Series #CDBA/S **SET~2**

रोल नं.
Roll No.

प्रश्न-पत्र कोड **Q.P. Code 430/S/2**

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

1. वर्ग अंतराल $30 - x$ का वर्ग चिह्न 36 होने के लिए, x का मान है :

(A) 38 (B) 40

(C) 36 (D) 42

2. 7 से 40 तक की संख्याओं वाले कार्डों को एक बक्से में रखा गया। बक्से में से यादृच्छया एक कार्ड निकाला गया। इस कार्ड पर 7 के गुणज होने की प्रायिकता है :

(A) $\frac{7}{34}$ (B) $\frac{7}{35}$

(C) $\frac{6}{35}$ (D) $\frac{5}{34}$

3. सबसे छोटी विषम अभाज्य संख्या तथा 2-अंकों की सबसे बड़ी संख्या का ल.स. (LCM) है :

(A) 1 (B) 99

(C) 297 (D) 300

General Instructions :

Read the following instructions very carefully and strictly follow them :

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

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

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

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

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

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

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

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

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

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

SECTION A

*This section has **20** Multiple Choice Questions (MCQs) carrying **1** mark each.* *20×1=20*

1. The value of x for which class mark of the class interval $30 - x$ is 36, is :

(A) 38 (B) 40

(C) 36 (D) 42

2. Cards numbered 7 to 40 were put in a box. A card is selected at random from the box. The probability that the selected card has a number, which is a multiple of 7, is :

(A) $\frac{7}{34}$ (B) $\frac{7}{35}$

(C) $\frac{6}{35}$ (D) $\frac{5}{34}$

3. The LCM of the smallest odd prime number and greatest 2-digit number, is :

(A) 1 (B) 99

(C) 297 (D) 300

4. यदि द्विघात समीकरण $x^2 - 4x + 3 = 0$ का एक मूल 1 है, तो दूसरा मूल है :

(A) 4 (B) – 4

(C) 3 (D) – 3

5. निम्नलिखित में से कौन-सी दो त्रिभुजों की समरूपता की कसौटी ***नहीं*** है ?

(A) SAS (B) SSS

(C) AAA (D) RHS

6. $3 \sin^2 \theta + 4 \cos^2 \theta$ बराबर है :

(A) 1 (B) 2

(C) $\sin^2 \theta + 3$ (D) $\cos^2 \theta + 3$

7. यदि किसी वृत्त की एक चाप की लंबाई, जो वृत्त के केंद्र पर कोण θ बनाती है, संख्यात्मक रूप में इसके द्वारा बनाए गए त्रिज्यखण्ड के क्षेत्रफल के बराबर है, तो वृत्त की त्रिज्या है :

(A) 1 इकाई (B) 2 इकाइयाँ

(C) 3 इकाइयाँ (D) $\frac{1}{2}$ इकाई

8. एक आँकड़े में 16 प्रेक्षण हैं जिन्हें उनके मूल्यों के अनुसार बढ़ते हुए क्रम में रखा गया है । आँकड़ों का माध्य, जिस प्रेक्षण का मान है, वह है :

(A) 8वाँ प्रेक्षण

(B) 7वाँ प्रेक्षण

(C) 8वें तथा 9वें प्रेक्षणों का औसत

(D) 7वें तथा 8वें प्रेक्षणों का औसत

9. यदि त्रिज्या R वाले एक गोले का आयतन, त्रिज्या r वाले अर्धगोले के आयतन का 16 गुना है, तो R : r है :

(A) 1 : 2 (B) 2 : 1

(C) 8 : 1 (D) 1 : 8

10. यदि $a = 2^7.3^{10}$ तथा $b = 2^3.3^7$ है, तो HCF (a, b) है :

(A) $2^7.3^{10}$ (B) $2^{10}.3^{17}$

(C) $2^3.3^7$ (D) $2^7.3^7$

4. If one root of the quadratic equation $x^2 - 4x + 3 = 0$ is 1, then the other root is :

(A) 4 (B) – 4

(C) 3 (D) – 3

5. Which of the following is ***not*** the criterion for similarity of two triangles ?

(A) SAS (B) SSS

(C) AAA (D) RHS

6. $3 \sin^2 \theta + 4 \cos^2 \theta$ is equal to :

(A) 1 (B) 2

(C) $\sin^2 \theta + 3$ (D) $\cos^2 \theta + 3$

7. If length of an arc of a circle subtending an angle θ at the centre is numerically equal to the area of the sector formed by it, then the radius of the circle is :

(A) 1 unit (B) 2 units

(C) 3 units (D) $\frac{1}{2}$ unit

8. There are 16 observations arranged in increasing order of their values in a data. The median will be the value of :

(A) 8^{th} observation

(B) 7^{th} observation

(C) average of 8^{th} and 9^{th} observations

(D) average of 7^{th} and 8^{th} observations

9. If the volume of a sphere of radius R is equal to 16 times the volume of a hemisphere of radius r, then R : r is :

(A) 1 : 2 (B) 2 : 1

(C) 8 : 1 (D) 1 : 8

10. If $a = 2^7.3^{10}$ and $b = 2^3.3^7$, then HCF (a, b) is :

(A) $2^7.3^{10}$ (B) $2^{10}.3^{17}$

(C) $2^3.3^7$ (D) $2^7.3^7$

11. समीकरण निकाय $2x - 3y = 5$ और $6x + 9y = 15$ का/के :

(A) एक अद्वितीय हल है

(B) कोई हल नहीं है

(C) अपरिमित रूप से अनन्त हल हैं

(D) अपरिमित रूप से अनन्त हल हैं अथवा कोई हल नहीं है

12. यदि बिंदुओं P(a, b) तथा Q(3, 3) को मिलाने वाले रेखाखण्ड का मध्य-बिंदु मूल-बिंदु है, तो $(a + b)$ का मान है :

(A) 0 (B) 3

(C) 6 (D) – 6

13. समीकरण $x^2 + x + 1 = 0$ के :

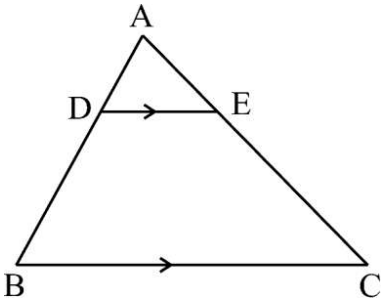
(A) वास्तविक तथा भिन्न मूल हैं

(B) कोई वास्तविक मूल नहीं हैं

(C) वास्तविक तथा समान मूल हैं

(D) दोनों ऋणात्मक मूल हैं

14. दी गई आकृति में, यदि Δ ABC में, DE $\parallel$ BC है, तो निम्नलिखित में से कौन-सी समिका सत्य है ?



(A) $\frac{AD}{AB} = \frac{AE}{CE}$ (B) $\frac{AD}{AB} = \frac{AE}{AC}$

(C) $\frac{AD}{BD} = \frac{AE}{AC}$ (D) $\frac{AD}{AB} = \frac{AC}{AE}$

15. एक रेखा जो एक वृत्त को दो भिन्न बिंदुओं पर काटती है, कहलाती है :

(A) जीवा (B) स्पर्श-रेखा

(C) छेदक रेखा (D) व्यास

11. The system of equations given by :

$2x - 3y = 5$

$6x + 9y = 15$

(A) has a unique solution
(B) has no solution
(C) has infinitely many solutions
(D) may have infinitely many solutions or no solution

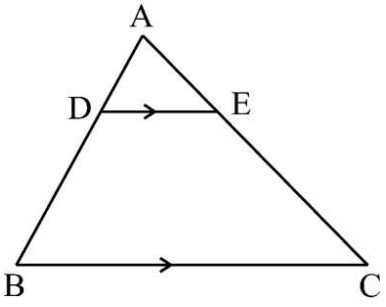
12. If origin is the mid-point of the line segment joining the points P(a, b) and Q(3, 3), then the value of $(a + b)$ is :

(A) 0 (B) 3
(C) 6 (D) – 6

13. The equation $x^2 + x + 1 = 0$ has :

(A) real and distinct roots
(B) no real roots
(C) real and equal roots
(D) both negative roots

14. In the given figure, if in Δ ABC, DE $\parallel$ BC, then which of the following equality holds ?



(A) $\frac{AD}{AB} = \frac{AE}{CE}$ (B) $\frac{AD}{AB} = \frac{AE}{AC}$

(C) $\frac{AD}{BD} = \frac{AE}{AC}$ (D) $\frac{AD}{AB} = \frac{AC}{AE}$

15. A line which intersects a circle in two distinct points, is called a :

(A) chord (B) tangent
(C) secant (D) diameter

16. यदि $\tan A = \frac{3}{4}$ है, तो $\frac{\sin^2 A + \cos^2 A}{\sec A}$ बराबर है :

(A) $\frac{4}{3}$ (B) $\frac{4}{5}$

(C) $\frac{3}{5}$ (D) $\frac{5}{4}$

17. एक कार एक 30 m ऊँची मीनार के आधार से दूर जा रही है । जब यह कार मीनार के आधार से $10\sqrt{3}$ m की दूरी पर है, तब इससे मीनार के शिखर का उन्नयन कोण है :

