Series WX1YZ/C

SET~1

प्रश्न–पत्र कोड ***Q.P. Code*** ***30/C/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. k के मान, जिनके लिए समीकरण $4x^2 + kx + 9 = 0$ के वास्तविक और बराबर मूल हैं, हैं :

(a) ± 11 (b) ± 12

(c) ± 6 (d) ± 3

2. बिन्दु (4, 7) की x-अक्ष से दूरी है :

(a) 7 इकाई (b) 5 इकाई

(c) 4 इकाई (d) 10 इकाई

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 values of k for which the equation $4x^2 + kx + 9 = 0$ has real and equal roots are :

(a) ± 11 (b) ± 12

(c) ± 6 (d) ± 3

2. The distance of the point (4, 7) from the x-axis is :

(a) 7 units (b) 5 units

(c) 4 units (d) 10 units

3. दो बच्चों के एक परिवार में कम-से-कम एक लड़की के होने की प्रायिकता है :

(a) $\frac{1}{2}$ (b) $\frac{2}{5}$

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

4. जिस स्थिति के लिए, समीकरण युग्म $ax + 2y = 7$ और $3x + by = 16$ समांतर रेखाओं का निरूपण करते हैं, वह है :

(a) $ab = \frac{7}{16}$ (b) $ab = 6$

(c) $ab = 3$ (d) $ab = 2$

5. बहुपद $3x^2 + 11x - 4$ के शून्यक हैं :

(a) $\frac{1}{2}, -4$ (b) $\frac{1}{4}, -3$

(c) $\frac{1}{3}, -4$ (d) $\frac{1}{3}, 4$

6. $\cot^2 \theta - \frac{1}{\sin^2 \theta}$ बराबर है :

(a) 1 (b) 2

(c) -2 (d) -1

7. बिन्दु A के निर्देशांक, जहाँ AB उस वृत्त का व्यास है जिसका केंद्र $(3, -2)$ तथा B $(7, 4)$ है, हैं :

(a) $(-1, -8)$ (b) $(-1, 8)$

(c) $(1, 8)$ (d) $(1, -8)$

8. यदि x, $2x + 9$, $4x + 3$ एक A.P. के तीन क्रमागत पद हैं, तो x का मान है :

(a) 3 (b) 10

(c) 13 (d) 15

3. In a family of two children, the probability of having at least one girl is :

(a) $\frac{1}{2}$ (b) $\frac{2}{5}$

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

4. The condition for which the pair of equations $ax + 2y = 7$ and $3x + by = 16$ represent parallel lines is :

(a) $ab = \frac{7}{16}$ (b) $ab = 6$

(c) $ab = 3$ (d) $ab = 2$

5. The zeroes of the polynomial $3x^2 + 11x - 4$ are :

(a) $\frac{1}{2}, -4$ (b) $\frac{1}{4}, -3$

(c) $\frac{1}{3}, -4$ (d) $\frac{1}{3}, 4$

6. $\cot^2 \theta - \frac{1}{\sin^2 \theta}$ is equal to :

(a) 1 (b) 2

(c) -2 (d) -1

7. The coordinates of the point A, where AB is the diameter of the circle whose centre is $(3, -2)$ and B $(7, 4)$ is :

(a) $(-1, -8)$ (b) $(-1, 8)$

(c) $(1, 8)$ (d) $(1, -8)$

8. If x, $2x + 9$, $4x + 3$ are three consecutive terms of an A.P., then the value of x is :

(a) 3 (b) 10

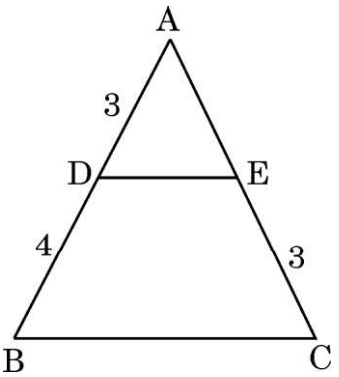
(c) 13 (d) 15

9. एक मीनार की ऊँचाई 20 m है । जब सूर्य का उन्नतांश $60°$ है, तो भूमि पर बनी मीनार की छाया की लम्बाई है :

(a) $\frac{20}{\sqrt{3}}$ m (b) $\frac{20}{3}$ m

(c) $20\sqrt{3}$ m (d) 20 m

10. दी गई आकृति में, DE ∥ BC और सभी माप cm में दिए हैं । AE की लम्बाई है :



(a) 2 cm (b) 2·25 cm

(c) 2·5 cm (d) 2·75 cm

11. एक 10 m लंबे ऊर्ध्वाधर खंभे की भूमि पर पड़ने वाली छाया की लम्बाई 5 m है । उसी समय में, एक मीनार की भूमि पर पड़ने वाली छाया की लम्बाई 12·5 m है । मीनार की ऊँचाई है :

(a) 20 m (b) 22 m

(c) 25 m (d) 24 m

12. आनुभविक संबंध का उपयोग करने पर एक बंटन, जिसका माध्य 7·2 और माध्यक 7·1 है, का बहुलक होगा :

(a) 6·2 (b) 6·3

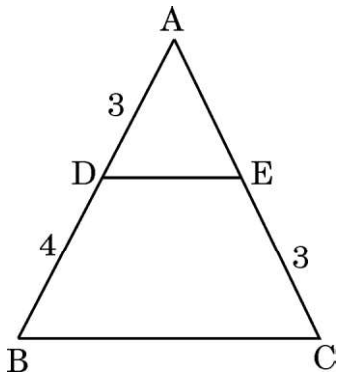
(c) 6·5 (d) 6·9

9. The height of a tower is 20 m. The length of its shadow made on the level ground when the Sun's altitude is 60°, is :

(a) $\frac{20}{\sqrt{3}}$ m (b) $\frac{20}{3}$ m

(c) $20\sqrt{3}$ m (d) 20 m

10. In the given figure, DE $\|$ BC and all measurements are given in centimetres. The length of AE is :



(a) 2 cm (b) 2·25 cm

(c) 2·5 cm (d) 2·75 cm

11. A vertical pole 10 m long casts a shadow of length 5 m on the ground. At the same time, a tower casts a shadow of length 12·5 m on the ground. The height of the tower is :

(a) 20 m (b) 22 m

(c) 25 m (d) 24 m

12. Using empirical relationship, the mode of a distribution whose mean is 7·2 and the median 7·1, is :

(a) 6·2 (b) 6·3

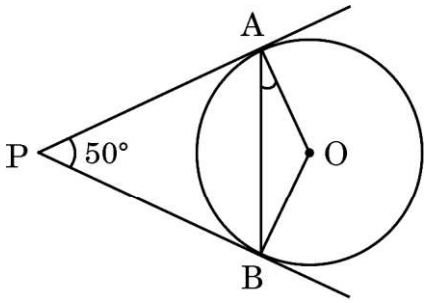
(c) 6·5 (d) 6·9

13. त्रिज्या 7 cm के केन्द्र O वाले वृत्त का एक चतुर्थांश OACB है जहाँ ACB वृत्त की चाप है । इस चतुर्थांश की परिधि है :

(a) 15 cm (b) 50 cm

(c) 25 cm (d) 44 cm

14. आकृति में, केन्द्र O वाले वृत्त पर PA और PB दो स्पर्श-रेखाएँ इस प्रकार हैं कि $\angle APB = 50°$ है । तब $\angle OAB$ की माप है :



(a) 25° (b) 50°

(c) 75° (d) 100°

15. त्रिज्या 7 cm के एक वृत्त पर, बिन्दु P जो वृत्त के केन्द्र से 25 cm की दूरी पर स्थित है, से डाली गई स्पर्श-रेखा की लम्बाई होगी :

(a) 22 cm (b) 24 cm

(c) 25 cm (d) 28 cm

16. यदि एक साइकिल का पहिया 11 km की दूरी तय करने में 5000 चक्कर लगाता है, तो पहिए का व्यास है :

