Series C5ABD/5 **SET~1**

प्रश्न–पत्र कोड
Q.P. Code **430/5/1**

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.

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) कृपया जाँच कर लें कि इस प्रश्न-पत्र में **38** प्रश्न हैं ।
Please check that this question paper contains **38** questions.

(iii) 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.

(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.

गणित (बुनियादी)
MATHEMATICS (BASIC)

निर्धारित समय : 3 घण्टे *अधिकतम अंक : 80*

Time allowed : 3 hours *Maximum Marks : 80*

सामान्य निर्देश :

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

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

(ii) *यह प्रश्न-पत्र **पाँच** खण्डों में विभाजित है – **क, ख, ग, घ** एवं **ङ** ।*

(iii) ***खण्ड क** में प्रश्न संख्या **1** से **18** तक बहुविकल्पीय (MCQ) तथा प्रश्न संख्या **19** एवं **20** अभिकथन एवं तर्क आधारित **1** अंक के प्रश्न हैं ।*

(iv) ***खण्ड ख** में प्रश्न संख्या **21** से **25** तक अति लघु-उत्तरीय (VSA) प्रकार के **2** अंकों के प्रश्न हैं ।*

(v) ***खण्ड ग** में प्रश्न संख्या **26** से **31** तक लघु-उत्तरीय (SA) प्रकार के **3** अंकों के प्रश्न हैं ।*

(vi) ***खण्ड घ** में प्रश्न संख्या **32** से **35** तक दीर्घ-उत्तरीय (LA) प्रकार के **5** अंकों के प्रश्न हैं ।*

(vii) ***खण्ड ङ** में प्रश्न संख्या **36** से **38** तक प्रकरण अध्ययन आधारित **4** अंकों के प्रश्न हैं । प्रत्येक प्रकरण अध्ययन में आंतरिक विकल्प **2** अंकों के प्रश्न में दिया गया है ।*

(viii) *प्रश्न-पत्र में समग्र विकल्प नहीं दिया गया है । यद्यपि, खण्ड ख के 2 प्रश्नों में, खण्ड ग के 2 प्रश्नों में, खण्ड घ के 2 प्रश्नों में तथा खण्ड ङ के 3 प्रश्नों में आंतरिक विकल्प का प्रावधान दिया गया है ।*

(ix) *जहाँ आवश्यक हो स्वच्छ आकृतियाँ बनाइए । जहाँ आवश्यक हो $\pi = \frac{22}{7}$ लीजिए, यदि अन्यथा न दिया गया हो ।*

(x) *कैल्कुलेटर का उपयोग **वर्जित** है ।*

खण्ड क

इस खण्ड में बहुविकल्पीय प्रश्न हैं, जिनमें प्रत्येक प्रश्न 1 अंक का है । *20×1=20*

1. संख्याओं 40 और 30 के लिए HCF × LCM है :

(A) 12 (B) 120

(C) 1200 (D) 40

General Instructions :

Read the following instructions very carefully and strictly follow them :

(i) *This question paper contains **38** questions. **All** questions are **compulsory**.*

(ii) *This question paper is divided into **five** Sections – **A**, **B, C, D** and **E**.*

(iii) *In **Section A,** Questions no. **1** to **18** are Multiple Choice Questions (MCQs) and questions number **19** and **20** are Assertion-Reason based questions of **1** mark each.*

(iv) *In **Section B,** Questions no. **21** to **25** are Very Short Answer (VSA) type questions, carrying **2** marks each.*

(v) *In **Section C,** Questions no. **26** to **31** are Short Answer (SA) type questions, carrying **3** marks each.*

(vi) *In **Section D,** Questions no. **32** to **35** are Long Answer (LA) type questions carrying **5** marks each.*

(vii) *In **Section E,** Questions no. **36** to **38** are case study based questions carrying **4** marks each. Internal choice is provided in **2** marks questions in each case study.*

(viii) *There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 2 questions in Section C, 2 questions in Section D and 3 questions in Section E.*

(ix) *Draw neat diagrams wherever required. Take $\pi = \frac{22}{7}$ wherever required, if not stated.*

(x) *Use of calculator is **not** allowed.*

SECTION A

This section comprises multiple choice questions (MCQs) of 1 mark each. *20×1=20*

1. HCF × LCM for the numbers 40 and 30 is :

(A) 12 (B) 120

(C) 1200 (D) 40

2. द्विघात समीकरण $x^2 + 3x - 10 = 0$ के मूल हैं :

(A) 5, 2 (B) – 5, 2

(C) 5, – 2 (D) – 5, – 2

3. रैखिक समीकरण युग्म $2kx + 5y = 7$, $6x + 5y = 11$ का केवल एक अद्वितीय हल होगा, यदि

(A) $k \neq 3$ (B) $k \neq -3$

(C) $k \neq \frac{1}{3}$ (D) $k \neq -\frac{1}{3}$

4. यदि एक बारंबारता बंटन का माध्य और बहुलक क्रमश: 28 और 16 हैं, तो इस बंटन का माध्यक है :

(A) 22 (B) 23·5

(C) 24 (D) 24·5

5. एक पासा एक बार लुढ़काया गया । एक विषम अभाज्य संख्या प्राप्त होने की प्रायिकता क्या है ?

(A) $\frac{1}{6}$ (B) $\frac{1}{3}$

(C) $\frac{2}{3}$ (D) $\frac{3}{4}$

6. यदि किसी वृत्त के एक त्रिज्यखण्ड का क्षेत्रफल, वृत्त के क्षेत्रफल का $\frac{1}{8}$ है, तो त्रिज्यखण्ड का केंद्रीय कोण है :

(A) 30° (B) 45°

(C) 60° (D) 90°

7. संख्या 424 का अभाज्य गुणनखंडन है :

(A) $2 \times 53 \times 4$ (B) $2 \times 53 \times 2$

(C) $2^3 \times 53$ (D) $2^4 \times 53$

2. The roots of the quadratic equation $x^2 + 3x - 10 = 0$ are :

(A) 5, 2 (B) – 5, 2

(C) 5, – 2 (D) – 5, – 2

3. The pair of linear equations $2kx + 5y = 7$, $6x + 5y = 11$ have a unique solution, if

(A) $k \neq 3$ (B) $k \neq -3$

(C) $k \neq \frac{1}{3}$ (D) $k \neq -\frac{1}{3}$

4. If the mean and mode of a frequency distribution are 28 and 16 respectively, then its median is :

(A) 22 (B) 23·5

(C) 24 (D) 24·5

5. A die is rolled once. What is the probability of getting an odd prime number ?

(A) $\frac{1}{6}$ (B) $\frac{1}{3}$

(C) $\frac{2}{3}$ (D) $\frac{3}{4}$

6. If the area of a sector of a circle is $\frac{1}{8}$ of the area of the circle, then the central angle of the sector is :

(A) 30° (B) 45°

(C) 60° (D) 90°

7. Prime factorisation of 424 is :

(A) $2 \times 53 \times 4$ (B) $2 \times 53 \times 2$

(C) $2^3 \times 53$ (D) $2^4 \times 53$

8. यदि x एक पूर्ण संख्या है, तो x के किस मान को छोड़कर 8^x सम अंक पर समाप्त होता है ?