(A) 30° (B) 45°

(C) 90° (D) 60°

18. त्रिज्या r वाले वृत्त पर जब एक चाप वृत्त के केंद्र पर 90° का कोण अंतरित करती है, तो संगत वृत्त के त्रिज्यखण्ड का क्षेत्रफल है :

(A) $\frac{1}{6}\pi r^2$ (B) $\frac{1}{4}\pi r^2$

(C) $\frac{1}{2}\pi r^2$ (D) πr^2

*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 ।

16. If $\tan A = \frac{3}{4}$, then $\frac{\sin^2 A + \cos^2 A}{\sec A}$ is equal to :

(A) $\frac{4}{3}$ (B) $\frac{4}{5}$

(C) $\frac{3}{5}$ (D) $\frac{5}{4}$

17. A car is moving away from the base of a 30 m high tower. The angle of elevation of the top of the tower from the car at an instant, when the car is $10\sqrt{3}$ m away from the base of the tower, is :

(A) 30° (B) 45°

(C) 90° (D) 60°

18. When degree measure of an angle subtended by an arc at the centre of a circle is 90°, the area of the corresponding sector of the circle of radius r, is :

(A) $\frac{1}{6}\pi r^2$ (B) $\frac{1}{4}\pi r^2$

(C) $\frac{1}{2}\pi r^2$ (D) πr^2

*Questions number **19** and **20** are Assertion and Reason based questions. Two statements are given, one labelled as Assertion (A) and the other 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. *अभिकथन (A) :* $2 + \sqrt{2}$ एक अपरिमेय संख्या है।

तर्क (R) : एक शून्येतर परिमेय संख्या तथा एक अपरिमेय संख्या का योगफल हमेशा एक अपरिमेय संख्या होती है।

20. *अभिकथन (A) :* बिंदु (– 3, 5) की x-अक्ष से दूरी 3 इकाई है।

तर्क (R) : एक बिंदु का भुज उसकी y-अक्ष से दूरी निर्धारित करता है।

खण्ड ख

*इस खण्ड में **5** अति लघु उत्तर वाले प्रश्न हैं, जिनमें प्रत्येक के **2** अंक हैं।* *5×2=10*

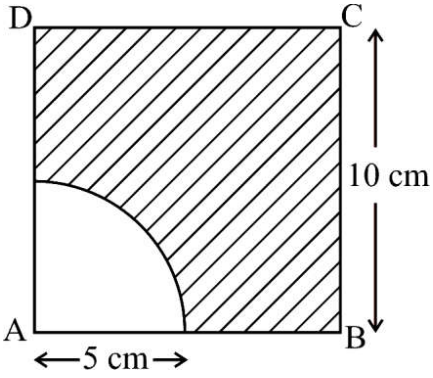
21. दो संकेंद्रीय वृत्तों में बड़े वृत्त की एक जीवा की लंबाई 8 cm है तथा छोटे वृत्त की त्रिज्या 3 cm है। यदि यह जीवा छोटे वृत्त की स्पर्श-रेखा है, तो बड़े वृत्त की त्रिज्या ज्ञात कीजिए।

22. (a) यदि $\tan A = \sqrt{3}$ है, तो $\cos^2 A - \sin^2 A$ का मान ज्ञात कीजिए।

अथवा

(b) यदि $x \sin 60° + \cos 30° - \tan 45° = \frac{\sqrt{3}}{2}$ है, तो x का मान ज्ञात कीजिए।

23. दी गई आकृति में, ABCD, 10 cm भुजा का एक वर्ग है। एक शीर्ष से 5 cm त्रिज्या का एक त्रिज्यखण्ड काटा गया है। छायांकित क्षेत्र का क्षेत्रफल ज्ञात कीजिए। ($\pi = 3.14$ लीजिए)



24. x तथा y के लिए हल कीजिए :

$23x + 24y = 23$

$24x + 23y = 24$

19. *Assertion (A) :* $2 + \sqrt{2}$ is an irrational number.

Reason (R) : The sum of a non-zero rational number and an irrational number is always an irrational number.

20. *Assertion (A) :* The distance of the point (– 3, 5) from the x-axis is 3 units.

Reason (R) : Abscissa of a point gives the distance of the point from the y-axis.

SECTION B

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

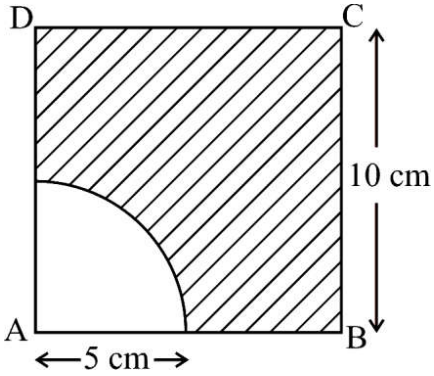
21. The length of a chord of a bigger circle concentric with a circle of radius 3 cm is 8 cm. If the chord is tangent to the smaller circle, then find the radius of the bigger circle.

22. (a) If $\tan A = \sqrt{3}$, then find the value of $\cos^2 A - \sin^2 A$.

OR

(b) If $x \sin 60° + \cos 30° - \tan 45° = \frac{\sqrt{3}}{2}$, find the value of x.

23. In the given figure, ABCD is a square of side 10 cm. A sector of radius 5 cm is cut out from one of the corners. Find the area of the shaded region. (Take $\pi = 3.14$)

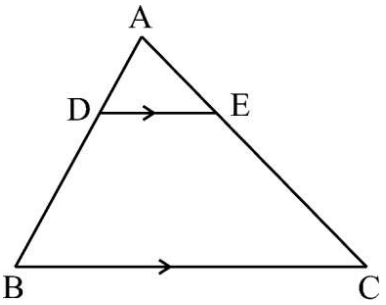


24. Solve for x and y :

$23x + 24y = 23$

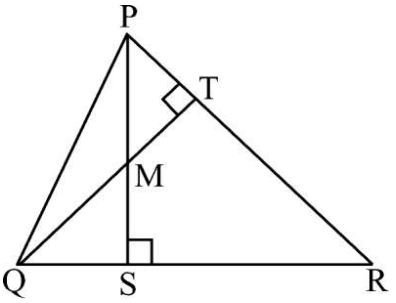
$24x + 23y = 24$

25. (a) दी गई आकृति में, ABC एक त्रिभुज है जिसमें DE ∥ BC, AD = 3 cm, BD = 4 cm तथा AC = 14 cm है। AE की लंबाई ज्ञात कीजिए।



अथवा

(b) दी गई आकृति में, PQR एक त्रिभुज है जिसमें PS तथा QT, क्रमश: बिंदुओं P तथा Q से खींचे गए शीर्षलंब हैं, जो एक-दूसरे को M पर काटते हैं । सिद्ध कीजिए कि $\Delta QSM \sim \Delta PTM$.



खण्ड ग

*इस खण्ड में **6** लघु उत्तर वाले प्रश्न हैं, जिनमें प्रत्येक के **3** अंक हैं।* *6×3=18*

26. (a) निम्नलिखित रैखिक समीकरण निकाय को आलेख द्वारा हल कीजिए :

$x + 2y = 6$ तथा $3x - 2y = 2$

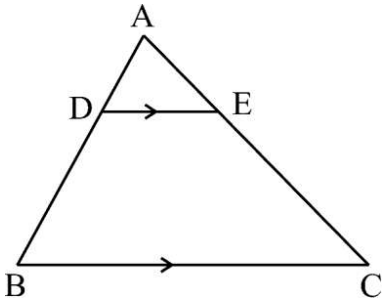
इन रेखाओं तथा y-अक्ष द्वारा बने त्रिभुज के शीर्षों के निर्देशांक भी लिखिए।

अथवा

(b) 16 वर्ष पहले, अपनी शादी के समय अजय की आयु अपनी पत्नी की आयु से 5 वर्ष अधिक थी। पत्नी तथा अजय की वर्तमान आयु में 8 : 9 का अनुपात है। उनकी शादी के समय की आयु ज्ञात कीजिए।

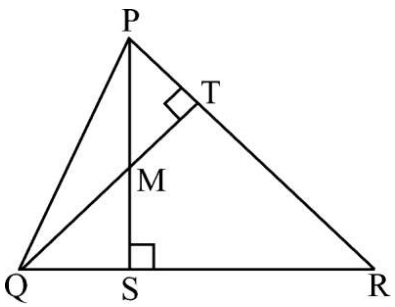
27. यदि बहुपद $x^2 - 6x + b$ का एक शून्यक दूसरे के दुगुने के समान है, तो b का मान ज्ञात कीजिए। अत: बहुपद के शून्यक भी ज्ञात कीजिए।

25. (a) In the given figure, ABC is a triangle in which DE || BC, AD = 3 cm, BD = 4 cm and AC = 14 cm. Find the length of AE.



OR

(b) In the given figure, PQR is a triangle in which PS and QT are altitudes from P and Q respectively, intersecting each other at M. Prove that $\Delta QSM \sim \Delta PTM$.



SECTION C

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

26. (a) Solve the following system of linear equations graphically :

$x + 2y = 6$ and $3x - 2y = 2$

Also, write the coordinates of the vertices of the triangle formed by these lines and y-axis.

OR

(b) 16 years ago, at the time of marriage, Ajay was 5 years elder to his wife. The present ages of the wife and Ajay are in the ratio 8 : 9. Find their ages at the time of their marriage.