(a) 65 cm (b) 35 cm

(c) 70 cm (d) 50 cm

17. लाली दो भिन्न सिक्के एक साथ उछालती है । उसे अधिक-से-अधिक एक चित प्राप्त होने की प्रायिकता है :

(a) 1 (b) $\frac{3}{4}$

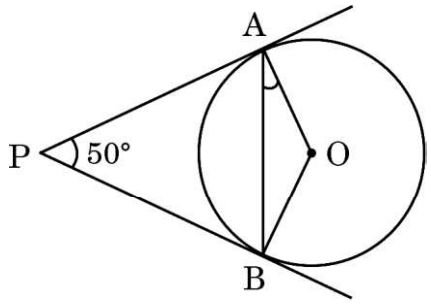
(c) $\frac{1}{2}$ (d) $\frac{1}{7}$

13. OACB is a quadrant of a circle with centre O and radius 7 cm where ACB is the arc. Then the perimeter of the quadrant is :

(a) 15 cm (b) 50 cm

(c) 25 cm (d) 44 cm

14. In the figure, PA and PB are two tangents to the circle with centre O such that $\angle$ APB = 50°. Then, the measure of $\angle$ OAB is :



(a) 25° (b) 50°

(c) 75° (d) 100°

15. The length of the tangent drawn from a point P, whose distance from the centre of a circle is 25 cm, and the radius of the circle is 7 cm, is :

(a) 22 cm (b) 24 cm

(c) 25 cm (d) 28 cm

16. If a bicycle wheel makes 5000 revolutions in moving 11 km, then the diameter of the wheel is :

(a) 65 cm (b) 35 cm

(c) 70 cm (d) 50 cm

17. Lali tosses two different coins simultaneously. The probability that she gets at most one head is :

(a) 1 (b) $\frac{3}{4}$

(c) $\frac{1}{2}$ (d) $\frac{1}{7}$

18. संख्याओं 1, 2, 3 में से एक संख्या चुनी जाती है और उसे x से निरूपित किया जाता है और संख्याओं 1, 4, 9 में से एक संख्या चुनी जाती है जिसे y से निरूपित किया जाता है । तब $P(xy < 9)$ है :

(a) $\frac{1}{9}$ (b) $\frac{3}{9}$

(c) $\frac{5}{9}$ (d) $\frac{7}{9}$

*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) :* दो खिलाड़ी, सानिया और अशनाम एक टेनिस मैच खेलते हैं । सानिया के मैच जीतने की प्रायिकता 0·79 है और अशनाम के मैच जीतने की प्रायिकता 0·21 है ।

तर्क (R) : दो पूरक घटनाओं की प्रायिकताओं का योगफल 1 होता है ।

20. *अभिकथन (A) :* एक निष्पक्ष पासा एक बार फेंका जाता है । एक अभाज्य संख्या प्राप्त होने की प्रायिकता $\frac{1}{2}$ है ।

तर्क (R) : एक प्राकृत संख्या, अभाज्य संख्या होती है यदि इस संख्या के केवल दो गुणनखण्ड हों ।

खण्ड ख

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

21. (क) यदि यह दिया हुआ है कि $\sqrt{2}$ एक अपरिमेय संख्या है, तो सिद्ध कीजिए कि $(5 - 2\sqrt{2})$ एक अपरिमेय संख्या है ।

अथवा

(ख) जाँच कीजिए कि क्या किसी प्राकृत संख्या n के लिए, संख्या 6^n, अंक 0 पर समाप्त हो सकती है ।

18. A number is chosen from the numbers 1, 2, 3 and denoted as x, and a number is chosen from the numbers 1, 4, 9 and denoted as y. Then P(xy < 9) is :

(a) $\frac{1}{9}$ (b) $\frac{3}{9}$

(c) $\frac{5}{9}$ (d) $\frac{7}{9}$

*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) :* Two players, Sania and Ashnam play a tennis match. The probability of Sania winning the match is 0·79 and that of Ashnam winning the match is 0·21.

Reason (R) : The sum of probabilities of two complementary events is 1.

20. *Assertion (A) :* A fair die is thrown once. The probability of getting a prime number is $\frac{1}{2}$.

Reason (R) : A natural number is a prime number if it has only two factors.

SECTION B

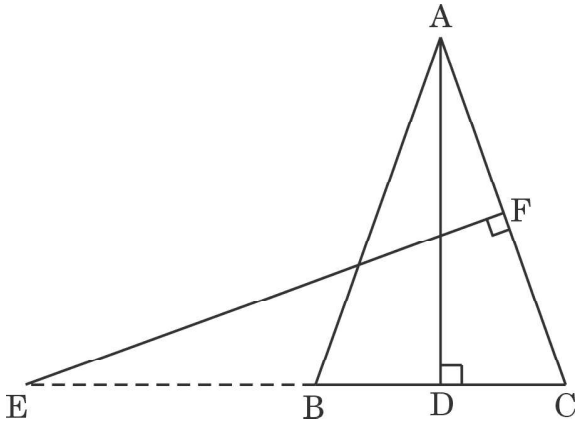
This section comprises very short answer (VSA) type questions of 2 marks each.

21. (a) If $\sqrt{2}$ is given as an irrational number, then prove that $(5 - 2\sqrt{2})$ is an irrational number.

OR

(b) Check whether 6^n can end with the digit 0 for any natural number n.

22. आकृति में, AB = AC वाले, एक समद्विबाहु त्रिभुज ABC की बढ़ाई गई भुजा CB पर स्थित E एक बिन्दु है । यदि AD $\perp$ BC और EF $\perp$ AC है, तो सिद्ध कीजिए कि Δ ABD ~ Δ ECF है ।



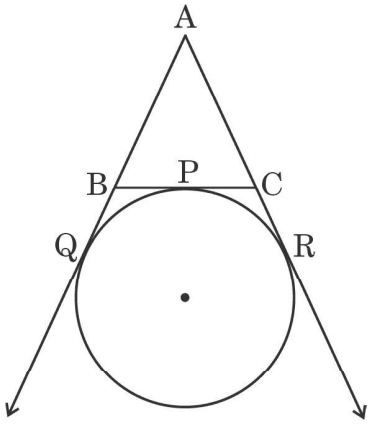
23. (क) दर्शाइए कि बिन्दु (– 3, – 3), (3, 3) और ($-3\sqrt{3}$, $3\sqrt{3}$) एक समबाहु त्रिभुज के शीर्ष हैं ।

अथवा

(ख) सिद्ध कीजिए कि A(4, 3), B(6, 4), C(5, 6), D(3, 5) एक वर्ग ABCD के शीर्ष हैं ।

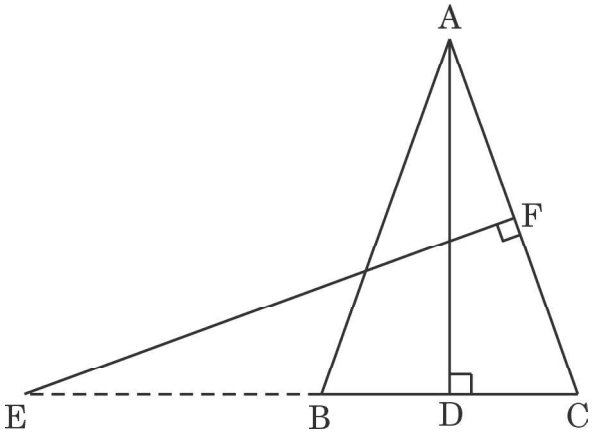
24. एक वृत्त बिन्दु P पर एक त्रिभुज ABC की भुजा BC को छू रहा है और क्रमश: बिन्दुओं Q और R में बढ़ाई गई भुजाओं AB और AC को छू रहा है ।

सिद्ध कीजिए कि AQ = $\frac{1}{2}$ (Δ ABC का परिमाप) ।



25. ज्ञात कीजिए कि बिन्दुओं (– 3, 10) और (6, – 8) को जोड़ने वाले रेखा-खण्ड को बिन्दु (– 1, k) किस अनुपात में विभाजित करता है । अत:, k का मान ज्ञात कीजिए ।

22. In the figure, E is a point on side CB produced of an isosceles triangle ABC with AB = AC. If AD $\perp$ BC and EF $\perp$ AC, prove that Δ ABD ~ Δ ECF.