(A) 6 (B) 4

(C) 2 (D) 0

9. जमीन पर खड़े एक पेड़ की छाया 7 m लंबी है, जब सूर्य का उन्नतांश 45° है । पेड़ की ऊँचाई है :

(A) $7\sqrt{3}$ m (B) $\frac{7}{3}\sqrt{3}$ m

(C) 7 m (D) 3·5 m

10. $\left(\frac{5}{\cot^2\theta} - \frac{5}{\cos^2\theta}\right)$ बराबर है :

(A) 1 (B) 5

(C) – 5 (D) 0

11. यदि $\tan^2\theta = 3$, जहाँ θ एक न्यून कोण है, तो θ का मान है :

(A) 30° (B) 60°

(C) 0° (D) 45°

12. 12 cm त्रिज्या वाले एक वृत्त की एक चाप की लंबाई 10π cm है । यह चाप वृत्त के केंद्र पर जो केंद्रीय कोण अंतरित करती है, वह है :

(A) 120° (B) 6°

(C) 75° (D) 150°

13. यदि एक वृत्त की दो त्रिज्याओं के बीच का कोण 130° है, तो इन त्रिज्याओं के सिरों पर बनी स्पर्श-रेखाओं के बीच का कोण है :

(A) 50° (B) 60°

(C) 90° (D) 130°

8. If x is a whole number, then 8^x ends with an even digit, except for which value of x ?

(A) 6 (B) 4

(C) 2 (D) 0

9. A tree casts a shadow 7 m long on the ground, when the angle of elevation of the Sun is 45°. The height of the tree is :

(A) $7\sqrt{3}$ m (B) $\frac{7}{3}\sqrt{3}$ m

(C) 7 m (D) 3·5 m

10. $\left(\frac{5}{\cot^2\theta} - \frac{5}{\cos^2\theta}\right)$ is equal to :

(A) 1 (B) 5

(C) – 5 (D) 0

11. If $\tan^2\theta = 3$, where θ is an acute angle, then the value of θ is :

(A) 30° (B) 60°

(C) 0° (D) 45°

12. The length of an arc of a circle with radius 12 cm is 10π cm. The central angle subtended by this arc at the centre, is :

(A) 120° (B) 6°

(C) 75° (D) 150°

13. If the angle between the two radii of a circle is 130°, then the angle between the tangents at the ends of these radii, is :

(A) 50° (B) 60°

(C) 90° (D) 130°

14. द्विघात समीकरण $x^2 - 4x + 3 = 0$ का विविक्तकर (discriminant) है :

(A) 28 (B) – 8

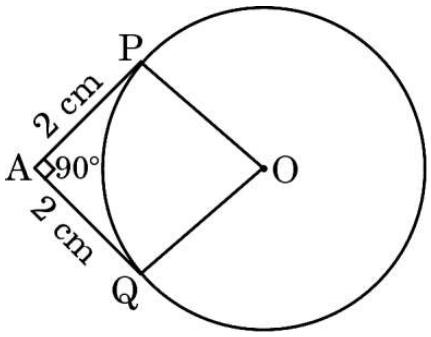
(C) 4 (D) 2

15. बिंदुओं A(– 2, 8) और B(– 6, 4) को मिलाने वाले रेखाखंड AB का मध्य-बिंदु है :

(A) (2, 6) (B) (– 4, 12)

(C) (– 4, 6) (D) (4, – 6)

16. केंद्र O वाले वृत्त पर बाह्य बिंदु A से दो स्पर्श-रेखाएँ AP और AQ परस्पर 90° के कोण पर झुकी हुई हैं । यदि प्रत्येक स्पर्श-रेखा की लंबाई 2 cm है, तो वृत्त की त्रिज्या है :



(A) 4 cm (B) 2 cm

(C) $2\sqrt{2}$ cm (D) 1 cm

17. यह दिया गया है कि $\Delta ABC \sim \Delta DEF$. यदि $\angle A = 55°$, $\angle E = 45°$ है, तो $\angle C$ है :

(A) 80° (B) 90°

(C) 55° (D) 45°

14. The discriminant of the quadratic equation $x^2 - 4x + 3 = 0$ is :

(A) 28 (B) – 8

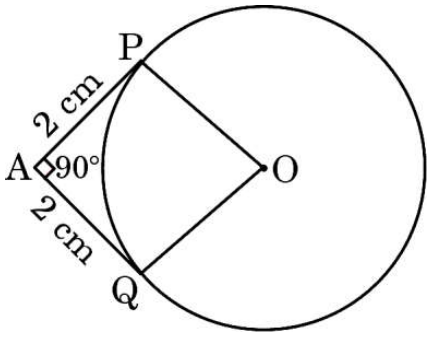
(C) 4 (D) 2

15. The mid-point of the line segment AB joining A(– 2, 8) and B(– 6, 4) is :

(A) (2, 6) (B) (– 4, 12)

(C) (– 4, 6) (D) (4, – 6)

16. AP and AQ are tangents drawn from an external point A to a circle with centre O and inclined to each other at an angle of 90°. If the length of each tangent is 2 cm, then the radius of the circle is :



(A) 4 cm (B) 2 cm

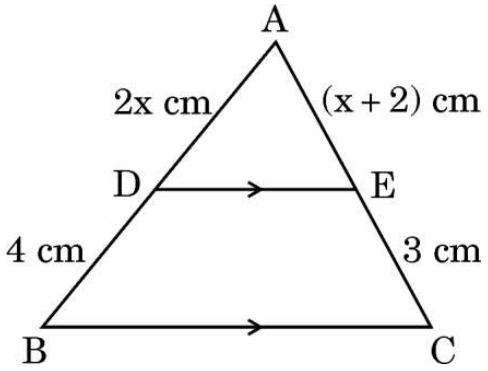
(C) $2\sqrt{2}$ cm (D) 1 cm

17. It is given that $\Delta ABC \sim \Delta DEF$. If $\angle A = 55°$, $\angle E = 45°$, then $\angle C$ is :

(A) 80° (B) 90°

(C) 55° (D) 45°

18. दी गई आकृति में, त्रिभुज ABC में, DE || BC है । यदि AD = 2x cm, AE = (x + 2) cm, DB = 4 cm, EC = 3 cm है, तो x का मान है :



(A) 3 (B) 2

(C) 6 (D) 4

*प्रश्न संख्या **19** और **20** अभिकथन एवं तर्क आधारित प्रश्न हैं । दो कथन दिए गए हैं जिनमें एक को अभिकथन (A) तथा दूसरे को तर्क (R) द्वारा अंकित किया गया है । इन प्रश्नों के सही उत्तर नीचे दिए गए 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 ।

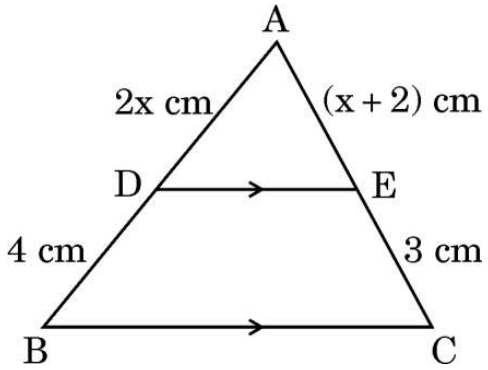
19. *अभिकथन (A) :* एक पासा फेंकने पर, संख्या 8 प्राप्त होने की प्रायिकता शून्य (0) है ।

तर्क (R) : एक असंभव घटना की प्रायिकता शून्य (0) होती है ।

20. *अभिकथन (A) :* समान्तर श्रेढ़ी 5, 1, – 3, – 7 .... का सार्व अन्तर 4 है ।

तर्क (R) : समान्तर श्रेढ़ी a_1, a_2, a_3 ...., a_n का सार्व अन्तर प्राप्त होता है $d = a_n - a_{n-1}$ से ।

18. In the given figure, in Δ ABC, DE || BC. If AD = 2x cm, AE = (x + 2) cm, DB = 4 cm, EC = 3 cm, then the value of x is :



(A) 3 (B) 2

(C) 6 (D) 4

*Questions number **19** and **20** are Assertion and Reason based questions. Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.*

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

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

(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false, but Reason (R) is true.

19. *Assertion (A) :* The probability of getting number 8 on rolling a die is zero (0).

Reason (R) : The probability of an impossible event is zero (0).

20. *Assertion (A) :* Common difference of the A.P. 5, 1, – 3, – 7 .... is 4.