27. If one zero of the polynomial $x^2 - 6x + b$ is twice the other, find the value of b. Also, find the zeroes of the polynomial so obtained.

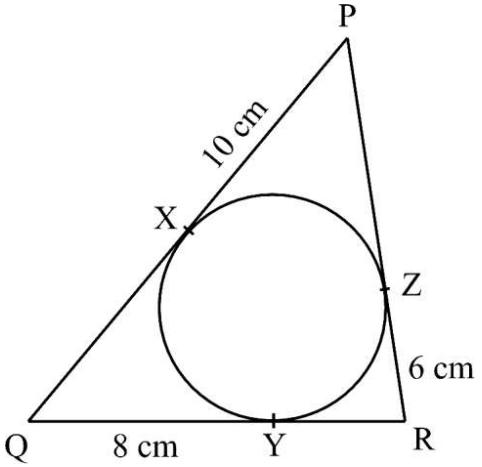
28. एक पासे की संख्याओं को प्रथम छह सम संख्याओं से बदल दिया जाता है। इस पासे को एक बार उछालने पर, पासे पर निम्नलिखित के आने की प्रायिकता ज्ञात कीजिए :

(i) 4 से बड़ी संख्या

(ii) 3 से भाज्य संख्या

(iii) 10 का गुणज न हो

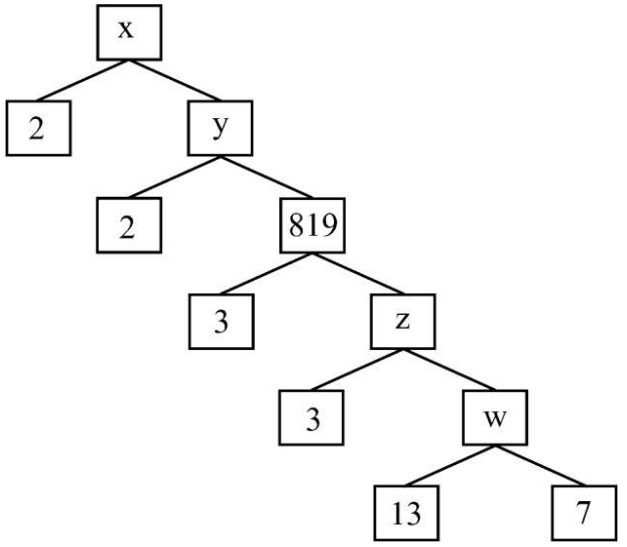
29. दी गई आकृति में, एक वृत्त के परिगत एक त्रिभुज PQR है। यदि PX = 10 cm, QY = 8 cm तथा RZ = 6 cm है, तो Δ PQR का परिमाप ज्ञात कीजिए।



30. (a) सिद्ध कीजिए कि $\sqrt{5}$ एक अपरिमेय संख्या है।

अथवा

(b) निम्नलिखित गुणनखण्ड-वृक्ष से x, y, z तथा w के मान ज्ञात कीजिए। x का अभाज्य गुणनखण्डन भी लिखिए।



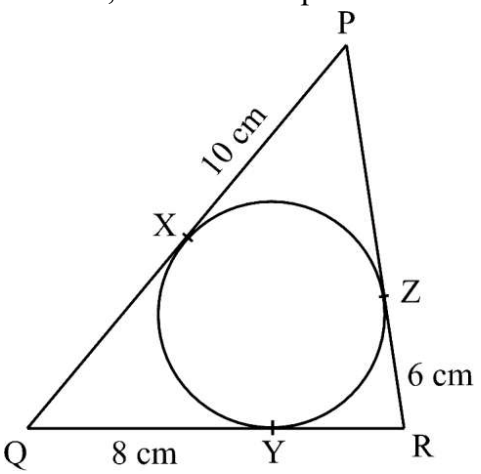
28. The numbers on a die are replaced by the first six even numbers. The die is rolled once. Find the probability that the number appearing on the die is :

(i) greater than 4

(ii) divisible by 3

(iii) not a multiple of 10

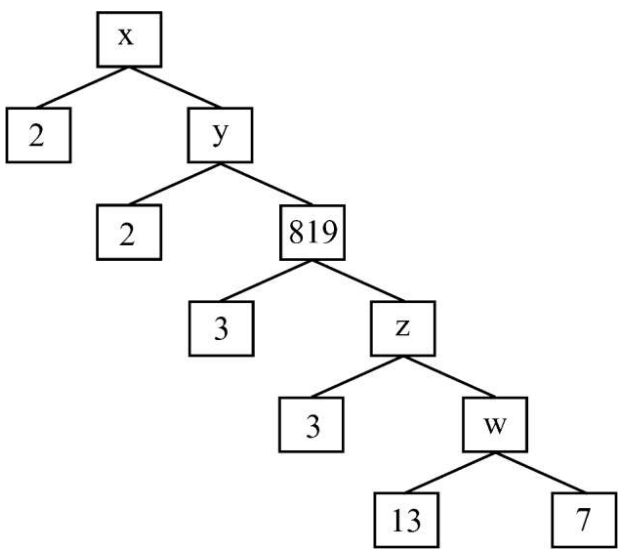
29. In the given figure, ΔPQR circumscribes the circle. If PX = 10 cm, QY = 8 cm and RZ = 6 cm, then find the perimeter of ΔPQR.



30. (a) Prove that $\sqrt{5}$ is an irrational number.

OR

(b) Find the values of x, y, z and w in the following factor tree. Also, write the prime factorisation of x.



31. यदि $x \cos \theta + y \sin \theta = a$ तथा $x \sin \theta - y \cos \theta = b$ है, तो सिद्ध कीजिए कि $a^2 + b^2 = x^2 + y^2$.

खण्ड घ

*इस खण्ड में **4** दीर्घ उत्तर प्रकार के प्रश्न हैं, जिनमें प्रत्येक के **5** अंक हैं।* *4×5=20*

32. (a) निम्नलिखित बंटन में एक इलाके के 64 बच्चों का साप्ताहिक जेब खर्च दर्शाया गया है। यदि माध्य जेब खर्च ₹ 180 है, तो x तथा y के मान ज्ञात कीजिए।

जेब खर्च (₹ में)	बच्चों की संख्या
110 – 130	7
130 – 150	6
150 – 170	9
170 – 190	13
190 – 210	x
210 – 230	5
230 – 250	y

अथवा

(b) निम्नलिखित आँकड़ों का बहुलक ज्ञात कीजिए :

वर्ग	1 – 3	3 – 5	5 – 7	7 – 9	9 – 11
बारंबारता	7	8	2	2	1

यदि उपर्युक्त आँकड़ों का माध्य 4.2 है, तो आनुभविक संबंध से माध्यक ज्ञात कीजिए।

33. (a) x के लिए हल कीजिए :

$$\frac{3}{x+1} - \frac{2}{3x-1} = \frac{1}{2} \left(x \neq -1, \frac{1}{3} \right)$$

अथवा

(b) दो धन पूर्णांकों के वर्गों का अन्तर 400 है। पूर्णांक ज्ञात कीजिए यदि यह प्रदत्त है कि छोटे पूर्णांक का दुगुना बड़े पूर्णांक से 5 अधिक है।

34. यदि किसी त्रिभुज की एक भुजा के समांतर अन्य दो भुजाओं को भिन्न-भिन्न बिंदुओं पर प्रतिच्छेद करने के लिए एक रेखा खींची जाए, तो सिद्ध कीजिए कि यह अन्य दो भुजाओं को समान अनुपात में बाँटती है।

31. If $x \cos \theta + y \sin \theta = a$ and $x \sin \theta - y \cos \theta = b$, prove that $a^2 + b^2 = x^2 + y^2$.

SECTION D

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

32. (a) The following distribution shows the weekly pocket allowance of 64 children of a locality. If the mean pocket allowance is ₹ 180, find the values of x and y.

Pocket allowance (in ₹)	Number of children
110 – 130	7
130 – 150	6
150 – 170	9
170 – 190	13
190 – 210	x
210 – 230	5
230 – 250	y

OR

(b) Find the mode of the following data :

Class	1 – 3	3 – 5	5 – 7	7 – 9	9 – 11
Frequency	7	8	2	2	1

If mean = 4.2, then find the median using empirical relationship.

33. (a) Solve for x :

$$\frac{3}{x+1} - \frac{2}{3x-1} = \frac{1}{2} \left(x \neq -1, \frac{1}{3} \right)$$

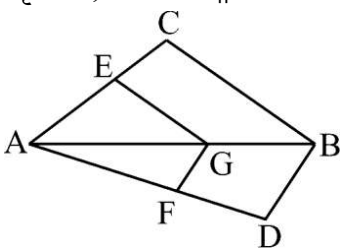
OR

(b) The difference of squares of two positive integers is 400. Find the integers if twice of the smaller integer is 5 more than the greater integer.

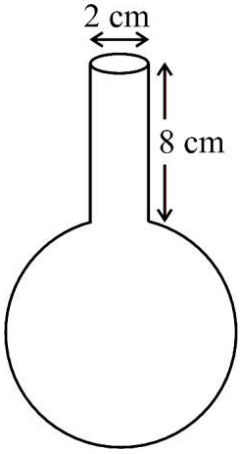
34. If a line is drawn parallel to one side of a triangle intersecting the other sides in distinct points, prove that it divides the other sides in the same ratio.

