Series DA2AB/2 SET~3

प्रश्न–पत्र कोड
Q.P. Code 430/2/3

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 परीक्षार्थी 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 candidates 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 पालन कीजिए :

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

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

(iii) *खण्ड –* ***क*** *में प्रश्न संख्या* **1** *से* **18** *तक बहुविकल्पीय 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** ***प्रकरण अध्ययन आधारित*** **4** *अंकों के प्रश्न हैं। 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 बनाएँ। यदि आवश्यक हो तो* $\pi = \frac{22}{7}$ *लें, जहाँ अन्यथा नहीं दिया गया है।*

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

General Instructions :

Read the following instructions carefully and follow them :

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

(ii) *Question Paper is divided into* ***five*** *Sections –* ***Section A, B, C, D*** *and* ***E****.*

(iii) *In Section–****A*** *question number* ***1*** *to* ***18*** *are Multiple Choice Questions (MCQs) and question number* ***19*** *&* ***20*** *are Assertion-Reason based questions of 1 mark each.*

(iv) *In Section–****B*** *question number* ***21*** *to* ***25*** *are Very Short Answer (VSA) type questions of* ***2*** *marks each.*

(v) *In Section–****C*** *question number* ***26*** *to* ***31*** *are Short Answer (SA) type questions carrying* ***3*** *marks each.*

(vi) *In Section–****D*** *question number* ***32*** *to* ***35*** *are Long Answer (LA) type questions carrying* ***5*** *marks each.*

(vii) *In Section–****E*** *question number* ***36*** *to* ***38*** *are* ***Case Study based*** *questions carrying* ***4*** *marks each. Internal choice is provided in* ***2*** *marks question 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 diagram wherever required. Take* $\pi = 22/7$ *wherever required if not stated.*

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

खण्ड – क

20 × 1 = 20

(बहुविकल्पीय प्रश्न)

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

1. 20 cm भुजा के एक घन का कुल पृष्ठीय क्षेत्रफल है : **1**

(A) $240\ cm^2$ (B) $160\ cm^2$

(C) $2400\ cm^2$ (D) $1600\ cm^2$

2. बहुपद $3x^2 + 8x - 3$ के शून्यक हैं : **1**

(A) $\frac{1}{3}, 3$ (B) $\frac{1}{3}, -3$

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

3. दो चरों x और y में बने रैखिक समीकरण युग्म $a_1x + b_1y = c_1$ और $a_2x + b_2y = c_2$ का आलेख समांतर रेखाएँ निरूपित करता है, यदि **1**

(A) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ (B) $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

(C) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2} = \frac{c_1}{c_2}$ (D) $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

4. मूल बिंदु से बिंदु (5, 4) की दूरी है : **1**

(A) 41 (B) $\sqrt{41}$

(C) 3 (D) 9

5. $\frac{2 \tan 30°}{1 - \tan^2 30°}$ बराबर है : **1**

(A) $\cos 60°$ (B) $\sin 60°$

(C) $\tan 60°$ (D) $\sin 30°$

6. यदि एक 6 m ऊँचे खंभे की छाया भूमि पर $2\sqrt{3}$ m लम्बी है, तो सूर्य का उन्नतांश है : **1**

(A) 30° (B) 45°

(C) 60° (D) 90°

Section – A

20 × 1 = 20

(Multiple Choice Questions)

Section-A consists of **20** Multiple Choice Questions of **1** mark each.

1. The total surface area of a cube of side 20 cm is **1**

(A) $240\ cm^2$ (B) $160\ cm^2$

(C) $2400\ cm^2$ (D) $1600\ cm^2$

2. The zeroes of the polynomial $3x^2 + 8x - 3$ are : **1**

(A) $\frac{1}{3}, 3$ (B) $\frac{1}{3}, -3$

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

3. The graph of a pair of linear equations $a_1x + b_1y = c_1$ and $a_2x + b_2y = c_2$ in two variables x and y represents parallel lines, if **1**

(A) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ (B) $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

(C) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2} = \frac{c_1}{c_2}$ (D) $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