Reason (R) : Common difference of the A.P. a_1, a_2, a_3 ...., a_n is obtained by $d = a_n - a_{n-1}$.

खण्ड ख

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

21. $\sin^2 30° + \cos^2 45° - \cos 0° \cdot \tan 45°$ का मान ज्ञात कीजिए ।

22. (a) वह अनुपात ज्ञात कीजिए जिसमें बिंदु (3, y), बिंदुओं (– 2, – 5) और (6, 3) को मिलाने वाले रेखाखंड को विभाजित करता है । y का मान भी ज्ञात कीजिए ।

अथवा

(b) y-अक्ष पर उस बिंदु को ज्ञात कीजिए जो बिंदुओं A(6, 5) और B(– 4, 3) से समान दूरी पर है ।

23. यदि द्विघात समीकरण $kx^2 - x - 2 = 0$ का एक मूल $\frac{2}{3}$ है, तो k का मान ज्ञात कीजिए ।

24. एक बिंदु A से, जो एक वृत्त के केंद्र से 10 cm दूरी पर है, वृत्त पर खींची गई स्पर्श-रेखा की लंबाई 6 cm है । वृत्त की त्रिज्या ज्ञात कीजिए ।

25. (a) यदि α, β द्विघात बहुपद $2x^2 + 7x + 5$ के शून्यक हैं, तो $\alpha^2 + \beta^2 + \alpha\beta$ का मान ज्ञात कीजिए ।

अथवा

(b) यदि द्विघात बहुपद $6x^2 + 37x - (p - 2)$ का एक शून्यक, दूसरे शून्यक का व्युत्क्रम है, तो p का मान ज्ञात कीजिए ।

SECTION B

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

21. Evaluate : $\sin^2 30° + \cos^2 45° - \cos 0° \cdot \tan 45°$

22. (a) Find the ratio in which the point (3, y), divides the line segment joining the points (– 2, – 5) and (6, 3). Also, find the value of y.

OR

(b) Find a point on y-axis which is equidistant from the points A(6, 5) and B(– 4, 3).

23. If $\frac{2}{3}$ is a root of the quadratic equation $kx^2 - x - 2 = 0$, then find the value of k.

24. The length of a tangent drawn to a circle from a point A, at a distance of 10 cm from the centre of the circle, is 6 cm. Find the radius of the circle.

25. (a) If α, β are zeroes of the quadratic polynomial $2x^2 + 7x + 5$, then find the value of $\alpha^2 + \beta^2 + \alpha\beta$.

OR

(b) If one zero of the quadratic polynomial $6x^2 + 37x - (p - 2)$ is reciprocal of the other, then find the value of p.

खण्ड ग

इस खण्ड में लघु-उत्तरीय (SA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक के 3 अंक हैं । *6×3=18*

26. सिद्ध कीजिए कि $6 + 3\sqrt{2}$ एक अपरिमेय संख्या है, जबकि दिया गया है कि $\sqrt{2}$ एक अपरिमेय संख्या है ।

27. द्विघात बहुपद $6x^2 - 7x - 3$ के शून्यक ज्ञात कीजिए और शून्यकों तथा बहुपद के गुणांकों के बीच के संबंध की सत्यता की जाँच कीजिए ।

28. सिद्ध कीजिए : $(\sin\theta + \text{cosec}\,\theta)^2 + (\cos\theta + \sec\theta)^2 = 7 + \tan^2\theta + \cot^2\theta$

29. (a) सिद्ध कीजिए कि किसी वृत्त के परिगत समांतर चतुर्भुज समचतुर्भुज होता है ।

अथवा

(b) सिद्ध कीजिए कि किसी बाह्य बिंदु से वृत्त पर खींची गई स्पर्श-रेखाओं की लंबाइयाँ बराबर होती हैं ।

30. (a) 20 m भुजा वाले एक समबाहु त्रिभुजाकार मैदान के एक कोने पर एक घोड़े को 14 m लंबी रस्सी से बाँध दिया गया है । मैदान के उस भाग का क्षेत्रफल ज्ञात कीजिए जिसे घोड़ा चर नहीं सकता है ।

अथवा

(b) एक घड़ी की मिनट की सुई की लंबाई 14 cm है । इस मिनट की सुई द्वारा 8:00 am और 8:05 am के बीच के समय में रचित क्षेत्रफल ज्ञात कीजिए ।

31. बिन्दुओं A(5, – 3) और B(– 4, 3) को मिलाने वाले रेखाखंड को सम-त्रिभाजित करने वाले बिन्दुओं के निर्देशांक ज्ञात कीजिए ।

SECTION C

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

26. Prove that $6 + 3\sqrt{2}$ is an irrational number, given that $\sqrt{2}$ is an irrational number.

27. Find the zeroes of the quadratic polynomial $6x^2 - 7x - 3$ and verify the relationship between the zeroes and the coefficients of the polynomial.

28. Prove that : $(\sin\theta + \text{cosec}\,\theta)^2 + (\cos\theta + \sec\theta)^2 = 7 + \tan^2\theta + \cot^2\theta$.

29. (a) Prove that the parallelogram circumscribing a circle is a rhombus.

OR

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

30. (a) A horse is tied with a 14 m long rope at one corner of an equilateral triangular field having side 20 m. Find the area of the field where the horse cannot graze.

OR

(b) The length of the minute hand of a clock is 14 cm. Find the area swept by the minute hand between 8:00 am and 8:05 am.

31. Find the coordinates of the points of trisection of the line segment joining the points A(5, – 3) and B(– 4, 3).

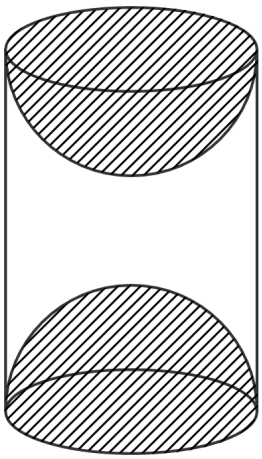
खण्ड घ

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

32. (a) एक खिलौना एक 7 cm त्रिज्या के शंकु के आकार का है जो समान त्रिज्या के एक अर्धगोले पर आरोपित है । इस खिलौने की कुल ऊँचाई 31 cm है । इस खिलौने का पृष्ठीय क्षेत्रफल ज्ञात कीजिए ।

अथवा

(b) लकड़ी के एक ठोस बेलन के प्रत्येक सिरे से एक अर्धगोला खोदकर निकालने पर लकड़ी की एक वस्तु बनाई जाती है । यदि बेलन की ऊँचाई 15 cm और उसके आधार की त्रिज्या 4·2 cm है, तो इस बनाई गई वस्तु का कुल पृष्ठीय क्षेत्रफल ज्ञात कीजिए ।



33. दो व्यक्तियों की मासिक आय का अनुपात 9 : 7 है और उनके खर्चों का अनुपात 4 : 3 है । यदि प्रत्येक व्यक्ति प्रति महीने में ₹ 2,000 बचा लेता है, तो उनकी मासिक आय ज्ञात कीजिए ।

34. (a) एक त्रिभुज ABC की भुजाएँ AB, BC तथा माध्यिका AD एक अन्य त्रिभुज PQR की क्रमश: भुजाओं PQ, QR तथा माध्यिका PM के समानुपाती हैं । दर्शाइए कि $\Delta ABC \sim \Delta PQR$ है ।

अथवा

(b) सिद्ध कीजिए कि यदि किसी त्रिभुज की एक भुजा के समांतर अन्य दो भुजाओं को भिन्न-भिन्न बिन्दुओं पर प्रतिच्छेदन करने के लिए एक रेखा खींची जाए, तो अन्य दो भुजाएँ एक ही अनुपात में विभाजित होती हैं ।

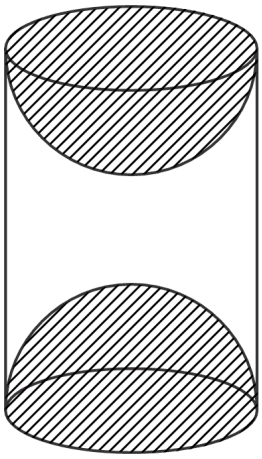
SECTION D

This section comprises Long Answer (LA) type questions of 5 marks each. *4×5=20*

32. (a) A toy is in the form of a cone of radius 7 cm mounted on a hemisphere of same radius. The total height of the toy is 31 cm. Find the surface area of the toy.