उपर्युक्त के प्रयोग से निम्न को सिद्ध कीजिए :

दी गई आकृति में, यदि EG || CB तथा FG || DB है, तो सिद्ध कीजिए कि $\frac{AE}{EC} = \frac{AF}{FD}$.



35. आकृति में दिखाई गई शीशे के गोलाकार बर्तन की एक बेलन के आकार की गर्दन की लंबाई 8 cm है तथा यह 2 cm चौड़ी है। गोलाकार भाग का व्यास 9 cm है। इस शीशे के बर्तन की धारिता mL में ज्ञात कीजिए। (लीजिए $1\ cm^3 = 1\ mL$ और $\pi = \frac{22}{7}$)

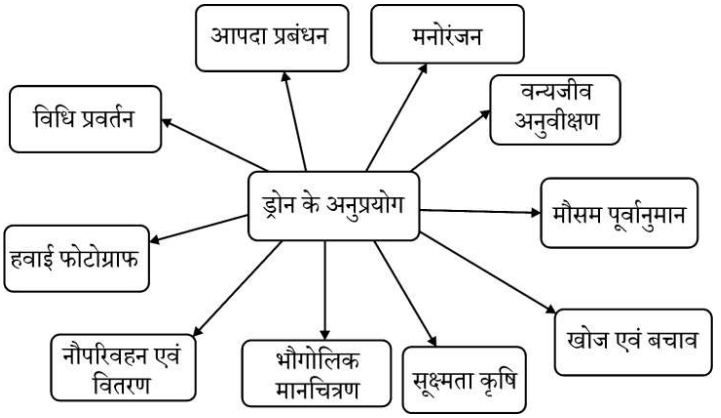


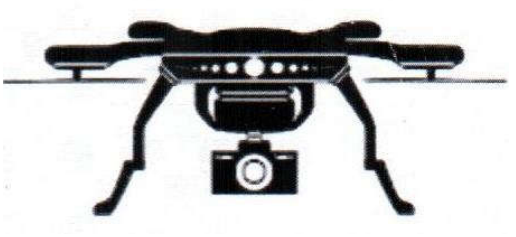
खण्ड ङ

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

प्रकरण अध्ययन – 1

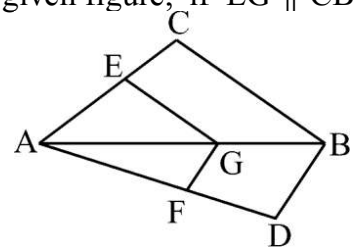
36. ड्रोन का प्रयोग सेना द्वारा निगरानी के लिए किया जाता है। आजकल ड्रोन का उपयोग व्यक्तिगत उद्यमियों, एस.एम.ई. और बड़ी कम्पनियों द्वारा विभिन्न अन्य कार्यों को पूरा करने के लिए भी किया जाता है।



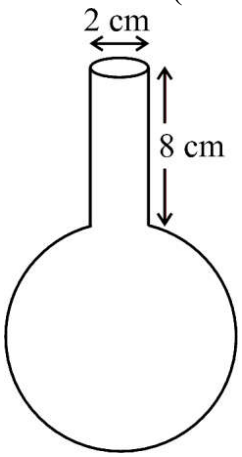


Use the above result to prove the following :

In the given figure, if EG ∥ CB and FG ∥ DB, then prove that $\frac{AE}{EC} = \frac{AF}{FD}$.



35. A spherical glass vessel (shown below) has a cylindrical neck, which is 8 cm long and 2 cm wide. The diameter of the spherical part is 9 cm. Find the capacity of the glass vessel in mL. (Take 1 cm^3 = 1 mL and $\pi = \frac{22}{7}$)

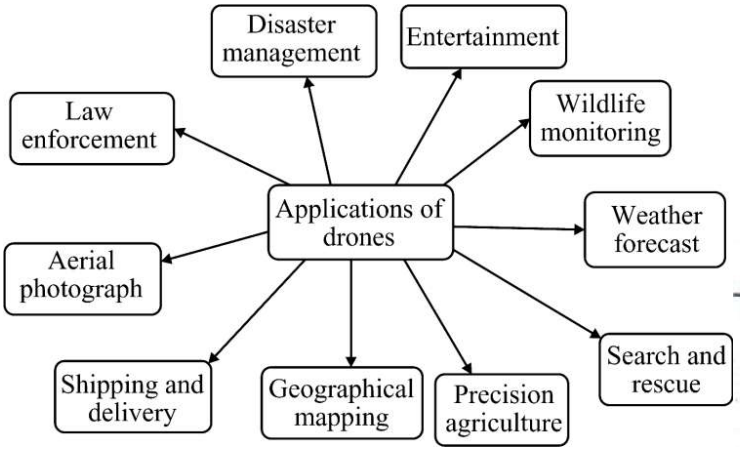


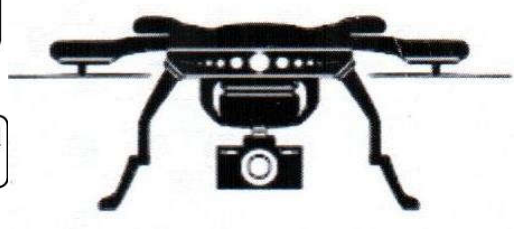
SECTION E

*This section has **3** case study based/source based/passage based/integrated units of assessment of **4** marks each with sub-parts.* *3×4=12*

Case Study – 1

36. Drones are used by military for surveillance purposes. These days, drones are also used by individual entrepreneurs, SMEs and large companies to accomplish various other tasks.





एक ड्रोन एक आयताकार क्षेत्र के ऊपर उड़ रहा है जिसके शीर्ष A(– 100, 0), B(100, 0), C(100, 150) तथा D(– 100, 150) पर हैं। ड्रोन एक स्थान (x, y) पर एक छवि बनाता है।

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

(i) आयताकार क्षेत्र की विमाएँ ज्ञात कीजिए। *1*

(ii) बिंदुओं A तथा C के बीच की दूरी ज्ञात कीजिए। *1*

(iii) (a) यदि ड्रोन किसी वस्तु P(x, y) का प्रतिबिंब आयताकार क्षेत्र में बनाता है, तो x तथा y में संबंध ज्ञात कीजिए जहाँ PA = PC है। *2*

अथवा

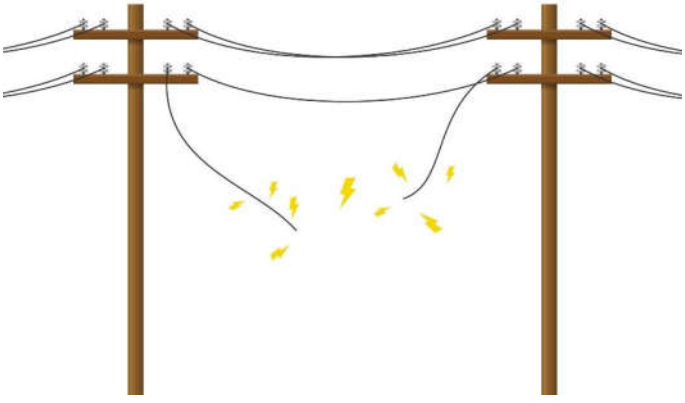
(b) यदि ड्रोन किसी वस्तु का प्रतिबिंब बिंदु Q पर प्राप्त करता है जिसका x-निर्देशांक 0 है तथा यह बिंदुओं A तथा D से समदूरस्थ है तो Q के निर्देशांक ज्ञात कीजिए। *2*

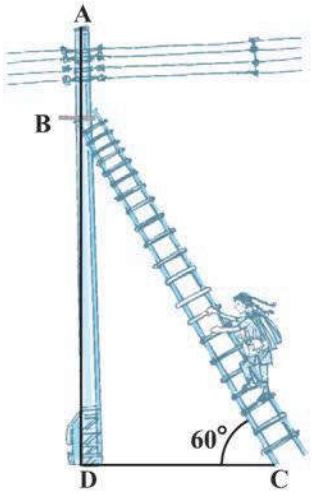
प्रकरण अध्ययन – 2

37. बिजली के खंभे पर शॉर्ट-सर्किट कई कारणों से हो सकता है, जैसे

(a) यदि इन्सूलेशन क्षतिग्रस्त अथवा पुराना है, तो वह गर्म (विद्युत ले जाने वाली) तारों को न्यूट्रल से छूने दे सकता है, जिससे शॉर्ट-सर्किट होता है।

(b) यदि कोई ढीले तार कनेक्शन अथवा संलग्न हों, तो यह जीवित और न्यूट्रल तारों को छूने देता है।





एक इलैक्ट्रीशियन को 5 m ऊँचे खंभे पर एक बिजली की खराबी ठीक करनी है जिसके लिए उसे खंभे के शिखर से 1 m नीचे तक पहुँचना है ताकि रिपेयर का काम कर सके।

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

(i) वह कितनी लंबी सीढ़ी का प्रयोग करे, जो क्षैतिज दिशा से 60° के कोण पर झुकी होने पर निश्चित स्थान पर पहुँच सके ? *2*

A drone is flying over a rectangular field with vertices at A(– 100, 0), B(100, 0), C(100, 150) and D(– 100, 150). The drone captures an image at a location (x, y).