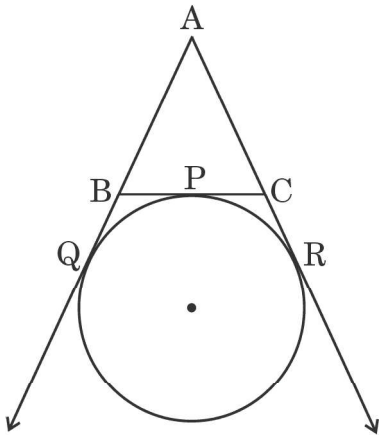
23. (a) Show that the points (– 3, – 3), (3, 3) and (– $3\sqrt{3}$, $3\sqrt{3}$) are the vertices of an equilateral triangle.

OR

(b) Prove that A(4, 3), B(6, 4), C(5, 6), D(3, 5) are the vertices of a square ABCD.

24. A circle is touching the side BC of a Δ ABC at the point P and touching AB and AC produced at points Q and R respectively.

Prove that AQ = $\frac{1}{2}$ (Perimeter of Δ ABC).



25. Find the ratio in which the point (– 1, k) divides the line segment joining the points (– 3, 10) and (6, – 8). Hence, find the value of k.

खण्ड ग

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

26. एक पिता की आयु अपने दो बच्चों की आयुओं के योगफल की दो गुना है । 20 वर्ष पश्चात्, उसकी आयु दोनों बच्चों की आयुओं के योगफल के बराबर होगी । पिता की वर्तमान आयु ज्ञात कीजिए ।

27. दो पानी के नल एक साथ एक हौज को $3\frac{1}{3}$ घंटों में भर सकते हैं । बड़े व्यास वाला नल अलग से हौज को भरने में, कम व्यास वाले नल से 5 घंटे कम समय लेता है । प्रत्येक नल द्वारा अलग से हौज को भरने के समय ज्ञात कीजिए ।

28. आधारभूत समानुपातिकता प्रमेय का कथन लिखिए और इसे सिद्ध कीजिए ।

29. (क) 50 और 500 के बीच के सभी पूर्णांकों, जो 7 से भाज्य हैं, का योगफल ज्ञात कीजिए ।

अथवा

(ख) 10 और 300 के बीच ऐसी कितनी संख्याएँ हैं जो 4 से भाग करने पर शेष 3 देती हैं ? इन संख्याओं का योगफल भी ज्ञात कीजिए ।

30. समीकरणों $x + y = 5$, $x - y = 5$ का ग्राफ खींचिए, तथा

(i) ग्राफ से, इन समीकरणों का हल ज्ञात कीजिए ।

(ii) इन रेखाओं और y-अक्ष से बनने वाले त्रिभुजाकार क्षेत्र को छायांकित कीजिए ।

31. (क) 6 cm त्रिज्या वाले एक वृत्त के लघु और दीर्घ त्रिज्यखण्डों का क्षेत्रफल ज्ञात कीजिए, यदि लघु चाप द्वारा केंद्र पर अंतरित कोण 60° है ।

($\pi = 3{\cdot}14$ का प्रयोग कीजिए)

अथवा

(ख) यदि 10 cm त्रिज्या वाले एक वृत्त की कोई जीवा केन्द्र पर 60° का कोण अंतरित करती है, तो संगत लघु वृत्तखण्ड का क्षेत्रफल ज्ञात कीजिए ।

($\pi = 3{\cdot}14$ और $\sqrt{3} = 1{\cdot}73$ का प्रयोग कीजिए)

SECTION C

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

26. The age of the father is twice the sum of the ages of his two children. After 20 years, his age will be equal to the sum of the ages of his children. Find the present age of the father.

27. Two water taps together can fill a tank in $3\frac{1}{3}$ hours. The tap of larger diameter takes 5 hours less than the smaller one to fill the tank separately. Find the time in which each tap can fill the tank separately.

28. State and prove Basic Proportionality theorem.

29. (a) Find the sum of all integers between 50 and 500, which are divisible by 7.

OR

(b) How many numbers lie between 10 and 300, which when divided by 4 leave a remainder 3 ? Also, find their sum.

30. Draw the graph of the following equations : $x + y = 5$, $x - y = 5$, and

(i) find the solution of the equations from the graph.

(ii) shade the triangular region formed by the lines and the y-axis.

31. (a) Find the area of the minor and the major sectors of a circle with radius 6 cm, if the angle subtended by the minor arc at the centre is 60°. (Use $\pi = 3{\cdot}14$)

OR

(b) If a chord of a circle of radius 10 cm subtends an angle of 60° at the centre of the circle, find the area of the corresponding minor segment of the circle. (Use $\pi = 3{\cdot}14$ and $\sqrt{3} = 1{\cdot}73$)

खण्ड घ

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

32. (क) एक तंबू 3 m की ऊँचाई तक एक लंब-वृत्तीय बेलन के आकार का है और फिर भूमि के ऊपर 13·5 m की अधिकतम ऊँचाई के साथ लंब-वृत्तीय शंकु बन जाता है । यदि आधार की त्रिज्या 14 m है, तो ₹ 2 प्रति वर्ग मीटर की दर से तंबू के भीतरी भाग को पेंट कराने की लागत ज्ञात कीजिए ।

अथवा

(ख) एक ठोस लकड़ी का खिलौना एक लंब-वृत्तीय शंकु के आकार का है जो उसी त्रिज्या के एक अर्धगोले पर अध्यारोपित है । यदि अर्धगोले की त्रिज्या 4·2 cm तथा खिलौने की कुल ऊँचाई 10·2 cm है, तो लकड़ी के खिलौने का आयतन ज्ञात कीजिए । इस खिलौने का कुल पृष्ठीय क्षेत्रफल भी ज्ञात कीजिए ।

33. समुद्र-तल से 100 m ऊँचे लाइटहाऊस के शिखर से देखने पर एक समुद्री जहाज का अवनमन कोण, सीधे उसकी ओर बढ़ते हुए 30° से 45° में बदल जाता है । अवलोकन की अवधि के दौरान जहाज द्वारा तय की गई दूरी का निर्धारण कीजिए ।

($\sqrt{3}$ = 1·732 का प्रयोग कीजिए)

34. एक स्कूल के दसवीं कक्षा की 50 छात्राओं की ऊँचाई (cm में) का सर्वेक्षण किया गया और संबंधित निम्नलिखित आँकड़े प्राप्त हुए :

ऊँचाई (cm में)	छात्राओं की संख्या
120 – 130	2
130 – 140	8
140 – 150	12
150 – 160	20
160 – 170	8
कुल	50

उपर्युक्त आँकड़ों का माध्य और बहुलक ज्ञात कीजिए ।

SECTION D

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

32. (a) A tent is in the shape of a right circular cylinder up to a height of 3 m and then a right circular cone, with a maximum height of 13·5 m above the ground. Calculate the cost of painting the inner side of the tent at the rate of ₹ 2 per square metre, if the radius of the base is 14 m.

OR

(b) A solid wooden toy is in the shape of a right circular cone mounted on a hemisphere of same radius. If the radius of the hemisphere is 4·2 cm and the total height of the toy is 10·2 cm, find the volume of the wooden toy. Also, find the total surface area of the toy.

33. As observed from the top of a lighthouse, 100 m above sea level, the angle of depression of a ship, sailing directly towards it, changes from 30° to 45°. Determine the distance travelled by the ship during the period of observation. (Use $\sqrt{3}$ = 1·732)

34. A survey regarding the heights (in cm) of 50 girls of class X of a school was conducted and the following data was obtained :

Height (in cm)	Number of girls
120 – 130	2
130 – 140	8
140 – 150	12
150 – 160	20
160 – 170	8
Total	50

Find the mean and mode of the above data.