4. The distance of the point (5, 4) from the origin is **1**

(A) 41 (B) $\sqrt{41}$

(C) 3 (D) 9

5. $\frac{2\tan 30°}{1 - \tan^2 30°}$ is equal to **1**

(A) cos 60° (B) sin 60°

(C) tan 60° (D) sin 30°

6. If a pole 6 m high casts a shadow $2\sqrt{3}$ m long on the ground, then the sun's elevation is : **1**

(A) 30° (B) 45°

(C) 60° (D) 90°

7. यदि P(A) किसी घटना A की प्रायिकता को दर्शाता हो, तो **1**

(A) $P(A) < 0$ (B) $P(A) > 1$

(C) $0 \leq P(A) \leq 1$ (D) $-1 \leq P(A) \leq 1$

8. एक रेखा जो एक वृत्त को दो अलग-अलग बिंदुओं पर काटती है, कहलाती है : **1**

(A) छेदक रेखा (B) जीवा

(C) व्यास (D) स्पर्श-रेखा

9. यदि n एक प्राकृत संख्या है, तो निम्न में से कौन सी संख्या अंक 0 पर समाप्त होगी ? **1**

(A) $(3 \times 2)^n$ (B) $(5 \times 2)^n$

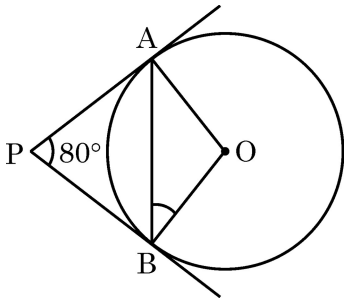
(C) $(6 \times 2)^n$ (D) $(4 \times 2)^n$

10. यदि $5 \cos A - 4 = 0$ है, तो $\tan A$ का मान है : **1**

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

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

11. दी गई आकृति में एक बिंदु P से O केंद्र वाले किसी वृत्त पर PA और PB स्पर्श-रेखाएँ परस्पर 80° के कोण पर झुकी हैं । $\angle ABO$ की माप है : **1**



(A) 40° (B) 80°

(C) 100° (D) 50°

12. निम्न में से किस समीकरण का मूल 2 है ? **1**

(A) $x^2 - 4x + 5 = 0$ (B) $x^2 + 3x - 12 = 0$

(C) $2x^2 - 7x + 6 = 0$ (D) $3x^2 - 6x - 2 = 0$

7. If P(A) denotes the probability of an event A, then **1**

(A) $P(A) < 0$ (B) $P(A) > 1$

(C) $0 \leq P(A) \leq 1$ (D) $-1 \leq P(A) \leq 1$

8. A line intersecting a circle in two distinct points is called a **1**

(A) secant (B) chord

(C) diameter (D) tangent

9. If n is any natural number, then which of the following numbers ends with digit 0 ? **1**

(A) $(3 \times 2)^n$ (B) $(5 \times 2)^n$

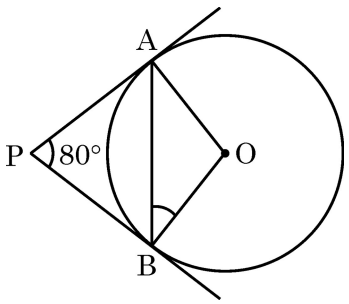
(C) $(6 \times 2)^n$ (D) $(4 \times 2)^n$

10. If $5 \cos A - 4 = 0$, then the value of tan A is **1**

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

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

11. In the given figure, tangents PA and PB from a point P to a circle with centre O are inclined to each other at an angle of 80°. $\angle ABO$ is equal to **1**



(A) 40° (B) 80°

(C) 100° (D) 50°

12. Which of the following equations has 2 as a root ? **1**

(A) $x^2 - 4x + 5 = 0$ (B) $x^2 + 3x - 12 = 0$

(C) $2x^2 - 7x + 6 = 0$ (D) $3x^2 - 6x - 2 = 0$

13. द्विघात बहुपद जिसके शून्यकों का योग –5 और गुणनफल 6 है, है : **1**

(A) $x^2 + 5x + 6$ (B) $x^2 - 5x + 6$

(C) $x^2 - 5x - 6$ (D) $-x^2 + 5x + 6$

14. 'p' का मान जिसके लिए समीकरण युग्म $-2x + 3y - 9 = 0$ और $4x + py + 7 = 0$ का केवल एक हल (अद्वितीय) है, है : **1**