Based on the above information, answer the following questions :

(i) Find the dimensions of the rectangular field. *1*

(ii) Find the distance between points A and C. *1*

(iii) (a) If a drone captures the image of an object P(x, y) on the rectangular field, find the relation between x and y such that PA = PC. *2*

OR

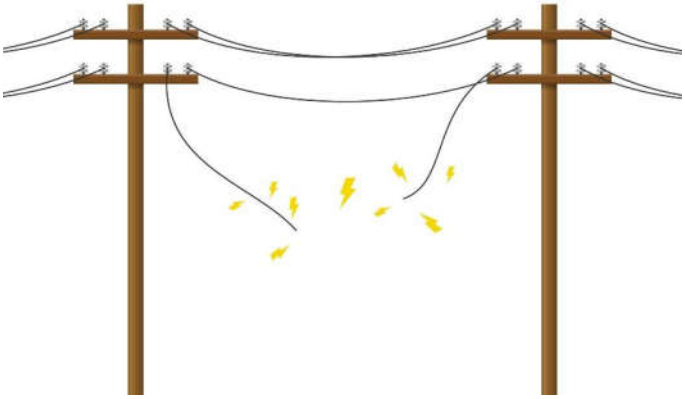
(b) If a drone captures the image of an object at a point Q whose x coordinate is 0 and it is equidistant from points A and D, find the coordinates of Q. *2*

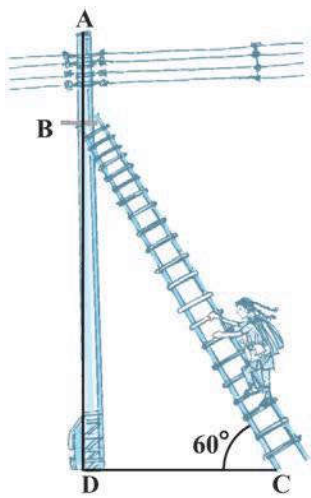
Case Study – 2

37. A short circuit can happen on electric poles due to several reasons, like

(a) If the insulation is damaged or old, it may allow the hot wires to touch with neutral. This will cause a short circuit.

(b) If there are any loose wire connections or attachments, it will allow the live and neutral wires to touch.





An electrician has to repair an electric fault on a pole of height 5 m. He needs to reach a point 1 m below the top of the pole to undertake the repair work.

Based on the above information, answer the following questions :

(i) What should be the length of the ladder that he should use which, when inclined at an angle of 60° to the horizontal, enables him to reach the required position ? *2*

(ii) (a) खंभे के पाद से, उसे कितनी दूरी पर सीढ़ी को रखना चाहिए ? *2*

अथवा

(b) यदि सीढ़ी की दूरी, खंभे के पाद से 4 m है, तो सीढ़ी की लम्बाई क्या होगी ? *2*

प्रकरण अध्ययन – 3

38. मैराथन एक लंबी दूरी की पैदल दौड़ है, जिसकी दूरी 42.195 km है। आमतौर पर इसे सड़क दौड़ के रूप में चलाया जाता है, लेकिन दूरी को ट्रेल रूट पर तय किया जा सकता है। मैराथन को दौड़ कर या दौड़ने/चलने की रणनीति के साथ पूरा किया जा सकता है। मैराथन 1896 में मूल आधुनिक ओलंपिक आयोजनों में से एक था।

कक्षा X की छात्रा नेहा, मैराथन में भाग लेना चाहती है। उसने धीरे-धीरे अपनी दौड़ की दूरी बढ़ा कर अपना अभ्यास शुरू करने का निर्णय लिया। पहले सप्ताह में, उसने प्रतिदिन 3 km दौड़ने का निर्णय लिया तथा प्रति सप्ताह इस दूरी को 2 km बढ़ाने का फैसला लिया, अर्थात् दूसरे सप्ताह के प्रतिदिन वह 5 km दौड़ेगी तथा तीसरे सप्ताह के प्रतिदिन 7 km दौड़ेगी, इसी प्रकार वह अपनी दूरी बढ़ाएगी।

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

(i) अपने अभ्यास के 8वें सप्ताह के प्रत्येक दिन नेहा कितनी दूरी दौड़ेगी ? *1*

(ii) किस सप्ताह में, वह प्रतिदिन 45 km दौड़ पाएगी ? *1*

(iii) (a) यदि नेहा ने प्रति सप्ताह में 5 दिन अभ्यास किया है, तो 11वें सप्ताह के पश्चात् नेहा ने कुल कितनी दूरी तय की ? *2*

अथवा

(b) यदि उसने प्रत्येक सप्ताह में दूरी 2 km के स्थान पर 3 km बढ़ाई होती, तो कितने सप्ताहों में उसने अपने-आप को 42 km प्रतिदिन दौड़ने के लिए तैयार कर लिया होता ? *2*

(ii) (a) How far from the foot of the pole should he place the foot of the ladder ? *2*

OR

(b) What is the length of the ladder if its foot is kept at a distance of 4 m from the foot of the pole ? *2*

Case Study – 3

38. The marathon is a long-distance foot race with a distance of 42.195 km, usually run as a road race, but the distance can be covered on trail routes. The marathon can be completed by running or with a run/walk strategy. The marathon was one of the original modern Olympic events in 1896.

Neha, a student of class X, wishes to participate in a marathon. She decided to begin her practice by gradually increasing her running distance. In the first week, she decided to run 3 km each day and increase the distance by 2 km each week, i.e., in the second week she would run 5 km each day, in the third week she would run 7 km each day and so on.

Based on the above information, answer the following questions :

(i) What distance will Neha cover each day of the 8^{th} week of her practice ? *1*

(ii) In which week would she be able to run for 45 km each day ? *1*

(iii) (a) What is the total distance covered by Neha after 11 weeks, if she practised for 5 days in each week ? *2*

OR

(b) Had she increased the distance by 3 km each week instead of 2 km each week, in how many weeks would she have trained herself to run for 42 km per day ? *2*

Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2024
SUBJECT NAME MATHEMATICS (BASIC) (Q.P. CODE 430/S/2)

General Instructions: -

1	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully.
2	**"Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, evaluation done and several other aspects. It's leakage to public in any manner could lead to derailment of the examination system and affect the life and future of millions of candidates. Sharing this policy/document to anyone, publishing in any magazine and printing in News Paper/Website etc. may invite action under various rules of the Board and 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.

MARKING SCHEME MATHEMATICS (BASIC) 430/S/2

SECTION A

*This section has **20** Multiple Choice Questions (MCQs) carrying **1** mark each.* $20\times1=20$

1. The value of x for which class mark of the class interval $30 - x$ is 36, is :

(A) 38 (B) 40

(C) 36 (D) 42

Answer (D) 42 — 1

2. Cards numbered 7 to 40 were put in a box. A card is selected at random from the box. The probability that the selected card has a number, which is a multiple of 7, is :

(A) $\frac{7}{34}$ (B) $\frac{7}{35}$

(C) $\frac{6}{35}$ (D) $\frac{5}{34}$

Answer (D) $\frac{5}{34}$ — 1

3. The LCM of the smallest odd prime number and greatest 2-digit number, is :

(A) 1 (B) 99

(C) 297 (D) 300

Answer (B) 99 — 1

4. If one root of the quadratic equation $x^2 - 4x + 3 = 0$ is 1, then the other root is :

(A) 4 (B) -4

(C) 3 (D) -3

Answer (C) 3 — 1

5. Which of the following is ***not*** the criterion for similarity of two triangles ?

(A) SAS (B) SSS

(C) AAA (D) RHS

Answer (D) RHS — 1

6. $3\sin^2\theta + 4\cos^2\theta$ is equal to :

(A) 1 (B) 2

(C) $\sin^2\theta + 3$ (D) $\cos^2\theta + 3$

Answer (D) $\cos^2\theta + 3$ — 1

7. If length of an arc of a circle subtending an angle θ at the centre is numerically equal to the area of the sector formed by it, then the radius of the circle is : (A) 1 unit (B) 2 units (C) 3 units (D) $\frac{1}{2}$ unit	
Answer (B) 2 units	1
8. There are 16 observations arranged in increasing order of their values in a data. The median will be the value of : (A) 8^{th} observation (B) 7^{th} observation (C) average of 8^{th} and 9^{th} observations (D) average of 7^{th} and 8^{th} observations	
Answer (C) average of 8^{th} and 9^{th} observations	1
9. If the volume of a sphere of radius R is equal to 16 times the volume of a hemisphere of radius r, then R : r is : (A) 1 : 2 (B) 2 : 1 (C) 8 : 1 (D) 1 : 8	
Answer (B) 2:1	1
10. If $a = 2^7.3^{10}$ and $b = 2^3.3^7$, then HCF (a, b) is : (A) $2^7.3^{10}$ (B) $2^{10}.3^{17}$ (C) $2^3.3^7$ (D) $2^7.3^7$	
Answer (C) $2^3.3^7$	1
11. The system of equations given by : $2x - 3y = 5$ $6x + 9y = 15$ (A) has a unique solution (B) has no solution (C) has infinitely many solutions (D) may have infinitely many solutions or no solution	
Answer (A) has a unique solution	1
12. If origin is the mid-point of the line segment joining the points P(a, b) and Q(3, 3), then the value of (a + b) is : (A) 0 (B) 3 (C) 6 (D) – 6	
Answer (D) -6	1