OR

(b) A wooden article was made by scooping out a hemisphere from each end of a solid cylinder. If the height of the cylinder is 15 cm and its base is of radius 4·2 cm, then find the total surface area of the article.



33. The ratio of monthly incomes of two persons is 9 : 7 and the ratio of their expenditures is 4 : 3. If each of them manages to save ₹ 2,000 per month, then find their monthly incomes.

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

OR

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

35. निम्नलिखित बारंबारता बंटन सारणी किसी मोहल्ले के 70 उपभोक्ताओं की बिजली की मासिक खपत दर्शाती है । इन आँकड़ों का माध्यक ज्ञात कीजिए ।

मासिक खपत (इकाइयों में)	उपभोक्ताओं की संख्या
65 – 85	7
85 – 105	8
105 – 125	7
125 – 145	20
145 – 165	14
165 – 185	9
185 – 205	5

खण्ड ङ

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

प्रकरण अध्ययन – 1

36. ***परिवार संरचना :*** हाल के एक सर्वे में यह पाया गया कि इस वर्ष के लिए, संयुक्त राज्य अमेरिका में 51% परिवारों में कोई बच्चा नहीं था, 20% परिवारों में एक बच्चा, 19% परिवारों में दो बच्चे, 7% परिवारों में तीन बच्चे और 3% परिवारों में चार या अधिक बच्चे थे ।



एक परिवार यादृच्छया चुना जाता है ।

35. The following frequency distribution table gives the monthly consumption of electricity of 70 consumers of a locality. Find the median of the data.

Monthly consumption (in units)	Number of consumers
65 – 85	7
85 – 105	8
105 – 125	7
125 – 145	20
145 – 165	14
165 – 185	9
185 – 205	5

SECTION E

This section comprises 3 case study based questions of 4 marks each. *3×4=12*

Case Study – 1

36. ***Family structure :*** In a recent survey of this year, 51% of the families in the United States of America had no children, 20% had one child, 19% had two children, 7% had three children and 3% had four or more children.



A family is selected at random.

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

(i) चुने गए परिवार में दो या तीन बच्चों के होने की प्रायिकता ज्ञात कीजिए । *1*

(ii) चुने गए परिवार में एक से अधिक बच्चों के होने की प्रायिकता ज्ञात कीजिए । *1*

(iii) (a) चुने गए परिवार में तीन से कम बच्चों के होने की प्रायिकता ज्ञात कीजिए । *2*

अथवा

(b) चुने गए परिवार में दो से अधिक बच्चों के होने की प्रायिकता ज्ञात कीजिए । *2*

प्रकरण अध्ययन – 2

37. सुमंत की माँ ने एक नई जूतों की दूकान शुरू की । जूतों को प्रदर्शित करने के लिए उसने पहली पंक्ति में 3 जोड़ी जूते रखे, दूसरी पंक्ति में 5 जोड़ी जूते रखे, तीसरी पंक्ति में 7 जोड़ी जूते रखे इत्यादि ।



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

(i) छठी पंक्ति में कितने जोड़ी जूते रखे हैं ? *1*

(ii) पहली और छठी पंक्तियों में रखी जूतों की जोड़ियों में कितना अंतर है ? *1*

(iii) (a) ज्ञात कीजिए पहली 15 पंक्तियों में कुल कितनी जूतों की जोड़ियाँ रखी गई हैं । *2*

अथवा

(b) यदि चौथी पंक्ति में प्रदर्शित जूतों की प्रत्येक जोड़ी ₹ 500 की कीमत पर 'बिक्री पर' लिखा है, तो ज्ञात कीजिए कि सुमंत की माँ कुल कितनी धनराशि कमा लेगी यदि यह मान लिया जाए कि चौथी पंक्ति में रखी जूते की सभी जोड़ियाँ बिक जाती हैं । *2*

Based on the above information, answer the following questions :

(i) Find the probability that the selected family has two or three children. *1*

(ii) Find the probability that the selected family has more than one child. *1*

(iii) (a) Find the probability that the selected family has less than three children. *2*

OR

(b) Find the probability that the selected family has more than two children. *2*

Case Study – 2

37. Sumant's mother started a new shoe shop. To display the shoes, she put 3 pairs of shoes in the 1^{st} row, 5 pairs in the 2^{nd} row, 7 pairs in the 3^{rd} row and so on.



Based on the above information, answer the following questions :

(i) How many pairs of shoes are displayed in the 6^{th} row ? *1*

(ii) What is the difference of pairs of shoes in the 1^{st} row and the 6^{th} row ? *1*

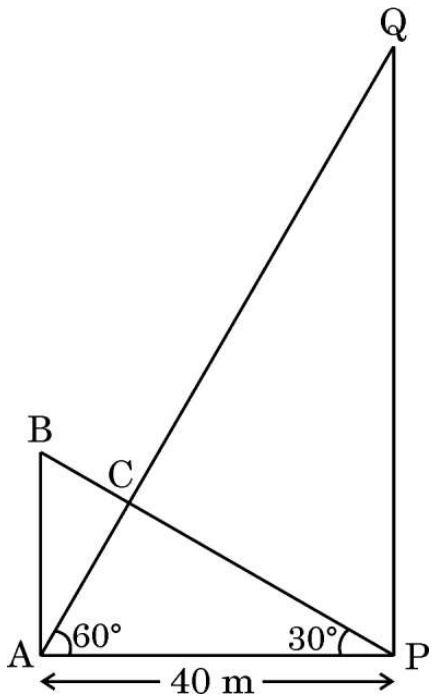
(iii) (a) Find the total number of pairs of shoes displayed in the first 15 rows. *2*

OR

(b) If the pairs of shoes displayed in the 4^{th} row are 'on sale' at price of ₹ 500 for each pair, then find the total amount (money) earned by Sumant's mother if all shoes displayed in the 4^{th} row are sold out. *2*

प्रकरण अध्ययन – 3

38. अलग-अलग ऊँचाई के दो खम्भे समतल जमीन पर और 40 m की दूरी पर खड़े हैं । दोनों खंभों को प्रत्येक खंभे के ऊपर से दूसरे खंभे के नीचे तक जुड़े तारों द्वारा सहारा दिया जाता है । एक युग्मन (coupling) को बिंदु C पर रखा गया है, जहाँ दो तार क्रॉस करते हैं (जैसा आकृति में दिखाया गया है) ।



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

(i) खंभे AB की ऊँचाई ज्ञात कीजिए । *1*

(ii) खंभे PQ की ऊँचाई ज्ञात कीजिए । *1*

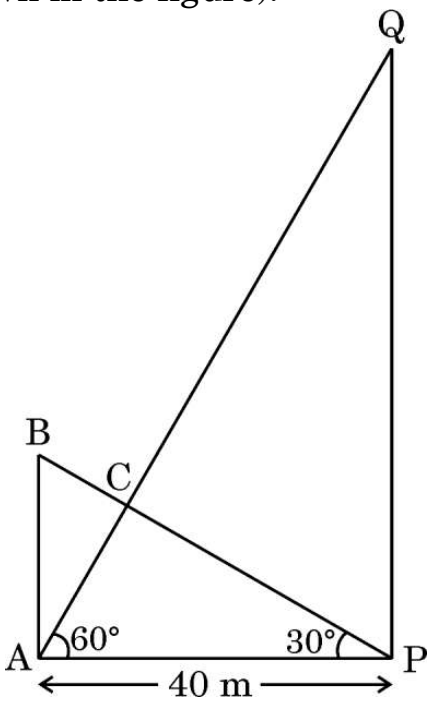
(iii) (a) यदि खंभे PQ के शिखर का, खंभे AB के शिखर से, उन्नयन कोण 30° है, तो दूरी BQ ज्ञात कीजिए । *2*

अथवा

(b) यदि युग्मन (coupling) जमीन से 20 m की ऊँचाई पर है, तो छोटे खंभे AB से तार के साथ-साथ युग्मन कितनी दूरी पर है ? *2*

Case Study – 3

38. Two poles of different heights stand on level ground and at a distance of 40 m. Both poles are supported by wires attached from the top of each pole to the bottom of the other. A coupling is placed at point C, where the two wires cross (as shown in the figure).