(A) $p \neq 6$ (B) $p = 6$

(C) $p = -6$ (D) $p \neq -6$

15. $\frac{\text{cosec}^2 A - \cot^2 A}{1 - \sin^2 A}$ बराबर है : **1**

(A) $\sin^2 A$ (B) $\cos^2 A$

(C) $\sec^2 A$ (D) $\tan^2 A$

16. एक शहर का पिछले 66 दिनों का बारिश का वार्षिक रिकार्ड नीचे तालिका में दिया है : **1**

बारिश (cm में) :	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
दिनों की संख्या :	22	10	8	15	5	6

बहुलक वर्ग तथा माध्यक वर्ग की ऊपरी सीमाओं का अन्तर है :

(A) 10 (B) 15

(C) 20 (D) 30

17. 21 cm त्रिज्या के एक वृत्त के 120° के कोण के लघु त्रिज्यखंड और संगत दीर्घ त्रिज्यखंड के क्षेत्रफलों का अन्तर है : **1**

(A) 231 cm^2 (B) 462 cm^2

(C) 346.5 cm^2 (D) 693 cm^2

18. एक समांतर श्रेढ़ी में, यदि $d = -4$ और $a_7 = 4$ है, तो इसका पहला पद 'a' बराबर है : **1**

(A) 6 के (B) 7 के

(C) 20 के (D) 28 के

13. A quadratic polynomial, the sum of whose zeroes is –5 and their product is 6, is **1**

(A) $x^2 + 5x + 6$ (B) $x^2 - 5x + 6$

(C) $x^2 - 5x - 6$ (D) $-x^2 + 5x + 6$

14. The value of 'p' for which the pair of equations $-2x + 3y - 9 = 0$ and $4x + py + 7 = 0$ has a unique solution is **1**

(A) $p \neq 6$ (B) $p = 6$

(C) $p = -6$ (D) $p \neq -6$

15. $\frac{\text{cosec}^2 A - \cot^2 A}{1 - \sin^2 A}$ is equal to **1**

(A) $\sin^2 A$ (B) $\cos^2 A$

(C) $\sec^2 A$ (D) $\tan^2 A$

16. The annual rainfall record of a city for 66 days is given in the following table : **1**

Rainfall (in cm) :	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
Number of days :	22	10	8	15	5	6

The difference of upper limits of modal and median classes is :

(A) 10 (B) 15

(C) 20 (D) 30

17. The difference of the areas of a minor sector of angle 120° and its corresponding major sector of a circle of radius 21 cm, is **1**

(A) 231 cm^2 (B) 462 cm^2

(C) 346.5 cm^2 (D) 693 cm^2

18. In an A.P., if $d = -4$ and $a_7 = 4$, then the first term 'a' is equal to **1**

(A) 6 (B) 7

(C) 20 (D) 28

(अभिकथन – तर्क आधारित प्रश्न)

निर्देश : निम्नलिखित प्रश्न **19** व **20** में एक अभिकथन (A) के बाद एक तर्क (R) दिया गया है । निम्न विकल्पों में से सही उत्तर चुनिए :

(A) अभिकथन (A) तथा तर्क (R) दोनों सत्य हैं और तर्क (R) अभिकथन (A) की पूरी व्याख्या करता है ।

(B) अभिकथन (A) तथा तर्क (R) दोनों सत्य हैं, परंतु तर्क (R) अभिकथन (A) की सही व्याख्या नहीं करता है ।

(C) अभिकथन (A) सत्य है, परन्तु तर्क (R) सत्य नहीं है ।

(D) अभिकथन (A) असत्य है, परन्तु तर्क (R) सत्य है ।

19. **अभिकथन (A) :** यदि किसी त्रिभुज की एक भुजा के समांतर अन्य दो भुजाओं को भिन्न-भिन्न बिंदुओं पर प्रतिच्छेदन करने के लिए एक रेखा खींची जाए, तो ये अन्य दो भुजाएँ एक ही अनुपात में विभाजित हो जाती हैं । **1**

तर्क (R) : त्रिभुज की किसी भी भुजा के समांतर रेखाएँ नहीं खींची जा सकती हैं ।

20. **अभिकथन (A) :** बिंदु (0, 4), y-अक्ष पर स्थित है । **1**

तर्क (R) : एक बिंदु, जो y-अक्ष पर स्थित है, का x-निदेशांक शून्य होता है ।

खण्ड – ख

(अति लघु-उत्तरीय प्रश्न)