35. (क) (i) सिद्ध कीजिए कि :

$$\sqrt{\sec^2\theta + \operatorname{cosec}^2\theta} = \tan\theta + \cot\theta$$

(ii) मान ज्ञात कीजिए :

$$\frac{\cos 45^\circ}{\sec 30^\circ + \operatorname{cosec} 30^\circ}$$

अथवा

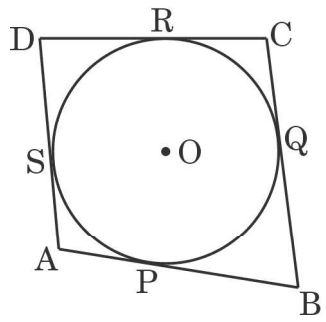
(ख) यदि $x \sin^3\theta + y \cos^3\theta = \sin\theta \cos\theta$ और $x \sin\theta = y \cos\theta$ है, तो सिद्ध कीजिए कि $x^2 + y^2 = 1$ है ।

खण्ड ङ

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

प्रकरण अध्ययन – 1

36. एक पार्क में चार खंभे एक वृत्ताकार फव्वारे के चारों ओर A, B, C और D की स्थिति में इस प्रकार खड़े होते हैं कि खंभे AB, BC, CD और DA में लगने वाला कपड़ा क्रमश: P, Q, R और S पर वृत्ताकार फव्वारे को छूता है जैसा कि चित्र में दिखाया गया है ।



उपर्युक्त सूचना के आधार पर, निम्न प्रश्नों के उत्तर दीजिए :

(i) यदि वृत्ताकार फव्वारे का केन्द्र O है, तो $\angle$ OSA का माप ज्ञात कीजिए । *1*

(ii) यदि AB = AD हो, तो ABCD आकृति का नाम लिखिए । *1*

(iii) (क) यदि DR = 7 cm और AD = 11 cm है, तो AP की लम्बाई ज्ञात कीजिए । *2*

अथवा

(iii) (ख) यदि वृत्ताकार फव्वारे का केन्द्र O है और $\angle$ QCR = 60° है, तो $\angle$ QOR का माप ज्ञात कीजिए । *2*

35. (a) (i) Prove that :

$$\sqrt{\sec^2 \theta + \operatorname{cosec}^2 \theta} = \tan \theta + \cot \theta$$

(ii) Evaluate :

$$\frac{\cos 45^\circ}{\sec 30^\circ + \operatorname{cosec} 30^\circ}$$

OR

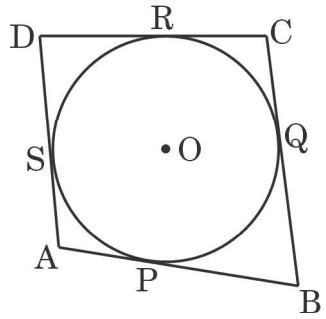
(b) If $x \sin^3 \theta + y \cos^3 \theta = \sin \theta \cos \theta$ and $x \sin \theta = y \cos \theta$, prove that $x^2 + y^2 = 1$.

SECTION E

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

Case Study – 1

36. In a park, four poles are standing at positions A, B, C and D around the circular fountain such that the cloth joining the poles AB, BC, CD and DA touches the circular fountain at P, Q, R and S respectively as shown in the figure.



Based on the above information, answer the following questions :

(i) If O is the centre of the circular fountain, then $\angle$ OSA = ... *1*

(ii) If AB = AD, then write the name of the figure ABCD. *1*

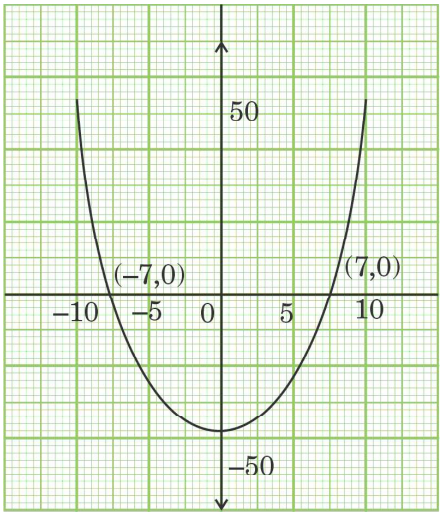
(iii) (a) If DR = 7 cm and AD = 11 cm, then find the length of AP. *2*

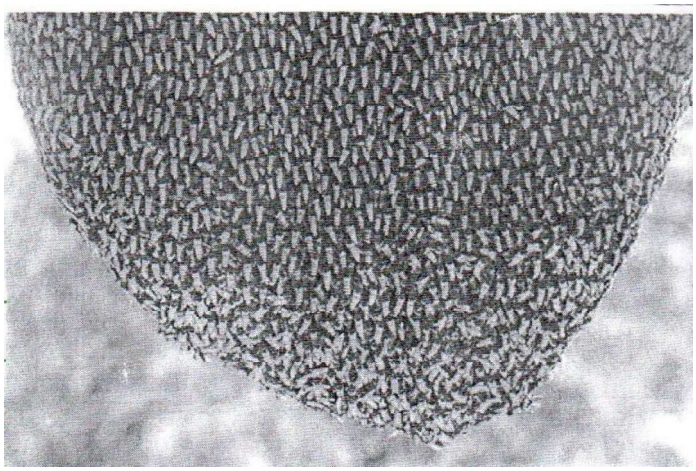
OR

(iii) (b) If O is the centre of the circular fountain with $\angle$ QCR = 60°, then find the measure of $\angle$ QOR. *2*

प्रकरण अध्ययन – 2

37. बगीचे में खेलते समय समायरा ने एक छत्ते को देखा और अपनी माँ से पूछा कि यह क्या है । उसकी माँ ने उत्तर दिया कि यह मधुमक्खियों द्वारा शहद जमा करने के लिए बनाया गया छत्ता है । साथ ही, उसने उसे बताया कि बनने वाले छत्ते की आकृति एक गणितीय संरचना है । छत्ते की गणितीय संरचना को ग्राफ में दिखाया गया है ।





उपर्युक्त सूचना के आधार पर, निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) दिए गए ग्राफ द्वारा दर्शाए गए बहुपद के लिए कितने शून्यक हैं ? *1*

(ii) बहुपद के शून्यक लिखिए । *1*

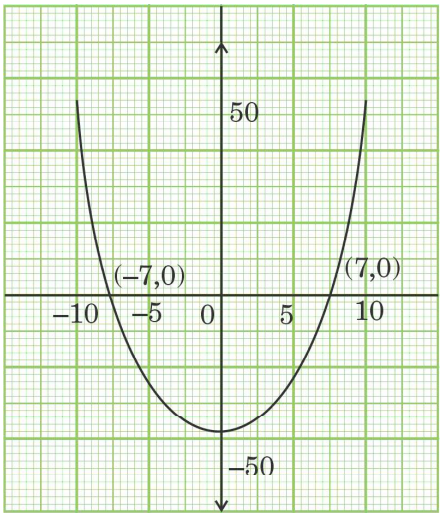
(iii) (क) यदि बहुपद $x^2 + (a + 1)x + b$ के शून्यक 2 और -3 हों, तो a और b के मान ज्ञात कीजिए । *2*

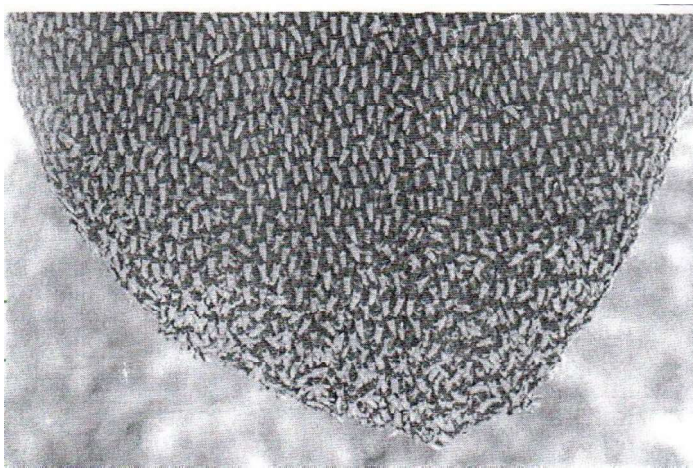
अथवा

(iii) (ख) यदि बहुपद $x^2 + px + 45$ के शून्यकों के अन्तर का वर्ग 144 है, तो p का मान ज्ञात कीजिए । *2*

Case Study – 2

37. While playing in a garden, Samaira saw a honeycomb and asked her mother what is that. Her mother replied that it's a honeycomb made by honey bees to store honey. Also, she told her that the shape of the honeycomb formed is a mathematical structure. The mathematical representation of the honeycomb is shown in the graph.