Based on the above information, answer the following questions :

(i) Find the height of pole AB. *1*

(ii) Find the height of pole PQ. *1*

(iii) (a) If the angle of elevation of the top of the pole PQ from the top of the pole AB is 30°, find the distance BQ. *2*

OR

(b) If the coupling is at a height of 20 m from the ground, how far down the wire from the smaller pole AB is the coupling ? *2*

Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2024
SUBJECT NAME MATHEMATICS (BASIC) (Q.P. CODE 430/5/1)

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

11	A full scale of marks (0-80) (example 0 to 80/70/60/50/40/30 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.
12	Every examiner has to necessarily do evaluation work for full working hours i.e., 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines).This is in view of the reduced syllabus and number of questions in question paper.
13	Ensure that you do not make the following common types of errors committed by the Examiner in the past:- ● Leaving answer or part thereof unassessed in an answer book. ● Giving more marks for an answer than assigned to it. ● Wrong totaling of marks awarded on an answer. ● Wrong transfer of marks from the inside pages of the answer book to the title page. ● Wrong question wise totaling on the title page. ● Wrong totaling of marks of the two columns on the title page. ● Wrong grand total. ● Marks in words and figures not tallying/not same. ● Wrong transfer of marks from the answer book to online award list. ● Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.) ● Half or a part of answer marked correct and the rest as wrong, but no marks awarded.
14	While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0)Marks.
15	Any unassessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.
16	The Examiners should acquaint themselves with the guidelines given in the "**Guidelines for spot Evaluation**" before starting the actual evaluation.
17	Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totaled and written in figures and words.
18	The candidates are entitled to obtain photocopy of the Answer Book on request on payment of the prescribed processing fee. All Examiners/Additional Head Examiners/Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme.

This section comprises Multiple Choice Questions (MCQ) of one mark each.

SECTION A 20×1=20

1. HCF × LCM for the numbers 40 and 30 is :

(A) 12 (B) 120

(C) 1200 (D) 40

Ans1. (C)1200 1

2. The roots of the quadratic equation $x^2 + 3x - 10 = 0$ are :

(A) 5, 2 (B) – 5, 2

(C) 5, – 2 (D) – 5, – 2

Ans2. (B) −5, 2 1

3. The pair of linear equations 2kx + 5y = 7, 6x + 5y = 11 have a unique solution, if

(A) $k \neq 3$ (B) $k \neq -3$

(C) $k \neq \frac{1}{3}$ (D) $k \neq -\frac{1}{3}$

Ans 3. (A) $k \neq 3$ 1

4. If the mean and mode of a frequency distribution are 28 and 16 respectively, then its median is :

(A) 22 (B) 23·5

(C) 24 (D) 24·5

Ans 4. (C) 24 1

5. A die is rolled once. What is the probability of getting an odd prime number ?

(A) $\frac{1}{6}$ (B) $\frac{1}{3}$

(C) $\frac{2}{3}$ (D) $\frac{3}{4}$

Ans5. (B) $\frac{1}{3}$ 1

6. If the area of a sector of a circle is $\frac{1}{8}$ of the area of the circle, then the central angle of the sector is :

(A) $30°$ (B) $45°$

(C) $60°$ (D) $90°$

Ans6. (B) $45°$ 1

7. Prime factorisation of 424 is :

(A) $2 \times 53 \times 4$ (B) $2 \times 53 \times 2$

(C) $2^3 \times 53$ (D) $2^4 \times 53$

Ans7. (C) $2^3 \times 53$ 1

8. If x is a whole number, then 8^x ends with an even digit, except for which value of x ?

(A) 6 (B) 4

(C) 2 (D) 0

Ans8. (D) 0 1

9. A tree casts a shadow 7 m long on the ground, when the angle of elevation of the Sun is $45°$. The height of the tree is :

(A) $7\sqrt{3}$ m (B) $\frac{7}{3}\sqrt{3}$ m

(C) 7 m (D) 3·5 m

Ans9. (C) 7m 1

10. $\left(\frac{5}{\cot^2\theta} - \frac{5}{\cos^2\theta}\right)$ is equal to :

(A) 1 (B) 5

(C) – 5 (D) 0

Ans10. (C) – 5 1

11. If $\tan^2 \theta = 3$, where θ is an acute angle, then the value of θ is :

(A) $30°$ (B) $60°$

(C) $0°$ (D) $45°$

Ans11. (B) $60°$ 1

12. The length of an arc of a circle with radius 12 cm is 10π cm. The central angle subtended by this arc at the centre, is :

(A) $120°$ (B) $6°$

(C) $75°$ (D) $150°$

Ans12. (D) $150°$ 1

13. If the angle between the two radii of a circle is $130°$, then the angle between the tangents at the ends of these radii, is :

(A) $50°$ (B) $60°$

(C) $90°$ (D) $130°$

Ans13. (A) $50°$ 1

14. The discriminant of the quadratic equation $x^2 - 4x + 3 = 0$ is :

(A) 28 (B) -8

(C) 4 (D) 2

Ans 14. (C) 4 1

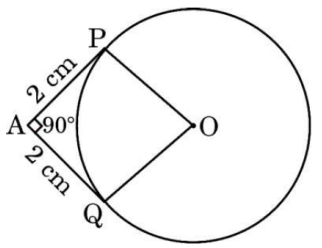
15. The mid-point of the line segment AB joining A$(-2, 8)$ and B$(-6, 4)$ is :

(A) $(2, 6)$ (B) $(-4, 12)$

(C) $(-4, 6)$ (D) $(4, -6)$

Ans15. (C) $(-4, 6)$ 1

16. AP and AQ are tangents drawn from an external point A to a circle with centre O and inclined to each other at an angle of 90°. If the length of each tangent is 2 cm, then the radius of the circle is :



(A) 4 cm (B) 2 cm

(C) $2\sqrt{2}$ cm (D) 1 cm

Ans16. (B) 2 cm 1

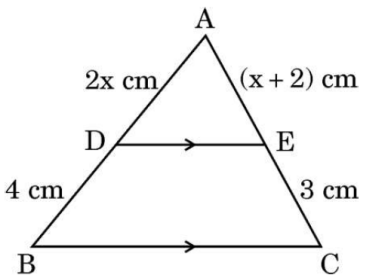
17. It is given that $\Delta ABC \sim \Delta DEF$. If $\angle A = 55°$, $\angle E = 45°$, then $\angle C$ is :

(A) 80° (B) 90°

(C) 55° (D) 45°

Ans17. (A) 80° 1

18. In the given figure, in ΔABC, $DE \parallel BC$. If AD = 2x cm, AE = (x + 2) cm, DB = 4 cm, EC = 3 cm, then the value of x is :



(A) 3 (B) 2

(C) 6 (D) 4

Ans18. (D) 4 1

*Questions number **19** and **20** are Assertion and Reason based questions. Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.*

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

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

(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false, but Reason (R) is true.

19. *Assertion (A) :* The probability of getting number 8 on rolling a die is zero (0).

Reason (R) : The probability of an impossible event is zero (0).