प्रश्न संख्या **21** से **25** तक अति लघु-उत्तरीय प्रकार के प्रश्न हैं तथा प्रत्येक प्रश्न के **2** अंक हैं ।

21. गलती से 15 खराब पेन 145 अच्छे पेनों में मिल गए हैं । एक पेन यादृच्छया इस मिश्रण से निकाला जाता है । निकाले गए पेन के अच्छा पेन होने की प्रायिकता ज्ञात कीजिए । **2**

22. सिद्ध कीजिए कि किसी वृत्त के किसी व्यास के सिरों पर खींची गईं स्पर्श-रेखाएँ समांतर परस्पर होती हैं । **2**

23. अभाज्य गुणनखंडन विधि से, 231 और 396 का LCM ज्ञात कीजिए । **2**

24. (a) दो प्राकृत संख्याओं का योग 70 है और उनका अंतर 10 है । प्राकृत संख्याएँ ज्ञात कीजिए । **2**

अथवा

(b) x और y के लिए हल कीजिए : **2**

$x - 3y = 7$

$3x - 3y = 5$

(Assertion – Reason based questions)

Directions : In question numbers **19** and **20**, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option :

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

(B) Both Assertion (A) and Reason (R) are correct 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) :** A line drawn parallel to any one side of a triangle intersects the other two sides in the same ratio. **1**

Reason (R) : Parallel lines cannot be drawn to any side of a triangle.

20. **Assertion (A) :** The point (0, 4) lies on y – axis. **1**

Reason (R) : The x-coordinate of a point, lying on y – axis, is zero.

Section – B

(Very Short Answer Type Questions)

Q. Nos. **21** to **25** are Very Short Answer type questions of **2** marks each.

21. 15 defective pens are accidentally mixed with 145 good ones. One pen is taken out at random from this lot. Determine the probability that the pen taken out is a good one. **2**

22. Prove that the tangents drawn at the ends of a diameter of a circle are parallel to each other. **2**

23. Find the LCM of 231 and 396 by prime factorisation method. **2**

24. (a) The sum of two natural numbers is 70 and their difference is 10. Find the natural numbers. **2**

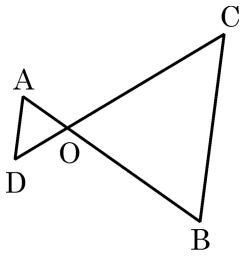
OR

(b) Solve for x and y : **2**

$x - 3y = 7$

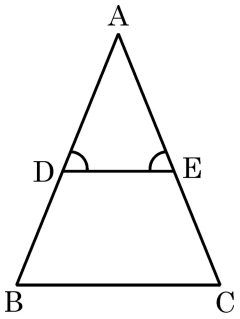
$3x - 3y = 5$

25. (a) दी गई आकृति में, $OA \cdot OB = OC \cdot OD$ है । सिद्ध कीजिए कि $\Delta AOD \sim \Delta COB$ **2**



अथवा

(b) दी गई आकृति में, $\angle D = \angle E$ और $\frac{AD}{DB} = \frac{AE}{EC}$ है । सिद्ध कीजिए कि ΔABC एक समद्विबाहु त्रिभुज है । **2**



खण्ड – ग

(लघु–उत्तरीय प्रश्न)

प्रश्न संख्या **26** से **31** तक लघु–उत्तरीय प्रकार के प्रश्न हैं तथा प्रत्येक प्रश्न के **3** अंक हैं ।

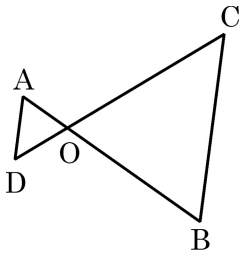
26. (a) द्विघात बहुपद $x^2 - 3x + 2$ के शून्यक α और β हैं । एक द्विघात बहुपद की रचना कीजिए जिसके शून्यक $2\alpha + 1$ और $2\beta + 1$ हैं । **3**

अथवा

(b) बहुपद $4x^2 - 4x + 1$ के शून्यक ज्ञात कीजिए और शून्यकों तथा गुणाकों के बीच के संबंध की सत्यता की जाँच कीजिए । **3**