13. The equation $x^2 + x + 1 = 0$ has :

(A) real and distinct roots

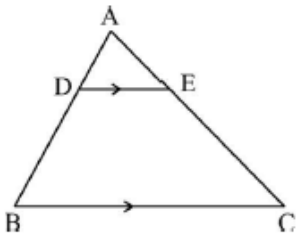
(B) no real roots

(C) real and equal roots

(D) both negative roots

Answer (B) no real roots	1

14. In the given figure, if in Δ ABC, DE ∥ BC, then which of the following equality holds ?



(A) $\frac{AD}{AB} = \frac{AE}{CE}$ (B) $\frac{AD}{AB} = \frac{AE}{AC}$

(C) $\frac{AD}{BD} = \frac{AE}{AC}$ (D) $\frac{AD}{AB} = \frac{AC}{AE}$

Answer (B) $\frac{AD}{AB} = \frac{AE}{AC}$	1

15. A line which intersects a circle in two distinct points, is called a :

(A) chord (B) tangent

(C) secant (D) diameter

Answer (C) secant	1

16. If $\tan A = \frac{3}{4}$, then $\frac{\sin^2 A + \cos^2 A}{\sec A}$ is equal to :

(A) $\frac{4}{3}$ (B) $\frac{4}{5}$

(C) $\frac{3}{5}$ (D) $\frac{5}{4}$

Answer (B) $\frac{4}{5}$	1

17. A car is moving away from the base of a 30 m high tower. The angle of elevation of the top of the tower from the car at an instant, when the car is $10\sqrt{3}$ m away from the base of the tower, is :

(A) 30° (B) 45°

(C) 90° (D) 60°

Answer (D) 60°	1

18. When degree measure of an angle subtended by an arc at the centre of a circle is 90°, the area of the corresponding sector of the circle of radius r, is :

(A) $\frac{1}{6}\pi r^2$ (B) $\frac{1}{4}\pi r^2$

(C) $\frac{1}{2}\pi r^2$ (D) πr^2

Answer (B) $\frac{1}{4}\pi r^2$ — 1

*Questions number **19** and **20** are Assertion and Reason based questions. Two statements are given, one labelled as Assertion (A) and the other 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) :* $2+\sqrt{2}$ is an irrational number.

Reason (R) : The sum of a non-zero rational number and an irrational number is always an irrational number.

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

20. *Assertion (A) :* The distance of the point (– 3, 5) from the x-axis is 3 units.

Reason (R) : Abscissa of a point gives the distance of the point from the y-axis.

Answer (D): Assertion (A) is false, but Reason (R) is true. — 1

SECTION B

*This section has **5** Very Short Answer (VSA) type questions of **2** marks each.* $5\times2=10$

21. The length of a chord of a bigger circle concentric with a circle of radius 3 cm is 8 cm. If the chord is tangent to the smaller circle, then find the radius of the bigger circle.

Solution: Clearly AC= BC = 4cm (Perpendicular from centre of a circle to the chord bisects the chord) $OB^2 = OC^2 + BC^2$ (By Pythagoras theorem in Δ OBC) $= 3^3 + 4^2 = 25$ OB = 5 $\therefore$ radius of the bigger circle is 5 cm	½ 1 ½

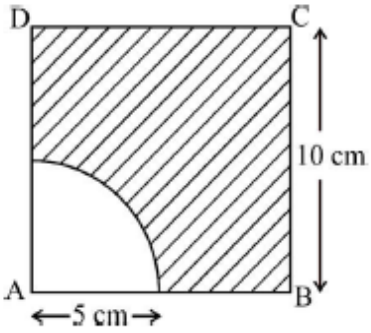
22. (a) If $\tan A = \sqrt{3}$, then find the value of $\cos^2 A - \sin^2 A$.

OR

(b) If $x \sin 60° + \cos 30° - \tan 45° = \frac{\sqrt{3}}{2}$, find the value of x.

Solution:(a) $\tan A = \sqrt{3} \Rightarrow A = 60^0$ $\cos^2 A - \sin^2 A = \cos^2 60^0 - \sin^2 60^0$ $= \left(\frac{1}{2}\right)^2 - \left(\frac{\sqrt{3}}{2}\right)^2$ $= -\frac{1}{2}$ **OR** (b) $x \sin 60° + \cos 30° - \tan 45° = \frac{\sqrt{3}}{2}$ $x\frac{\sqrt{3}}{2} + \frac{\sqrt{3}}{2} - 1 = \frac{\sqrt{3}}{2}$ $\Rightarrow x = \frac{2}{\sqrt{3}} or \frac{2\sqrt{3}}{3}$	½ ½+½ ½ 1½ ½

23. In the given figure, ABCD is a square of side 10 cm. A sector of radius 5 cm is cut out from one of the corners. Find the area of the shaded region. (Take $\pi = 3.14$)



Solution: Area of the shaded region = area of square – area of sector $= (10)^2 - \frac{90}{360}\pi(5)^2$ $= 100 - \frac{3.14\times 25}{4}$ $= 80.38\ sq.cm$	½ 1 ½

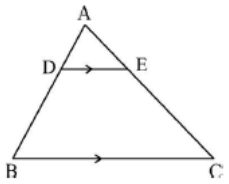
24. Solve for x and y :

$23x + 24y = 23$

$24x + 23y = 24$

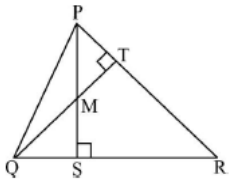
Solution: Solving both the equations to get x = 1 and y = 0	 1+1

25. (a) In the given figure, ABC is a triangle in which DE ∥ BC, AD = 3 cm, BD = 4 cm and AC = 14 cm. Find the length of AE.



OR

(b) In the given figure, PQR is a triangle in which PS and QT are altitudes from P and Q respectively, intersecting each other at M. Prove that $\Delta QSM \sim \Delta PTM$.



Solution:(a) Let AE = *x* cm As DE ∥ BC , $\frac{AD}{DB} = \frac{AE}{EC}$	 1
$\frac{3}{4} = \frac{x}{14-x}$	½
$\Rightarrow$ *x* = 6 cm $\Rightarrow$ AE =6 cm	½
OR	
(b) In Δ QSM and Δ PTM $\angle$ QSM = $\angle$ PTM (each 90^0) $\angle$ QMS = $\angle$ PMT (vertically opposite angles) $\therefore \Delta$ QSM ~ Δ PTM (AA criteria)	 ½ ½ 1

SECTION C

*This section has **6** Short Answer (SA) type questions of **3** marks each.* $6\times3=18$

26. (a) Solve the following system of linear equations graphically :

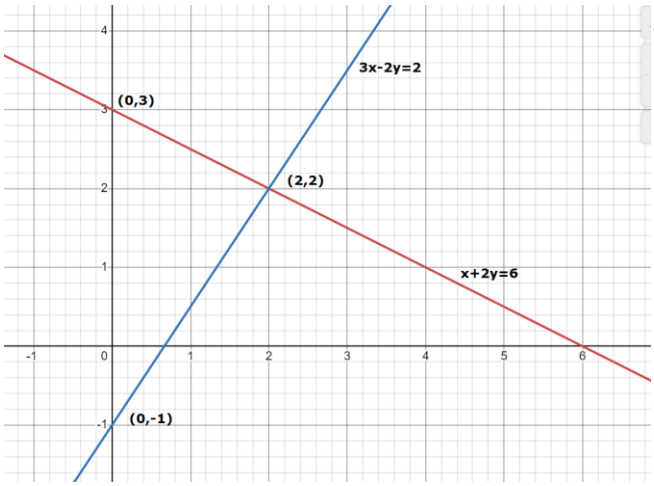
$x + 2y = 6$ and $3x - 2y = 2$

Also, write the coordinates of the vertices of the triangle formed by these lines and y-axis.

OR

(b) 16 years ago, at the time of marriage, Ajay was 5 years elder to his wife. The present ages of the wife and Ajay are in the ratio 8 : 9. Find their ages at the time of their marriage.

Solution:(a)



Drawing the graph of x+2y=6 — 1

Drawing the graph of 3x – 2y = 2 — 1

Solution x=2 and y = 2 — ½

Vertices of the required Δ are (0,3),(0,-1) and (2,2) — ½

OR

(b) Let Ajay's age at the time of marriage be x years

Let wife's age at the time of the marriage be y years

A.T.Q.

$x = y + 5$ ---------- (1) — 1

$\frac{y+16}{x+16} = \frac{8}{9} \Rightarrow 8x - 9y = 16$ ----------(2) — 1

Solving (1) and (2) to get x = 29 and y = 24 ∴ Ajay's age at the time of marriage = 29 years and his wife's age =24 years	½+½

27. If one zero of the polynomial $x^2 - 6x + b$ is twice the other, find the value of b. Also, find the zeroes of the polynomial so obtained.