Ans19. (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A). 1

20. *Assertion (A) :* Common difference of the A.P. 5, 1, – 3, – 7 .... is 4.

Reason (R) : Common difference of the A.P. a_1, a_2, a_3 ...., a_n is obtained by $d = a_n - a_{n-1}$.

Ans20. (D) Assertion (A) is false, but Reason (R) is true. 1

SECTION B

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

21. Evaluate : $\sin^2 30° + \cos^2 45° - \cos 0° \cdot \tan 45°$

Sol.21. $\sin^2 30° + \cos^2 45° - \cos 0° \cdot \tan 45°$

$= \left(\frac{1}{2}\right)^2 + \left(\frac{1}{\sqrt{2}}\right)^2 - 1\times1$ $1\frac{1}{2}$

$= -\frac{1}{4}$ $\frac{1}{2}$

22. (a) Find the ratio in which the point (3, y), divides the line segment joining the points (– 2, – 5) and (6, 3). Also, find the value of y.

OR

(b) Find a point on y-axis which is equidistant from the points A(6, 5) and B(– 4, 3).

Sol.22. (a) Let P (3, y) divides the given line segment in the ratio k : 1

$\therefore\ 3 = \frac{6k+(1)(-2)}{k+1}$, $y = \frac{k(3)+1(-5)}{k+1}$ 1

$3k + 3 = 6k - 2 \Rightarrow 5 = 3k$

$k = \frac{5}{3} \Rightarrow y = 0$ $\frac{1}{2} + \frac{1}{2}$

$\therefore$ ratio is 5 : 3

OR

(b) Let the point on y-axis be P(0, y) $\frac{1}{2}$

$PA = PB \Rightarrow PA^2 = PB^2$

$(0 - 6)^2 + (y - 5)^2 = (0 + 4)^2 + (y - 3)^2$ 1

$36 + y^2 - 10y + 25 = 16 + y^2 - 6y + 9$

$y = 9$ $\frac{1}{2}$

$\therefore$ point P(0, 9)

23. If $\frac{2}{3}$ is a root of the quadratic equation $kx^2 - x - 2 = 0$, then find the value of k.

Sol.23. $\frac{2}{3}$ is a root of the quadratic equation $kx^2 - x - 2 = 0$

$\therefore\ k\left(\frac{2}{3}\right)^2 - \frac{2}{3} - 2 = 0$ $\frac{1}{2}$

$\Rightarrow \frac{4}{9}k = \frac{8}{3}$ 1

$k = 6$ $\frac{1}{2}$

24. The length of a tangent drawn to a circle from a point A, at a distance of 10 cm from the centre of the circle, is 6 cm. Find the radius of the circle.

Sol.24. Radius of circle

$= \sqrt{10^2 - 6^2}$ 1

$= 8$ cm 1

25. (a) If α, β are zeroes of the quadratic polynomial $2x^2 + 7x + 5$, then find the value of $\alpha^2 + \beta^2 + \alpha\beta$.

OR

(b) If one zero of the quadratic polynomial $6x^2 + 37x - (p - 2)$ is reciprocal of the other, then find the value of p.

Sol.25. (a) α, β are zeroes of $2x^2 + 7x + 5$

$\therefore \alpha + \beta = \frac{-7}{2}, \quad \alpha\beta = \frac{5}{2}$ 1

$\alpha^2 + \beta^2 + \alpha\beta = (\alpha + \beta)^2 - \alpha\beta$

$= \left(\frac{-7}{2}\right)^2 - \frac{5}{2} = \frac{39}{4}$ 1

OR

(b) Let $p(x) = 6x^2 + 37x - (p - 2)$, $a = 6$, $b = 37$, $c = -(p - 2)$

$\alpha, \frac{1}{\alpha}$ be zeroes of $p(x)$ $\frac{1}{2}$

$\therefore \alpha \times \frac{1}{\alpha} = \frac{c}{a} = \frac{-(p-2)}{6}$ 1

$1 = \frac{-p+2}{6}$

$p = -4$ $\frac{1}{2}$

SECTION C

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

26. Prove that $6 + 3\sqrt{2}$ is an irrational number, given that $\sqrt{2}$ is an irrational number.

Sol.26. Let us assume that $6 + 3\sqrt{2}$ is a rational number

$\therefore 6 + 3\sqrt{2} = x$ say 1

$\Rightarrow \sqrt{2} = \frac{x-6}{3}$ 1

Now $\frac{x-6}{3}$ is a rational number

$\Rightarrow \sqrt{2}$ is a rational number

But this contradicts the given fact that $\sqrt{2}$ is an irrational number 1

$\therefore$ our assumption is wrong

$\Rightarrow 6 + 3\sqrt{2}$ is an irrational number.

27. Find the zeroes of the quadratic polynomial $6x^2 - 7x - 3$ and verify the relationship between the zeroes and the coefficients of the polynomial.

Sol.27. Let $p(x) = 6x^2 - 7x - 3$

$= (2x - 3)(3x + 1)$ 1

$\therefore$ zeroes of $p(x)$ are $\frac{3}{2}, \frac{-1}{3}$ 1

Sum of zeroes $= \frac{3}{2} - \frac{1}{3} = \frac{7}{6} = \frac{-\text{Coeff. of } x}{\text{Coeff. of } x^2}$ $\frac{1}{2}$

Product of zeroes $= \left(\frac{3}{2}\right)\left(\frac{-1}{3}\right) = \frac{-1}{2} = \frac{-3}{6} = \frac{\text{constant term}}{\text{Coeff. of } x^2}$ $\frac{1}{2}$

Hence verified.

28. Prove that : $(\sin\theta + \text{cosec}\,\theta)^2 + (\cos\theta + \sec\theta)^2 = 7 + \tan^2\theta + \cot^2\theta$.

Sol.28. LHS $= \sin^2\theta + \text{cosec}^2\theta + 2\sin\theta\,\text{cosec}\,\theta + \cos^2\theta + \sec^2\theta + 2\cos\theta\sec\theta$ 1

$= (\sin^2\theta + \cos^2\theta) + \text{cosec}^2\theta + \sec^2\theta + 2\sin\theta\,\frac{1}{\sin\theta} + 2\cos\theta\,\frac{1}{\cos\theta}$ $\frac{1}{2}$

$= (1) + (1 + \cot^2\theta) + (1 + \tan^2\theta) + 2 + 2$ 1

$= 7 + \tan^2\theta + \cot^2\theta = \text{RHS}$ $\frac{1}{2}$

29. (a) Prove that the parallelogram circumscribing a circle is a rhombus.

OR

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

Sol.29. (a)Let ABCD be a parallelogram touching the circle at P, Q, R and S $\frac{1}{2}$ **for Fig.**

To prove: ABCD is a rhombus.

Proof: We know that tangents drawn from the external point to the circle are equal.

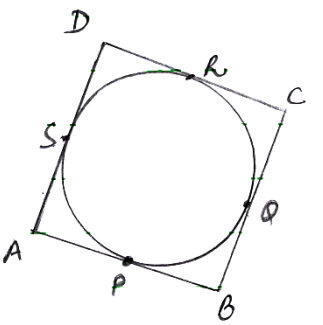
$\therefore$ AP = AS – (i)

PB = BQ – (ii)

CR = CQ – (iii)

DR = DS – (iv)

Adding (i), (ii), (iii) and (iv) 1



$AP + PB + CR + DR = AS + BQ + CQ + DS$ $\frac{1}{2}$

$\Rightarrow AB + CD = AD + BC$ (v)

Now $AB = CD$ and $AD = BC$ (Opposite sides of parallelogram)

From (v), we get $AB + AB = AD + AD$ $\frac{1}{2}$

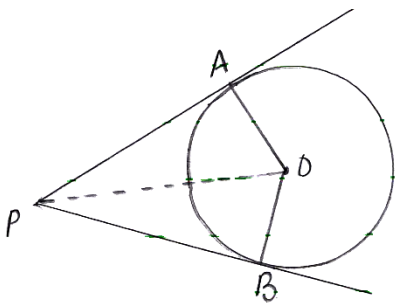
$\Rightarrow 2\,AB = 2\,AD$

$\Rightarrow AB = AD$ $\frac{1}{2}$

Hence, ABCD is a rhombus.