Based on the above information, answer the following questions :

(i) How many zeroes are there for the polynomial represented by the graph given ? *1*

(ii) Write the zeroes of the polynomial. *1*

(iii) (a) If the zeroes of a polynomial $x^2 + (a + 1)x + b$ are 2 and – 3, then determine the values of a and b. *2*

OR

(iii) (b) If the square of difference of the zeroes of the polynomial $x^2 + px + 45$ is 144, then find the value of p. *2*

प्रकरण अध्ययन – 3

38. 14 फरवरी को इंटरनेशनल बुक गिविंग डे के रूप में मनाया जाता है और दुनिया के कई देश इस दिन को मनाते हैं । भारत में भी कुछ लोगों ने इस दिन को मनाना शुरू किया और एक सार्वजनिक पुस्तकालय को निम्नलिखित संख्या में कुछ विषयों की पुस्तकें दान कीं :

इतिहास = 96, विज्ञान = 240, गणित = 336

इन पुस्तकों को कम-से-कम ढेरों में इस प्रकार व्यवस्थित करना है कि प्रत्येक ढेर में केवल एक विषय की पुस्तकें हों और प्रत्येक ढेर पर पुस्तकों की संख्या समान हो ।

उपर्युक्त सूचना के आधार पर, निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) प्रत्येक ढेर में कितनी किताबें व्यवस्थित हैं ? *1*

(ii) गणित की सभी पुस्तकों को व्यवस्थित करने के लिए कितने ढेरों का उपयोग किया जाता है ? *1*

(iii) (क) सभी पुस्तकों को व्यवस्थित करने के लिए उपयोग किए जाने वाले ढेरों की कुल संख्या निर्धारित कीजिए । *2*

अथवा

(iii) (ख) यदि इतिहास, विज्ञान और गणित की प्रत्येक पुस्तक की मोटाई क्रमश: 1·8 cm, 2·2 cm और 2·5 cm है, तो इतिहास, विज्ञान और गणित की पुस्तकों के प्रत्येक ढेर की ऊँचाई ज्ञात कीजिए । *2*

Case Study – 3

38. February 14 is celebrated as International Book Giving Day and many countries in the world celebrate this day. Some people in India also started celebrating this day and donated the following number of books of various subjects to a public library :

History = 96, Science = 240, Mathematics = 336.

These books have to be arranged in minimum number of stacks such that each stack contains books of only one subject and the number of books on each stack is the same.

Based on the above information, answer the following questions :

(i) How many books are arranged in each stack ? *1*

(ii) How many stacks are used to arrange all the Mathematics books ? *1*

(iii) (a) Determine the total number of stacks that will be used for arranging all the books. *2*

OR

(iii) (b) If the thickness of each book of History, Science and Mathematics is 1·8 cm, 2·2 cm and 2·5 cm respectively, then find the height of each stack of History, Science and Mathematics books. *2*

Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Supplementary Examination, July- **2023**
MATHEMATICS PAPER CODE 30/C/1

General Instructions: -

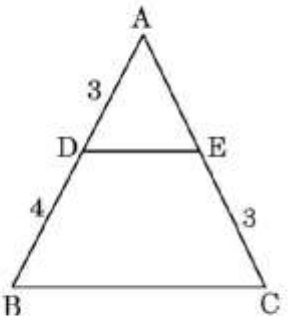
1	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested 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 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	**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".**
10	**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".**

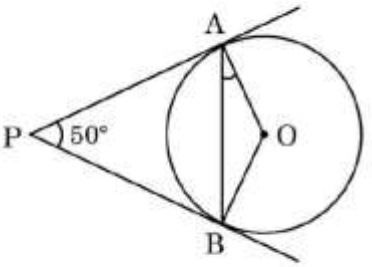
11	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
12	A full scale of marks _____ (example 0 to 80/70/60/50/40/30 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.
13	Every examiner 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:- ● 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.
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 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.
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/C/1)

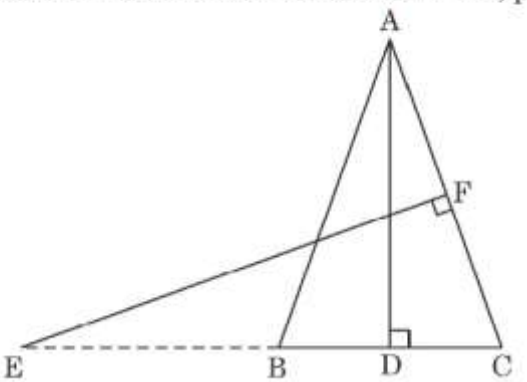
Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Marks
	SECTION A Questions no. 1 to 18 are multiple choice questions (MCQs) and questions number 19 and 20 are Assertion-Reason based questions of 1 mark each	
1.	The values of k for which the equation $4x^2 + kx + 9 = 0$ has real and equal roots are : (a) ± 11 (b) ± 12 (c) ± 6 (d) ± 3	
Sol.	(b) ± 12	1
2.	The distance of the point (4, 7) from the x-axis is : (a) 7 units (b) 5 units (c) 4 units (d) 10 units	
Sol.	(a) 7 units	1
3.	In a family of two children, the probability of having at least one girl is : (a) $\frac{1}{2}$ (b) $\frac{2}{5}$ (c) $\frac{3}{4}$ (d) $\frac{1}{4}$	
Sol.	(c) $\frac{3}{4}$	1
4.	The condition for which the pair of equations $ax + 2y = 7$ and $3x + by = 16$ represent parallel lines is : (a) $ab = \frac{7}{16}$ (b) $ab = 6$ (c) $ab = 3$ (d) $ab = 2$	
Sol.	(b) $ab = 6$	1

5.	The zeroes of the polynomial $3x^2 + 11x - 4$ are : (a) $\frac{1}{2}, -4$ (b) $\frac{1}{4}, -3$ (c) $\frac{1}{3}, -4$ (d) $\frac{1}{3}, 4$	
Sol.	(c) $\frac{1}{3}, -4$	1
6.	$\cot^2\theta - \frac{1}{\sin^2\theta}$ is equal to : (a) 1 (b) 2 (c) -2 (d) -1	
Sol.	(d) -1	1
7.	The coordinates of the point A, where AB is the diameter of the circle whose centre is $(3, -2)$ and B $(7, 4)$ is : (a) $(-1, -8)$ (b) $(-1, 8)$ (c) $(1, 8)$ (d) $(1, -8)$	
Sol.	(a) $(-1, -8)$	1
8.	If x, $2x + 9$, $4x + 3$ are three consecutive terms of an A.P., then the value of x is : (a) 3 (b) 10 (c) 13 (d) 15	
Sol.	(d) 15	1
9.	The height of a tower is 20 m. The length of its shadow made on the level ground when the Sun's altitude is 60°, is : (a) $\frac{20}{\sqrt{3}}$ m (b) $\frac{20}{3}$ m (c) $20\sqrt{3}$ m (d) 20 m	
Sol.	(a) $\frac{20}{\sqrt{3}}$ m	1