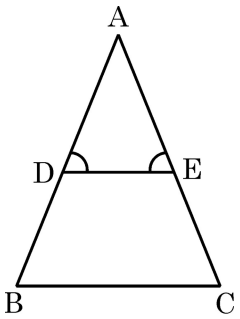
27. किसी कार के दो वाइपर (wipers) हैं, जो परस्पर कभी आच्छादित नहीं होते हैं । प्रत्येक वाइपर की पत्ती की लंबाई 21 cm है और 120° के कोण तक घूमकर सफाई कर सकता है । पत्तियों की प्रत्येक बुहार के साथ जितना क्षेत्रफल साफ हो जाता है, ज्ञात कीजिए । **3**

25. (a) In the given figure, OA·OB = OC·OD. Prove that ΔAOD ~ ΔCOB. **2**



OR

(b) In the given figure, $\angle D = \angle E$ and $\frac{AD}{DB} = \frac{AE}{EC}$. Prove that ΔABC is isosceles. **2**



Section – C

(Short Answer Type Questions)

Q. Nos. **26** to **31** are Short Answer type questions of **3** marks each.

26. (a) Zeroes of the quadratic polynomial $x^2 - 3x + 2$ are α and β. Construct a quadratic polynomial whose zeroes are 2α + 1 and 2β + 1. **3**

OR

(b) Find the zeroes of the polynomial $4x^2 - 4x + 1$ and verify the relationship between the zeroes and the coefficients. **3**

27. A car has two wipers which do not overlap. Each wiper has a blade of length 21 cm sweeping through an angle of 120°. Find the area cleaned at each sweep of the blades. **3**

28. 52 ताश की एक गड्डी से सभी बादशाह और बेगम के पत्ते हटा दिए जाते हैं । तत्पश्चात् बचे हुए पत्तों को भली-भाँति फेंट दिया जाता है और उनसे एक पत्ता यादृच्छया निकाला जाता है । प्रायिकता ज्ञात कीजिए कि यह चुना गया पत्ता **1+1+1**

(a) पान का इक्का है ।

(b) काले रंग का पत्ता है ।

(c) हुकुम के गुलाम का पत्ता है ।

29. (a) दो संकेंद्रीय वृत्तों में, बड़े वृत्त की एक जीवा, जिसकी लंबाई 24 cm है, छोटे वृत्त, जिसकी त्रिज्या 5 cm है, को स्पर्श करती है । बड़े वृत्त की त्रिज्या ज्ञात कीजिए । **3**

अथवा

(b) सिद्ध कीजिए कि किसी बाह्य बिंदु से किसी वृत्त पर खींची गईं दो स्पर्श-रेखाओं के बीच का कोण स्पर्श बिंदुओं को मिलाने वाले रेखाखण्ड द्वारा केंद्र पर अंतरित कोण का संपूरक होता है । **3**

30. सिद्ध कीजिए कि $\frac{\tan\theta}{1-\cot\theta}+\frac{\cot\theta}{1-\tan\theta}=1+\sec\theta\,\text{cosec}\,\theta$ **3**

31. सिद्ध कीजिए कि $5\sqrt{2}-3$ एक अपरेमीय संख्या है, दिया गया है कि $\sqrt{2}$ एक अपरिमेय संख्या है । **3**

खण्ड – घ

(दीर्घ-उत्तरीय प्रश्न)

प्रश्न संख्या **32** से **35** तक दीर्घ-उत्तरीय प्रश्न हैं जिनमें प्रत्येक के **5** अंक हैं ।

32. समुद्र तल से 75 m ऊँचे लाइट हाऊस के शिखर से देखने पर दो जहाजों के अवनमन कोण 30° और 45° हैं । यदि लाइट हाऊस के एक ही ओर एक जहाज दूसरे जहाज के ठीक पीछे हो, तो दो जहाजों के बीच की दूरी ज्ञात कीजिए । [$\sqrt{3}=1.732$ का प्रयोग करें ।] **5**

28. All the kings and queens are removed from a deck of 52 playing cards. Remaining cards are well shuffled and then a card is drawn at random. Find the probability that the drawn card is **1+1+1**