OR

(b) Given PA and PB are tangents drawn from the external point P to the circle with centre O.



$\frac{1}{2}$ **for Fig.**

To prove: PA = PB

Construction: Join OA, OB and OP $\frac{1}{2}$

Proof: In Δ AOP and Δ BOP

OA = OB (radii)

OP = OP (common)

$\angle$ OAP = $\angle$ OBP (each 90° as radius $\perp$ tangent) 1

$\therefore \Delta$ AOP $\cong \Delta$ BOP (RHS cong.) $\frac{1}{2}$

$\Rightarrow$ PA = PB (c.p.c.t.) $\frac{1}{2}$

30. (a) A horse is tied with a 14 m long rope at one corner of an equilateral triangular field having side 20 m. Find the area of the field where the horse cannot graze.

OR

(b) The length of the minute hand of a clock is 14 cm. Find the area swept by the minute hand between 8:00 am and 8:05 am.

Sol.30. (a) Side of equilateral triangle = 20 m

Length of rope = 14 m

$\theta = 60°$ $\frac{1}{2}$

Area grazed by horse = $\frac{\pi r^2 \theta}{360°}$

$= \frac{60°}{360°} \times \frac{22}{7} \times 14 \times 14 = \frac{308}{3}$ m^2 or 102·67 m^2 1

Area of $\Delta = \frac{\sqrt{3} \times 400}{4} = 100\sqrt{3}$ or 173 m^2 $\frac{1}{2} + \frac{1}{2}$

Required area = $(100\sqrt{3} - 102{\cdot}67)$ m^2 or $70{\cdot}33$ m^2 $\frac{1}{2}$

OR

(b) Angle swept by minute hand in 60 minutes = 360°
Angle swept by minute hand in 5 minutes = 30° 1
r = 14 cm

Area swept = $\frac{\pi r^2\theta}{360^\circ} = \frac{30^\circ}{360^\circ} \times \frac{22}{7} \times 14 \times 14$ $\frac{1}{2}+1$

$= \frac{154}{3}$ cm^2 or 51.33 cm^2 $\frac{1}{2}$

31. Find the coordinates of the points of trisection of the line segment joining the points A(5, – 3) and B(– 4, 3).

Sol. 31. Let P and Q divide the line segment joining A(5, – 3) and B(– 4, 3) in three equal parts such that AP : PB = 1 : 2

$P\left(\frac{1\times-4+2\times5}{1+2}, \frac{1\times3+2\times-3}{1+2}\right)$ $\frac{1}{2}+\frac{1}{2}$

i.e., P(2, – 1) $\frac{1}{2}$

AQ : QB = 2 : 1

$Q\left(\frac{2\times-4+1\times5}{2+1}, \frac{2\times3+1\times-3}{2+1}\right)$ $\frac{1}{2}+\frac{1}{2}$

i.e., Q(–1, 1) $\frac{1}{2}$

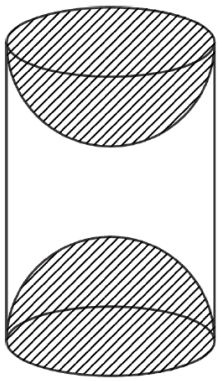
SECTION D

This section comprises Long Answer (LA) type questions of 5 marks each. *4×5=20*

32. (a) A toy is in the form of a cone of radius 7 cm mounted on a hemisphere of same radius. The total height of the toy is 31 cm. Find the surface area of the toy.

OR

(b) A wooden article was made by scooping out a hemisphere from each end of a solid cylinder. If the height of the cylinder is 15 cm and its base is of radius 4·2 cm, then find the total surface area of the article.



Sol.32. (a) Radius of cone = Radius of hemisphere 'r' = 7 cm

Total height of toy = 31 cm

$\therefore$ height of cone $= 31 - 7 = 24$ cm 1

Slant height $l = \sqrt{\mathbf{r^2 + h^2}}$

$= \sqrt{(\mathbf{7})^2 + (\mathbf{24})^2}$

$= 25$ cm 1

Total surface area of toy = CSA of hemisphere + CSA of cone $\frac{1}{2}$

$= 2\pi r^2 + \pi r l = \pi r(2r + l)$

$= \frac{22}{7} \times 7 \times (14 + 25)$ 2

$= 22 \times 39$

$= 858 \text{ cm}^2$ $\frac{1}{2}$

OR

(b) Height of cylinder = 15 cm

Radius of cylinder = Radius of hemisphere = 4·2 cm 1

Total surface area = CSA of cylinder + CSA of 2 hemispheres 1

$= 2\pi rh + 4\pi r^2$

$= 2 \times \frac{22}{7} \times 4{\cdot}2 \times (15 + 2 \times 4{\cdot}2)$ 2

$= 2 \times \frac{22}{7} \times 4.2 \times 23{\cdot}4 = 617.76 \text{ cm}^2$ 1

33. The ratio of monthly incomes of two persons is 9 : 7 and the ratio of their expenditures is 4 : 3. If each of them manages to save ₹ 2,000 per month, then find their monthly incomes.

Sol.33. Let the monthly incomes of two persons be 9x and 7x

Let the expenditures be 4y and 3y 1

ATQ. $9x - 4y = 2000$ (i) 1

$7x - 3y = 2000$ (ii) 1

solving to get

$x = 2000$ 1

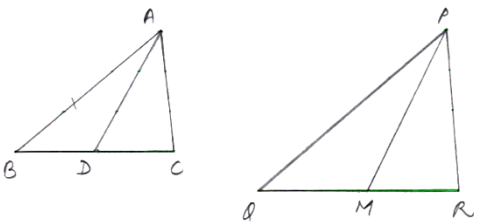
$\therefore$ monthly incomes of the persons are ₹18000 and ₹14000 respectively. 1

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

OR

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

Sol.34.



$\frac{1}{2}$ for Fig.

(a) Given: In Δ ABC and Δ PQR

$\frac{AB}{PQ} = \frac{BC}{QR} = \frac{AD}{PM}$ where AD, PM are medians. 1

To prove: Δ ABC ~ Δ PQR

Proof: In Δ ABC and Δ PQR

$\frac{AB}{PQ} = \frac{\frac{1}{2}BC}{\frac{1}{2}QR} = \frac{AD}{PM}$

$\Rightarrow \frac{AB}{PQ} = \frac{BD}{QM} = \frac{AD}{PM}$ 1

$\Rightarrow \Delta$ ABD ~ Δ PQM (SSS similarity) $\frac{1}{2}$

$\Rightarrow \angle B = \angle Q$ $\frac{1}{2}$

In Δ ABC and Δ PQR,

$\frac{AB}{PQ} = \frac{BC}{QR}$ (given)

$\angle B = \angle Q$ (Proved above) $1\frac{1}{2}$

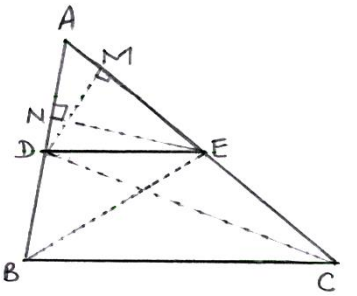
$\therefore \Delta$ ABC ~ Δ PQR (SAS similarity)

OR

(b) Given: In Δ ABC, DE || BC

To Prove: $\frac{AD}{DB} = \frac{AE}{EC}$ $\frac{1}{2}$ for Fig.

