.5<br>$\therefore$ Capacity of hemispherical cup is $\frac{4851}{2}$ $cm^3$ or 2425.5 $cm^3$<br>OR<br>(ii) (b) Capacity of cylindrical cup $= \frac{22}{7} \times (7)^2 \times 14$<br>$= 539$<br>$\therefore$ Capacity of cylindrical cup is 539 $cm^3$<br>(iii) External Curved surface area of cylindrical cup $= 2 \times \frac{22}{7} \times \frac{7}{2} \times 14 = 308$<br>$\therefore$ External Curved surface area of cylindrical cup is 308 $cm^2$ | 1<br><br>1<br><br>1<br><br><br><br>1<br><br>1<br><br>1 |

38.

**Case Study – 3**

Computer-based learning (CBL) refers to any teaching methodology that makes use of computers for information transmission. At an elementary school level, computer applications can be used to display multimedia lesson plans. A survey was done on 1000 elementary and secondary schools of Assam and they were classified by the number of computers they had.

| Number of Computers | 1 – 10 | 11 – 20 | 21 – 50 | 51 – 100 | 101 and more |
|---|---|---|---|---|---|
| Number of Schools | 250 | 200 | 290 | 180 | 80 |

One school is chosen at random. Then :

(i) Find the probability that the school chosen at random has more than 100 computers.

(ii) (a) Find the probability that the school chosen at random has 50 or fewer computers.

**OR**

(ii) (b) Find the probability that the school chosen at random has no more than 20 computers.

(iii) Find the probability that the school chosen at random has 10 or less than 10 computers.

Sol.

(i) P (more than 100 computers) = $\frac{80}{1000}$ or 0·08 — 1

(ii)(a) 50 or fewer computers = 250 + 200 + 290 = 740 — 1

Required probability = $\frac{740}{1000}$ or 0·74 — 1

**OR**

(ii)(b) No more than 20 computers = 250 + 200 = 450 — 1

Required probability = $\frac{450}{1000}$ or 0·45 — 1

(iii) P (10 or less than 10 computer) = $\frac{250}{1000}$ or 0·25 — 1