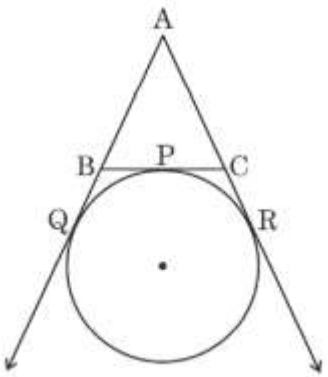
10.	In the given figure, DE ∥ BC and all measurements are given in centimetres. The length of AE is :  (a) 2 cm (b) 2·25 cm (c) 2·5 cm (d) 2·75 cm	
Sol.	(b) 2.25 cm	1
11.	A vertical pole 10 m long casts a shadow of length 5 m on the ground. At the same time, a tower casts a shadow of length 12·5 m on the ground. The height of the tower is : (a) 20 m (b) 22 m (c) 25 m (d) 24 m	
Sol.	(c) 25 m	1
12.	Using empirical relationship, the mode of a distribution whose mean is 7·2 and the median 7·1, is : (a) 6·2 (b) 6·3 (c) 6·5 (d) 6·9	
Sol.	(d) 6.9	1
13.	OACB is a quadrant of a circle with centre O and radius 7 cm where ACB is the arc. Then the perimeter of the quadrant is : (a) 15 cm (b) 50 cm (c) 25 cm (d) 44 cm	
Sol.	(c) 25 cm	1

14.	In the figure, PA and PB are two tangents to the circle with centre O such that $\angle APB = 50°$. Then, the measure of $\angle OAB$ is :  (a) 25° (b) 50° (c) 75° (d) 100°	
Sol.	(a) 25°	1
15.	The length of the tangent drawn from a point P, whose distance from the centre of a circle is 25 cm, and the radius of the circle is 7 cm, is : (a) 22 cm (b) 24 cm (c) 25 cm (d) 28 cm	
Sol.	(b) 24 cm	1
16.	If a bicycle wheel makes 5000 revolutions in moving 11 km, then the diameter of the wheel is : (a) 65 cm (b) 35 cm (c) 70 cm (d) 50 cm	
Sol.	(c) 70 cm	1
17.	Lali tosses two different coins simultaneously. The probability that she gets at most one head is : (a) 1 (b) $\frac{3}{4}$ (c) $\frac{1}{2}$ (d) $\frac{1}{7}$	
Sol.	(b) $\frac{3}{4}$	1

18.	A number is chosen from the numbers 1, 2, 3 and denoted as x, and a number is chosen from the numbers 1, 4, 9 and denoted as y. Then P(xy < 9) is : (a) $\frac{1}{9}$ (b) $\frac{3}{9}$ (c) $\frac{5}{9}$ (d) $\frac{7}{9}$	
Sol.	(c) $\frac{5}{9}$	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) :* Two players, Sania and Ashnam play a tennis match. The probability of Sania winning the match is 0·79 and that of Ashnam winning the match is 0·21. *Reason (R) :* The sum of probabilities of two complementary events is 1.	
Sol.	(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).	1
20.	*Assertion (A) :* A fair die is thrown once. The probability of getting a prime number is $\frac{1}{2}$. *Reason (R) :* A natural number is a prime number if it has only two factors.	
Sol.	(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).	1

	SECTION B This section comprises very short answer (VSA) type questions of 2 marks each.	
21. (a)	If $\sqrt{2}$ is given as an irrational number, then prove that $(5 - 2\sqrt{2})$ is an irrational number.	
Sol.	Let us assume that $5 - 2\sqrt{2}$ be a rational number. $\therefore 5 - 2\sqrt{2} = \frac{p}{q}$, where p and q are integers and $q \neq 0$. $\Longrightarrow \sqrt{2} = \frac{5q - p}{2q}$ RHS is a rational number. So, LHS is also a rational number which contradict the given fact that $\sqrt{2}$ is an irrational number. So, our assumption is wrong. Hence, $5 - 2\sqrt{2}$ is an irrational number.	1 ½ ½
	OR	
21. (b)	Check whether 6^n can end with the digit 0 for any natural number n.	
Sol.	If the number 6^n ends with the digit 0, then it should be divisible by 2 and 5. But prime factorisation of 6^n is $(2 \times 3)^n$. $\therefore$ Prime factorisation of 6^n does not contain prime number 5. Hence, 6^n can't end with the digit 0.	1 1
22.	In the figure, E is a point on side CB produced of an isosceles triangle ABC with AB = AC. If AD ⊥ BC and EF ⊥ AC, prove that Δ ABD ~ Δ ECF.  	

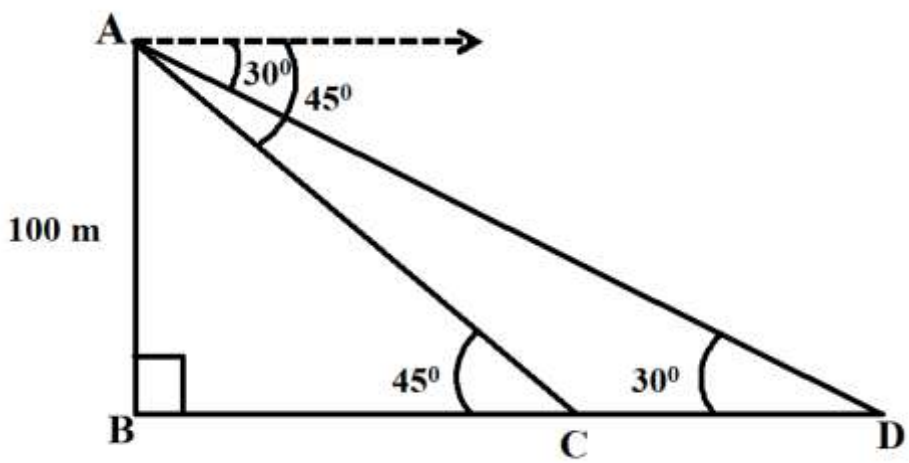
Sol.	In Δ ABC, AB = AC (Given) ∴ ∠ACB = ∠ABC ----- ① In Δ ABD and Δ ECF ∠ADB = ∠EFC (each 90°) ∠ABD = ∠ACD (from ①) ∴ Δ ABD ~ Δ ECF (AA rule)	 1 ½ ½
23. (a)	Show that the points $(-3, -3)$, $(3, 3)$ and $(-3\sqrt{3}, 3\sqrt{3})$ are the vertices of an equilateral triangle.	
Sol.	Let A $(-3, -3)$, B $(3, 3)$ and C $(-3\sqrt{3}, 3\sqrt{3})$ be the given points. Using distance formula AB = $\sqrt{(3+3)^2 + (3+3)^2} = 6\sqrt{2}$ units BC = $\sqrt{(-3\sqrt{3}-3)^2 + (3\sqrt{3}-3)^2} = 6\sqrt{2}$ units CA = $\sqrt{(-3+3\sqrt{3})^2 + (-3-3\sqrt{3})^2} = 6\sqrt{2}$ units As AB = BC = CA, so the given points are the vertices of an equilateral triangle.	 ½ ½ ½ ½
	OR	
23(b).	Prove that A(4, 3), B(6, 4), C(5, 6), D(3, 5) are the vertices of a square ABCD.	
Sol.	AB = $\sqrt{(6-4)^2 + (4-3)^2} = \sqrt{5}$ units BC = $\sqrt{(5-6)^2 + (6-4)^2} = \sqrt{5}$ units CD = $\sqrt{(3-5)^2 + (5-6)^2} = \sqrt{5}$ units DA = $\sqrt{(4-3)^2 + (3-5)^2} = \sqrt{5}$ units AC = $\sqrt{(5-4)^2 + (6-3)^2} = \sqrt{10}$ units BD = $\sqrt{(3-6)^2 + (5-4)^2} = \sqrt{10}$ units As AB = BC = CD = DA and AC = BD, so ABCD is a square.	1 ½ ½