Solution: Let zeroes be α and 2α	½
Sum of zeroes = $3\alpha = 6 \Rightarrow \alpha = 2$	1
Product of zeroes = $b = 2\alpha^2 = 8$	1
∴ Zeroes are 2 and 4	½

28. The numbers on a die are replaced by the first six even numbers. The die is rolled once. Find the probability that the number appearing on the die is :

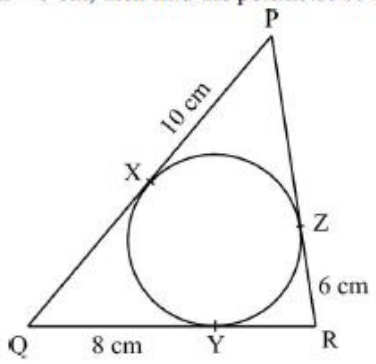
(i) greater than 4

(ii) divisible by 3

(iii) not a multiple of 10

Solution:(i) P (number greater than 4) $= \frac{4}{6}$ *or* $\frac{2}{3}$	1
(ii) P(number divisible by 3) = $\frac{2}{6}$ *or* $\frac{1}{3}$	1
(iii) P(number not a multiple of 10) = $\frac{5}{6}$	1

29. In the given figure, ΔPQR circumscribes the circle. If PX = 10 cm, QY = 8 cm and RZ = 6 cm, then find the perimeter of ΔPQR.

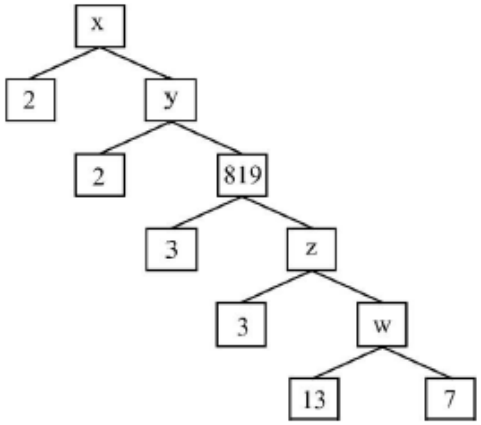


Solution: RZ = RY $\Rightarrow$ RY =6 cm QX = QY $\Rightarrow$ QX = 8 cm PZ = PX $\Rightarrow$ PZ = 10 cm } the lengths of tangents drawn from an external point to a circle are equal PQ = PX + QX = 18 cm QR = QY + YR = 14 cm PR = PZ +ZR = 16 cm Perimeter of Δ PQR = PQ +QR +PR = 48 cm	1 1½ ½

30. (a) Prove that $\sqrt{5}$ is an irrational number.

OR

(b) Find the values of x, y, z and w in the following factor tree. Also, write the prime factorisation of x.



Solution:(a) Let us assume that √5 is a rational number. So it can be expressed in the form p/q where p, q are co-prime integers and q≠0 √5 = p/q On squaring both the sides we get, $\Rightarrow 5 = (p/q)^2$ $\Rightarrow 5q^2 = p^2$.....(1) So p^2 is divisible by 5 $\Rightarrow$ p is divisible by 5 $\Rightarrow$ p = 5m , for some integer m $\Rightarrow p^2 = 25m^2$ .....(2) From equations (1) and (2), we get, $5q^2 = 25m^2$	1 ½

$\Rightarrow q^2 = 5m^2$ $\Rightarrow q^2$ is divisible by 5 $\Rightarrow$ q is divisible by 5 Hence, p, q have a common factor 5. This contradicts our assumption that they are co-primes. So, $\sqrt{5}$ is an irrational number.	1 ½
OR	
(b) $w = 13 \times 7 = 91$ $z = 91 \times 3 = 273$ $y = 2 \times 819 = 1638$ $x = 1638 \times 2 = 3276$ $3276 = 2 \times 2 \times 3 \times 3 \times 7 \times 13$	½ ½ ½ ½ 1

31. If $x \cos\theta + y \sin\theta = a$ and $x \sin\theta - y \cos\theta = b$, prove that $a^2 + b^2 = x^2 + y^2$.

Solution: $x^2 \cos^2\theta + y^2 \sin^2\theta + 2xy \sin\theta.\cos\theta = a^2$	1
$x^2 \sin^2\theta + y^2 \cos^2\theta - 2xy \sin\theta.\cos\theta = b^2$	1
adding, we get, $x^2(\cos^2\theta + \sin^2\theta) + y^2(\cos^2\theta + \sin^2\theta) = a^2 + b^2$	½
$\Rightarrow x^2 + y^2 = a^2 + b^2$	½

SECTION D

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

32. (a) The following distribution shows the weekly pocket allowance of 64 children of a locality. If the mean pocket allowance is ₹ 180, find the values of x and y.

Pocket allowance (in ₹)	Number of children
110 – 130	7
130 – 150	6
150 – 170	9
170 – 190	13
190 – 210	x
210 – 230	5
230 – 250	y

OR

(b) Find the mode of the following data :

Class	1 – 3	3 – 5	5 – 7	7 – 9	9 – 11
Frequency	7	8	2	2	1

If mean = 4.2, then find the median using empirical relationship.

Solution:(a)

Pocket allowance (in ₹)	Number of children (f_i)	x_i	$f_i x_i$
110 - 130	7	120	840
130 - 150	6	140	840
150 - 170	9	160	1440
170 - 190	13	180	2340
190 - 210	x	200	200 x
210 - 230	5	220	1100
230 - 250	y	240	240 y
	40+x+y		6560 +200x +240y

2 marks for correct table

A.T.Q.

$40 + x + y = 64 \Rightarrow x + y = 24$ ----------(1)

1

$$Mean = \frac{\sum f_i x_i}{\sum f_i}$$

$$180 = \frac{6560+200x+240y}{64}$$

$\Rightarrow$ $5x + 6y = 124$ ----------(2)

1

Solving (1) and (2) to get

$x = 20$ and $y = 4$

½ + ½

(b) **OR**

Class	Frequency
1 – 3	7
3 -5	8
5 -7	2
7 -9	2
9 -11	1

Modal class : 3-5

$$\text{Mode} = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h$$

$$Mode = 3 + \frac{8-7}{2\times 8 - 7 - 2} \times 2 \qquad 2$$

$$= 3 + \frac{2}{7} = 3.29(approx.) \qquad 1$$

$3\ Median = Mode + 2\ Mean$

$$Median = \frac{3.29 + 2\times 4.2}{3} \qquad 1\frac{1}{2}$$

$$= 3.89(approx.) \qquad \frac{1}{2}$$

33. (a) Solve for x :

$$\frac{3}{x+1} - \frac{2}{3x-1} = \frac{1}{2} \left(x \neq -1, \frac{1}{3} \right)$$

OR

(b) The difference of squares of two positive integers is 400. Find the integers if twice of the smaller integer is 5 more than the greater integer.

Solution: (a)

$$\frac{3(3x-1) - 2(x+1)}{(x+1)(3x-1)} = \frac{1}{2} \qquad 1\frac{1}{2}$$

$$\Rightarrow \quad 14x - 10 = 3x^2 + 2x - 1 \qquad 1\frac{1}{2}$$

$$\Rightarrow \quad x^2 - 4x + 3 = 0$$

$$\Rightarrow \quad (x-1)(x-3) = 0 \qquad 1$$

$\Rightarrow$ x= 1, x = 3 $\qquad \frac{1}{2} + \frac{1}{2}$

OR

(b) Let the smaller positive integer be x

then the greater positive integer = 2x -5 $\qquad$ 1

A. T. Q. $(2x- 5)^2 - x^2 = 400$ $\qquad$ 1

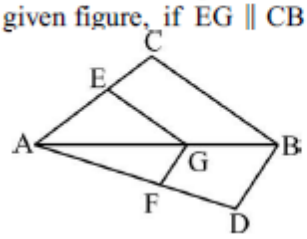
$$\Rightarrow \quad 3x^2 - 20x - 375 = 0$$

$$\Rightarrow \quad (x-15)(3x+25) = 0 \qquad 1\frac{1}{2}$$

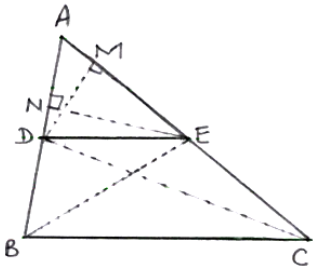
$\Rightarrow$ x= 15, x= $-\frac{25}{3}$ (Rejected) $\therefore$ numbers are 15 and 25	1 ½

34. If a line is drawn parallel to one side of a triangle intersecting the other sides in distinct points, prove that it divides the other sides in the same ratio.

Use the above result to prove the following :
In the given figure, if EG ∥ CB and FG ∥ DB, then prove that $\frac{AE}{EC} = \frac{AF}{FD}$.