Construction: Join BE, DC
Draw DM ⊥ AC and EN ⊥ AB 1



Proof:

$\frac{ar(\Delta ADE)}{ar(\Delta BDE)} = \frac{\frac{1}{2}\times AD\times EN}{\frac{1}{2}\times DB\times EN}$

$\frac{ar(\Delta ADE)}{ar(\Delta BDE)} = \frac{AD}{DB}$ (i) 1

and $\frac{ar(\Delta ADE)}{ar(\Delta CDE)} = \frac{\frac{1}{2}\times AE\times DM}{\frac{1}{2}\times EC\times DM}$

$\frac{ar(\Delta ADE)}{ar(\Delta CDE)} = \frac{AE}{EC}$ (ii) **1**

Δ BDE and Δ CDE are on the same base DE and between the same parallels DE and BC.

∴ ar (Δ BDE) = ar (Δ CDE) (iii) 1

From (i), (ii) and (iii)

$\frac{AD}{DB} = \frac{AE}{EC}$ $\frac{1}{2}$

35. The following frequency distribution table gives the monthly consumption of electricity of 70 consumers of a locality. Find the median of the data.

Monthly consumption (in units)	Number of consumers
65 – 85	7
85 – 105	8
105 – 125	7
125 – 145	20
145 – 165	14
165 – 185	9
185 – 205	5

Sol.35.

Monthly consumption	Number of consumers	cf
65 – 85	7	7
85 – 105	8	15
105 – 125	7	22
125 – 145	20	42
145 – 165	14	56
165 – 185	9	65
185 – 205	5	70

2 for table

$\frac{N}{2} = \frac{70}{2} = 35$

$l = 125$, c.f. $= 22$, f $= 20$, h $= 20$ 1

Median $= l + \left(\frac{\frac{N}{2} - cf}{f}\right) \times$ h

$= 125 + \frac{(35-22)}{20} \times 20$ $1\frac{1}{2}$

$= 125 + 13 = 138$ $\frac{1}{2}$

Note: No marks to be deducted in case student substitutes the values correctly in the formula without writing values of *l*, cf, etc.

SECTION E

This section comprises 3 case study based questions of 4 marks each. *3×4=12*

Case Study – 1

36. ***Family structure :*** In a recent survey of this year, 51% of the families in the United States of America had no children, 20% had one child, 19% had two children, 7% had three children and 3% had four or more



A family is selected at random.

Based on the above information, answer the following questions :

(i) Find the probability that the selected family has two or three children. *1*

(ii) Find the probability that the selected family has more than one child. *1*

(iii) (a) Find the probability that the selected family has less than three children. *2*

OR

(b) Find the probability that the selected family has more than two children. *2*

Sol.36. (i) P(2 or 3 children) $= \frac{19+7}{100}$ $\frac{1}{2}$

$= \frac{26}{100}$ or $\frac{13}{50}$ $\frac{1}{2}$

(ii) P(more than one child) $= \frac{19+7+3}{100}$ $\frac{1}{2}$

$= \frac{29}{100}$ $\frac{1}{2}$

(iii)(a) P(less than 3 children) $= \frac{51+20+19}{100}$ $1\frac{1}{2}$

$= \frac{90}{100}$ or $\frac{9}{10}$ $\frac{1}{2}$

OR

(iii)(b) P(more than 2 children) $= \frac{7+3}{100}$ $1\frac{1}{2}$

$= \frac{1}{10}$ $\frac{1}{2}$

37. Sumant's mother started a new shoe shop. To display the shoes, she put 3 pairs of shoes in the 1^{st} row, 5 pairs in the 2^{nd} row, 7 pairs in the 3^{rd} row and so on.



Based on the above information, answer the following questions :

(i) How many pairs of shoes are displayed in the 6^{th} row ? *1*

(ii) What is the difference of pairs of shoes in the 1^{st} row and the 6^{th} row ? *1*

(iii) (a) Find the total number of pairs of shoes displayed in the first 15 rows. *2*

OR

(b) If the pairs of shoes displayed in the 4^{th} row are 'on sale' at price of ₹ 500 for each pair, then find the total amount (money) earned by Sumant's mother if all shoes displayed in the 4^{th} row are sold out. *2*

Sol.37. (i)

$a = 3, d = 2$ $\frac{1}{2}$

Pair of shoes in 6^{th} row $= 3 + (5)2 = 13$ $\frac{1}{2}$

(ii) Difference of pair of shoes in 6^{th} and 1^{st} row $= 13 - 3 = 10$ 1

(iii)(a) $n = 15$

Total pair of shoes in 15 rows $= \frac{n}{2}[2a + (n-1)d]$

$= \frac{15}{2}[2 \times 3 + 14 \times 2]$ 1

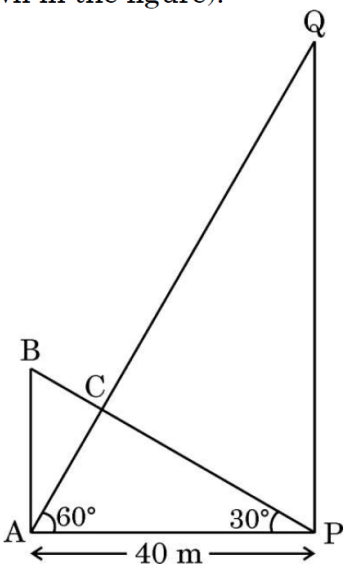
$= \frac{15}{2} \times 34 = 255$ 1

OR

(iii) (b)Pair of shoes in 4^{th} row $= 3 + (3)2 = 9$ 1

Money earned = 500 × 9 = ₹ 4500 1

38. Two poles of different heights stand on level ground and at a distance of 40 m. Both poles are supported by wires attached from the top of each pole to the bottom of the other. A coupling is placed at point C, where the two wires cross (as shown in the figure).



Based on the above information, answer the following questions :

(i) Find the height of pole AB. *1*

(ii) Find the height of pole PQ. *1*

(iii) (a) If the angle of elevation of the top of the pole PQ from the top of the pole AB is 30°, find the distance BQ. *2*

OR

(b) If the coupling is at a height of 20 m from the ground, how far down the wire from the smaller pole AB is the coupling ? *2*

Sol.38. (i) In right Δ ABP,

$\tan 30° = \frac{AB}{AP}$ $\frac{1}{2}$

$\frac{1}{\sqrt{3}} = \frac{AB}{40} \Rightarrow AB = \frac{40}{\sqrt{3}} = \frac{40\sqrt{3}}{3}$ m $\frac{1}{2}$

(ii) In right Δ APQ,

$\tan 60° = \frac{PQ}{AP}$ $\frac{1}{2}$

$\sqrt{3} = \frac{PQ}{40} \Rightarrow PQ = 40\sqrt{3}$ m $\frac{1}{2}$

(iii)(a) In Δ BQM,

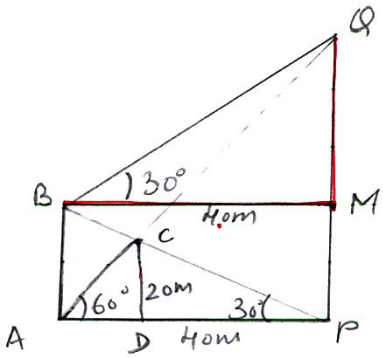
$\cos 30° = \frac{BM}{BQ}$ $\frac{1}{2}$

$\frac{\sqrt{3}}{2} = \frac{40}{BQ}$

$\frac{1}{2}$ for Fig.

$BQ = \frac{80}{\sqrt{3}} = \frac{80\sqrt{3}}{3}$ 1

OR



(iii) (b) CD = 20 m $\frac{1}{2}$ for Fig.

In right Δ ACD, $\sin 60° = \frac{CD}{AC}$ $\frac{1}{2}$

$\frac{\sqrt{3}}{2} = \frac{20}{AC} \Rightarrow AC = \frac{40}{\sqrt{3}} = \frac{40\sqrt{3}}{3}$ m 1

Note: In case students find BC correctly, full marks may be awarded.