24.	A circle is touching the side BC of a Δ ABC at the point P and touching AB and AC produced at points Q and R respectively. Prove that AQ = $\frac{1}{2}$ (Perimeter of Δ ABC).  	
Sol.	Perimeter of Δ ABC = AB + BC + CA = AB + BP + CP + CA = AB + BQ + CR + CA [BP = BQ ; CP = CR] = AQ + AR = AQ + AQ [AQ = AR] = 2 AQ ∴ AQ = $\frac{1}{2}$ (Perimeter of Δ ABC)	½ ½ ½ ½
25.	Find the ratio in which the point (– 1, k) divides the line segment joining the points (– 3, 10) and (6, – 8). Hence, find the value of k.	
Sol.	Let C (– 1, k) be divides the line segment joining the points A (– 3, 10) and B (6, – 8) in the ratio m : 1. Using section formula $-1 = \frac{-3+6m}{m+1}$ $\Rightarrow m = \frac{2}{7}$ Hence, required ratio is 2 : 7 $k = \frac{10\times7-8\times2}{2+7} = 6$	1 1

	SECTION C This section comprises of Short Answer (SA) type questions of 3 marks each.	
26.	The age of the father is twice the sum of the ages of his two children. After 20 years, his age will be equal to the sum of the ages of his children. Find the present age of the father.	
Sol.	Let the present age of the father be 'x' years and the sum of present ages of his two children be 'y' years A.T.Q. $x = 2y$ ----- ① $x + 20 = y + 40$ ----- ② Solving ① and ②, we get $x = 40$ Hence, the present age of the father is 40 years.	 1 1 1
27.	Two water taps together can fill a tank in $3\frac{1}{3}$ hours. The tap of larger diameter takes 5 hours less than the smaller one to fill the tank separately. Find the time in which each tap can fill the tank separately.	
Sol.	Let the time taken by the tap of smaller diameter to fill the tank separately be 'x' hours and the time taken by the tap of larger diameter to fill the tank separately be $(x - 5)$ hours. A.T.Q. $\frac{1}{x} + \frac{1}{x-5} = \frac{3}{10}$ $\Rightarrow \quad 3x^2 - 35x + 50 = 0$ $\Rightarrow \quad (x - 10)(3x - 5) = 0$ $\Rightarrow \quad x = 10 \text{ or } x = \frac{5}{3}$ But $x = \frac{5}{3}$ is not possible, so $x = 10$ ∴ time taken by the tap of smaller diameter to fill the tank separately is 10 hours and time taken by the tap of larger diameter to fill the tank separately is $10 - 5 = 5$ hours	 1 1 ½ ½
28.	State and prove Basic Proportionality theorem.	
Sol.	Correct statement of Basic Proportionality Correct figure, given, to prove and construction Correct proof	½ 1 1½

29 (a).	Find the sum of all integers between 50 and 500, which are divisible by 7.	
Sol.	56, 63, …, 497 Here a = 56 and d = 7 Let $a_n = 497$ $\Rightarrow$ 56 + (n – 1) × 7 = 497 $\Rightarrow$ n = 64 $S_{64} = \frac{64}{2} \times (56 + 497) = 17696$	1 ½ ½ 1
	OR	
29 (b).	How many numbers lie between 10 and 300, which when divided by 4 leave a remainder 3 ? Also, find their sum.	
Sol.	11, 15, …, 299 Here a = 11 and d = 4 Let $a_n = 299$ $\Rightarrow$ 11 + (n – 1) × 4 = 299 $\Rightarrow$ n = 73 $S_{73} = \frac{73}{2} \times (11 + 299) = 11315$	1 ½ ½ 1
30.	Draw the graph of the following equations : x + y = 5, x – y = 5, and (i) find the solution of the equations from the graph. (ii) shade the triangular region formed by the lines and the y-axis.	
Sol.	Correct graph of line for equation x + y = 5. Correct graph of line for equation x – y = 5. (i) (5, 0) (ii) Correct shade the required triangular region.	1 1 ½ ½
31 (a).	Find the area of the minor and the major sectors of a circle with radius 6 cm, if the angle subtended by the minor arc at the centre is 60°. (Use π = 3·14)	
Sol.	Area of minor sector = $\frac{3.14 \times (6)^2 \times 60°}{360°}$ = 18.84 Hence, area of minor sector is 18.84 cm^2	1 ½

	Area of major sector = Area of circle – Area of minor sector $= 3.14 \times (6)^2 - 18.84$ $= 94.2$ Hence, area of major sector is 94.2 cm^2	 1 ½
	OR	
31 (b).	If a chord of a circle of radius 10 cm subtends an angle of 60° at the centre of the circle, find the area of the corresponding minor segment of the circle. (Use $\pi = 3{\cdot}14$ and $\sqrt{3} = 1{\cdot}73$)	
Sol.	Area of minor segment $= \frac{3.14 \times (10)^2 \times 60°}{360°} - \frac{1}{2} \times (10)^2 \times \frac{\sqrt{3}}{2}$ $= \frac{314}{6} - \frac{173}{4}$ $= 9\frac{1}{12}$ or 9.08 Hence, area of minor segment is 9.08 cm^2.	2 ½ ½
	SECTION D This section comprises of Long Answer (LA) type questions of 5 marks each.	
32 (a).	A tent is in the shape of a right circular cylinder up to a height of 3 m and then a right circular cone, with a maximum height of 13·5 m above the ground. Calculate the cost of painting the inner side of the tent at the rate of ₹ 2 per square metre, if the radius of the base is 14 m.	
Sol.	Height of conical part = 13.5 – 3 = 10.5 m Slant height $= \sqrt{(14)^2 + (10.5)^2} = 17.5$ m SA of tent = CSA of conical part + CSA of cylindrical part $= \left(\frac{22}{7} \times 14 \times 17.5\right) + \left(2 \times \frac{22}{7} \times 14 \times 3\right)$ $= 1034$ m^2 Cost of painting @ ₹ 2 per m^2 = 1034 × 2 = ₹ 2068	½ 1 2 ½ 1
	OR	
32 (b).	A solid wooden toy is in the shape of a right circular cone mounted on a hemisphere of same radius. If the radius of the hemisphere is 4·2 cm and the total height of the toy is 10·2 cm, find the volume of the wooden toy. Also, find the total surface area of the toy.	

Sol.	Height of conical part = 10.2 – 4.2 = 6 cm	½
	Volume of toy = Volume of conical part + Volume of hemispherical part	
	$= \left(\frac{1}{3} \times \frac{22}{7} \times (4.2)^2 \times 6\right) + \left(\frac{2}{3} \times \frac{22}{7} \times (4.2)^3\right)$	1
	= 266.112	1
	Hence, Volume of toy is 266.112 cm^3	
	Slant height of conical part = $\sqrt{(4.2)^2 + (6)^2} \approx 7.32$ cm	1
	TSA of the toy = CSA of hemispherical part + CSA of conical part	
	$= \left(2 \times \frac{22}{7} \times (4.2)^2\right) + \left(\frac{22}{7} \times 4.2 \times 7.32\right)$	1
	= 207.504	½
	Hence, TSA of toy is 207.504 cm^2	
33.	As observed from the top of a lighthouse, 100 m above sea level, the angle of depression of a ship, sailing directly towards it, changes from 30° to 45°. Determine the distance travelled by the ship during the period of observation. (Use $\sqrt{3}$ = 1·732)	
Sol.	Correct figure.	2
		
	In Δ ABC	
	$\frac{100}{BC}$ = tan 45° = 1	½
	$\Rightarrow$ BC = 100 --- (1)	½
	In Δ ABD	
	$\frac{100}{BD}$ = tan 30° = $\frac{1}{\sqrt{3}}$	½
	$\Rightarrow$ BD = 100 $\sqrt{3}$	

$\Longrightarrow 100 + CD = 100\sqrt{3}$ ½

$\Longrightarrow CD = 100\sqrt{3} - 100 = 100(1.732 - 1) = 73.2$ 1

Hence, distance travelled by the ship during the period of observation is 73.2 m

34. A survey regarding the heights (in cm) of 50 girls of class X of a school was conducted and the following data was obtained :

Height (in cm)	Number of girls
120 – 130	2
130 – 140	8
140 – 150	12
150 – 160	20
160 – 170	8
Total	50

Find the mean and mode of the above data.