Solution (a)Given: In Δ ABC, DE || BC
To Prove: $\frac{AD}{DB} = \frac{AE}{EC}$



½

Construction: Join BE, DC and draw DM ⊥ AC and EN ⊥ AB
Proof:

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

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

1½

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

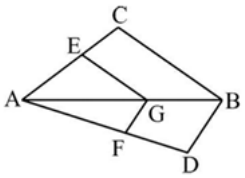
$\therefore$ ar (Δ BDE) = ar (Δ CDE) (iii)

½

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

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

½



In Δ ABC, EG || CB

$\therefore \frac{AE}{EC} = \frac{AG}{GB}$ _____ (iv)

In Δ ADB, FG || DB

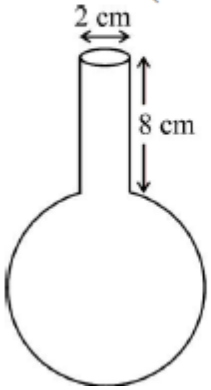
$\therefore \frac{AG}{GB} = \frac{AF}{FD}$ _____ (v)

1½

from (iv) and (v) $\frac{AE}{EC} = \frac{AF}{FD}$

½

35. A spherical glass vessel (shown below) has a cylindrical neck, which is 8 cm long and 2 cm wide. The diameter of the spherical part is 9 cm. Find the capacity of the glass vessel in mL. (Take 1 cm^3 = 1 mL and $\pi = \frac{22}{7}$)

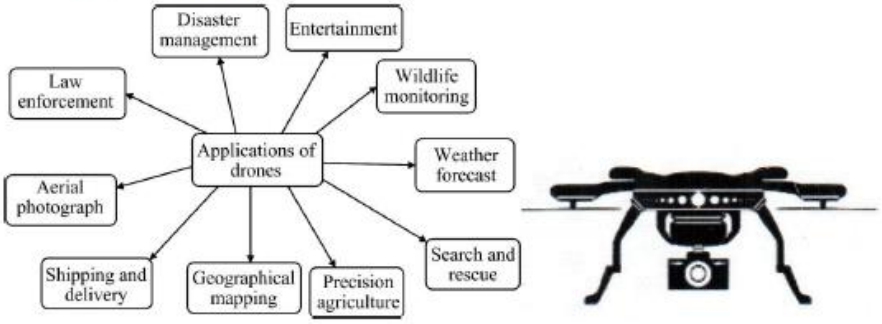


Solution: Volume of vessel = Volume of sphere + Volume of Cylinder	1
$= \frac{4}{3}\pi R^3 + \pi r^2 h$	
$= \frac{4}{3}\times\frac{22}{7}\times\frac{9}{2}\times\frac{9}{2}\times\frac{9}{2}+\frac{22}{7}\times 1\times 1\times 8$	1½+1½
= 407 cu.cm = 407 ml	½+½

SECTION E

*This section has **3** case study based/source based/passage based/integrated units of assessment of **4** marks each with sub-parts.* *3×4=12*

36. Drones are used by military for surveillance purposes. These days, drones are also used by individual entrepreneurs, SMEs and large companies to accomplish various other tasks.



A drone is flying over a rectangular field with vertices at A(– 100, 0), B(100, 0), C(100, 150) and D(– 100, 150). The drone captures an image at a location (x, y).

Based on the above information, answer the following questions :

(i) Find the dimensions of the rectangular field. *1*

(ii) Find the distance between points A and C. *1*

(iii) (a) If a drone captures the image of an object P(x, y) on the rectangular field, find the relation between x and y such that PA = PC. *2*

OR

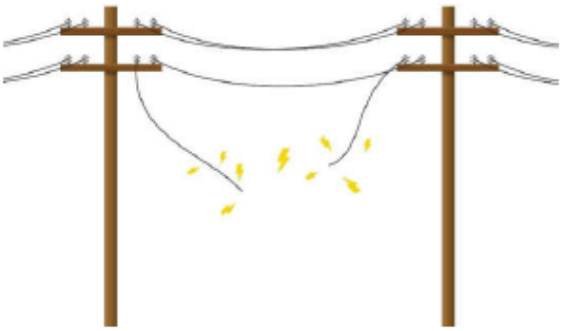
(b) If a drone captures the image of an object at a point Q whose x coordinate is 0 and it is equidistant from points A and D, find the coordinates of Q. *2*

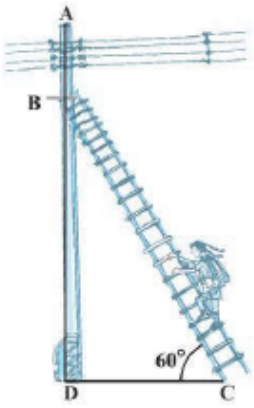
Solution(i) Dimensions of the rectangular field are 200 units and 150 units	1
(ii) $AC = \sqrt{(200)^2 + (150)^2}$ $= 250$	1
(iii) PA = PC $\Rightarrow (x+100)^2 + y^2 = (x - 100)^2 + (y - 150)^2$	1
$\Rightarrow 4x + 3y = 225$	1
OR	
Let coordinates of Q be (0,y)	
QA = QD	
$\Rightarrow (0+100)^2 + y^2 = (0 + 100)^2 + (y - 150)^2$	1
$y = 75$	½
The coordinates of the point Q are (0,75)	½

37. A short circuit can happen on electric poles due to several reasons, like

(a) If the insulation is damaged or old, it may allow the hot wires to touch with neutral. This will cause a short circuit.

(b) If there are any loose wire connections or attachments, it will allow the live and neutral wires to touch.





An electrician has to repair an electric fault on a pole of height 5 m. He needs to reach a point 1 m below the top of the pole to undertake the repair work.

Based on the above information, answer the following questions :

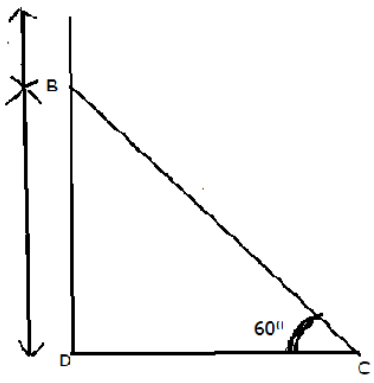
(i) What should be the length of the ladder that he should use which, when inclined at an angle of 60° to the horizontal, enables him to reach the required position ? *2*

(ii) (a) How far from the foot of the pole should he place the foot of the ladder ? *2*

OR

(b) What is the length of the ladder if its foot is kept at a distance of 4 m from the foot of the pole ? *2*

Solution:



(i) In ΔBDC , let BC = x

$$sin\,60^0 = \frac{4}{x}$$ 1

$$\Rightarrow \frac{\sqrt{3}}{2} = \frac{4}{x}$$ ½

$$\Rightarrow x = \frac{8}{\sqrt{3}}\ m\ or \frac{8\sqrt{3}}{3}\ m$$ ½

$\therefore$ Length of the ladder = $\frac{8}{\sqrt{3}}\ m\ or \frac{8\sqrt{3}}{3}\ m$

(ii) (a) In Δ BDC , let DC = y

$$tan\,60^0 = \frac{4}{y}$$ 1

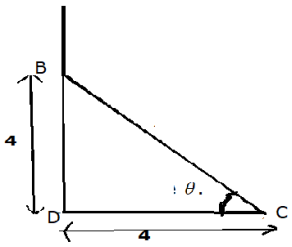
$$\Rightarrow \sqrt{3} = \frac{4}{y}$$ ½

$$\Rightarrow y = \frac{4}{\sqrt{3}}\ m\ or \frac{4\sqrt{3}}{3}\ m$$ ½

$\therefore$ foot of the ladder should be placed at a distance of $\frac{4\sqrt{3}}{3}\ m$ from the foot of the pole.

OR

(b)



Let angle be θ.

In Δ BDC,

$$\tan\theta = \frac{4}{4} = 1 \Rightarrow \theta = 45^0$$ ½

$$Now\ \cos 45^0 = \frac{4}{BC} \Rightarrow \frac{1}{\sqrt{2}} = \frac{4}{BC} \Rightarrow BC = 4\sqrt{2}$$ 1½

$\therefore$ the length of the ladder if its foot is kept at a distance of 4m from the foot of the pole is $4\sqrt{2}$ m

38. The marathon is a long-distance foot race with a distance of 42.195 km, usually run as a road race, but the distance can be covered on trail routes. The marathon can be completed by running or with a run/walk strategy. The marathon was one of the original modern Olympic events in 1896.

Neha, a student of class X, wishes to participate in a marathon. She decided to begin her practice by gradually increasing her running distance. In the first week, she decided to run 3 km each day and increase the distance by 2 km each week, i.e., in the second week she would run 5 km each day, in the third week she would run 7 km each day and so on.

Based on the above information, answer the following questions :

(i) What distance will Neha cover each day of the 8^{th} week of her practice ? *1*

(ii) In which week would she be able to run for 45 km each day ? *1*

(iii) (a) What is the total distance covered by Neha after 11 weeks, if she practised for 5 days in each week ? *2*

OR

(b) Had she increased the distance by 3 km each week instead of 2 km each week, in how many weeks would she have trained herself to run for 42 km per day ? *2*

Solution: (i) Distance covered in each day of the 8^{th} week = 3 + 7(2) = 17 km — 1

(ii) 45 = 3 + (n-1)2 $\Rightarrow$ n = 22 — 1

(iii) $s_{11} = \frac{11}{2}(2 \times 3 + 10 \times 2)$

$= 143km$ — 1

Total distance covered by Neha after 11 weeks practicing 5 days in each week

= 143 × 5 = 715 km — 1

OR

42 = 3 + (n-1)3 — 1

$\Rightarrow$ n = 14 — 1

Neha would have trained herself to run for 42 km per day in 14 weeks.