Sol.

Height (in cm)	No. of girls	x_i	u_i	f_iu_i
120 – 130	2	125	– 2	– 4
130 – 140	8	135	– 1	– 8
140 – 150	12	145 = a	0	0
150 – 160	20	155	1	20
160 – 170	8	165	2	16
Total	50			24

Correct table 1½

Mean = $145 + \frac{24}{50} \times 10$ 1

= 149.8 ½

∴ mean height is 149.8 cm

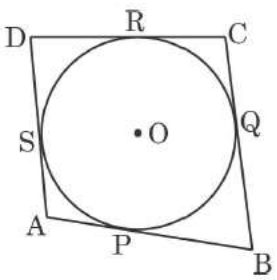
Modal class is 150 – 160 ½

Mode = $150 + \frac{(20-12)}{(2\times20-12-8)} \times 10$ 1

= 154 ½

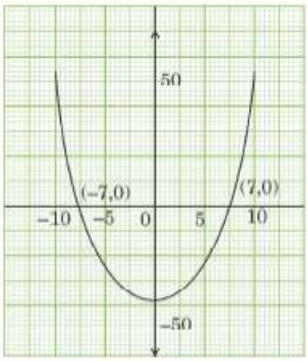
∴ modal height is 154 cm

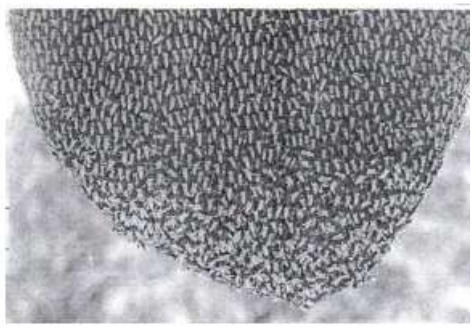
35 (a).	(i) Prove that : $\sqrt{\sec^2\theta + \text{cosec}^2\theta} = \tan\theta + \cot\theta$ (ii) Evaluate : $\frac{\cos 45^\circ}{\sec 30^\circ + \text{cosec } 30^\circ}$	
	(i) LHS = $\sqrt{1+\tan^2\theta+1+\cot^2\theta}$ $= \sqrt{\tan^2\theta+\cot^2\theta+2\times\tan\theta\times\cot\theta}$ $= \sqrt{(\tan\theta+\cot\theta)^2}$ $= \tan\theta + \cot\theta$ = RHS (ii) $\frac{\frac{1}{\sqrt{2}}}{\frac{2}{\sqrt{3}}+2}$ $= \frac{\sqrt{3}}{2\sqrt{2}(1+\sqrt{3})} \times \frac{\sqrt{2}}{\sqrt{2}}$ $= \frac{\sqrt{6}}{4(1+\sqrt{3})} \times \frac{(1-\sqrt{3})}{(1-\sqrt{3})}$ $= \frac{3\sqrt{2}-\sqrt{6}}{8}$	1 1 ½ 1 ½ ½ ½
	OR	
35 (b).	If $x\sin^3\theta + y\cos^3\theta = \sin\theta\cos\theta$ and $x\sin\theta = y\cos\theta$, prove that $x^2 + y^2 = 1$.	
Sol.	Given, $x\sin^3\theta + y\cos^3\theta = \sin\theta\cos\theta$ $\Rightarrow$ $x\sin\theta(\sin^2\theta) + y\cos\theta(\cos^2\theta) = \sin\theta\cos\theta$ $\Rightarrow$ $x\sin\theta(\sin^2\theta) + x\sin\theta(\cos^2\theta) = \sin\theta\cos\theta$ $\Rightarrow$ $x\sin\theta(\sin^2\theta+\cos^2\theta) = \sin\theta\cos\theta$ $\Rightarrow$ $x = \cos\theta$ Given, $x\sin\theta = y\cos\theta$ $\Rightarrow$ $\cos\theta\sin\theta = y\cos\theta$ $\Rightarrow$ $y = \sin\theta$ LHS = $x^2 + y^2 = (\cos\theta)^2 + (\sin\theta)^2 = 1$ = RHS	1 1 1 1 1
	SECTION E This section comprises of 3 case-study based questions of 4 marks each.	

36.	In a park, four poles are standing at positions A, B, C and D around the circular fountain such that the cloth joining the poles AB, BC, CD and DA touches the circular fountain at P, Q, R and S respectively as shown in the figure.   Based on the above information, answer the following questions : (i) If O is the centre of the circular fountain, then $\angle$ OSA = ... (ii) If AB = AD, then write the name of the figure ABCD. (iii) (a) If DR = 7 cm and AD = 11 cm, then find the length of AP. **OR** (iii) (b) If O is the centre of the circular fountain with $\angle$ QCR = 60°, then find the measure of $\angle$ QOR.	
Sol.	(i) 90° (ii) AB + DC = BC + DA Given, AB = AD $\Rightarrow$ BC = DC So, ABCD is a Kite (iii) (a) DS = DR = 7 cm AD = 11 cm 7 + SA = 11 $\Rightarrow$ SA = 4 cm $\therefore$ AP = SA = 4 cm OR (b) $\angle$QOR = 180° – 60° = 120°	1 1 ½ ½ ½ ½ 1 1

37.

While playing in a garden, Samaira saw a honeycomb and asked her mother what is that. Her mother replied that it's a honeycomb made by honey bees to store honey. Also, she told her that the shape of the honeycomb formed is a mathematical structure. The mathematical representation of the honeycomb is shown in the graph.





Based on the above information, answer the following questions :

(i) How many zeroes are there for the polynomial represented by the graph given ?

(ii) Write the zeroes of the polynomial.

(iii) (a) If the zeroes of a polynomial $x^2 + (a + 1)x + b$ are 2 and – 3, then determine the values of a and b.

OR

(iii) (b) If the square of difference of the zeroes of the polynomial $x^2 + px + 45$ is 144, then find the value of p.

Sol.

(i) Two — 1

(ii) 7 and – 7 — 1

(iii) (a) $-(a + 1) = 2 + (-3) \Rightarrow a = 0$ — 1

$b = 2 \times (-3) \Rightarrow b = -6$ — 1

OR

(b) Let α and β be the zeroes of given polynomial

Here, $\alpha + \beta = -p$ and $\alpha\beta = 45$ — ½

$(\alpha - \beta)^2 = 144$ — ½

$\Rightarrow (\alpha + \beta)^2 - 4\alpha\beta = 144$

$\Rightarrow (-p)^2 - 4 \times 45 = 144$ — ½

$\Rightarrow p = \pm 18$ — ½

38.	February 14 is celebrated as International Book Giving Day and many countries in the world celebrate this day. Some people in India also started celebrating this day and donated the following number of books of various subjects to a public library : History = 96, Science = 240, Mathematics = 336. These books have to be arranged in minimum number of stacks such that each stack contains books of only one subject and the number of books on each stack is the same. Based on the above information, answer the following questions : (i) How many books are arranged in each stack ? (ii) How many stacks are used to arrange all the Mathematics books ? (iii) (a) Determine the total number of stacks that will be used for arranging all the books. **OR** (iii) (b) If the thickness of each book of History, Science and Mathematics is 1·8 cm, 2·2 cm and 2·5 cm respectively, then find the height of each stack of History, Science and Mathematics books.	
Sol.	(i) HCF (96, 240, 336) = 48 (ii) Number of stacks = $\frac{336}{48} = 7$ (iii) (a) Total number of stacks = $\frac{96}{48} + \frac{240}{48} + \frac{336}{48}$ $= 14$ OR (b) Height of each stack of History = $48 \times 1.8 = 86.4$ cm Height of each stack of Science = $48 \times 2.2 = 105.6$ cm Height of each stack of Mathematics = $48 \times 2.5 = 120$ cm	1 1 1 1 1 mark for 1 correct answer, 1½ mark for two correct answer and 2 marks for all correct answers.