(a) an ace of hearts

(b) a black card

(c) a jack of spades

29. (a) In two concentric circles, a chord of length 24 cm of larger circle touches the smaller circle, whose radius is 5 cm. Find the radius of the larger circle. **3**

OR

(b) Prove that the angle between the two tangents drawn from an external point to a circle is supplementary to the angle subtended by the line segment joining the points of contact at the centre. **3**

30. Prove that $\frac{\tan\theta}{1-\cot\theta}+\frac{\cot\theta}{1-\tan\theta}=1+\sec\theta\,\text{cosec}\,\theta$ **3**

31. Prove that $5\sqrt{2}-3$ is an irrational number, given that $\sqrt{2}$ is an irrational number. **3**

Section – D

(Long Answer Type Questions)

Q. Nos. **32** to **35** are Long Answer type questions of **5** marks each.

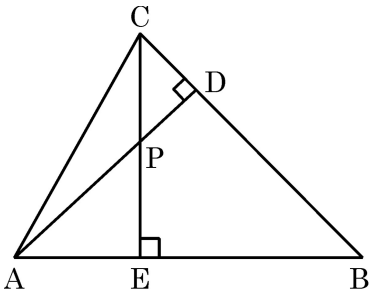
32. As observed from the top of a 75 m light house from the sea-level, the angles of depression of two ships are 30° and 45°. If one ship is exactly behind the other on the same side of the light house, find the distance between the two ships. [Use $\sqrt{3}=1.732$] **5**

33. (a) दी गई आकृति में, ΔABC के शीर्षलंब CE और AD परस्पर बिंदु P पर प्रतिच्छेद करते हैं । दर्शाइए कि **1+2+2**

(i) $\Delta AEP \sim \Delta CDP$

(ii) $\Delta ABD \sim \Delta CBE$

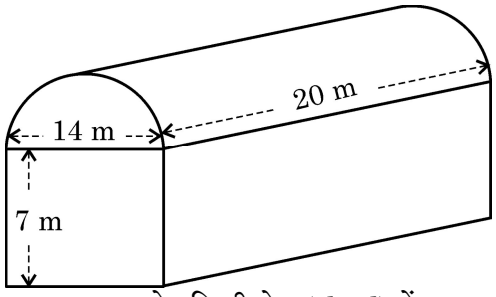
(iii) $\Delta AEP \sim \Delta ADB$



अथवा

(b) AD तथा PM क्रमशः त्रिभुजों ABC और PQR की माध्यिकाएँ हैं, जबकि $\Delta ABC \sim \Delta PQR$ है । सिद्ध कीजिए कि $\frac{AB}{PQ} = \frac{AD}{PM}$ है । **5**

34. (a) **5**



एक कपड़ा उद्योग किसी शेड (shed) में चलता है । यह शेड एक घनाभ के आकार का है जिस पर एक अर्धबेलन आरोपित है । यदि इस शेड के आधार की विमाएँ 14 m × 20 m है तथा घनाभाकार भाग की ऊँचाई 7 m है, तो शेड में समावेशित हो सकने वाली हवा का आयतन ज्ञात कीजिए । आगे, मान लीजिए कि उद्योग के लिए मशीनरी ने शेड का कुल स्थान 400 m^3 ही घेरा है, तो शेड की कितनी जगह अभी भी बची है ।

अथवा

(b) 8 cm ऊँचाई तथा 6 cm त्रिज्या वाले एक ठोस बेलन में से एक शंक्वाकार खोल काटकर निकाल दिया जाता है जिसकी ऊँचाई तथा त्रिज्या बेलन की ऊँचाई और त्रिज्या के समान हैं । शेष बचे ठोस का सम्पूर्ण पृष्ठ क्षेत्रफल ज्ञात कीजिए । ($\pi = 3.14$ लीजिए ।) **5**

35. एक आयताकार प्लॉट का क्षेत्रफल 528 m^2 है । इस प्लॉट की लम्बाई (मीटर में) इसकी चौड़ाई के दुगुने से एक अधिक है । इस प्लॉट की लम्बाई और चौड़ाई ज्ञात कीजिए । ₹ 80 प्रति वर्ग मीटर की दर से प्लॉट को समतल कराने का खर्च भी ज्ञात कीजिए । **5**

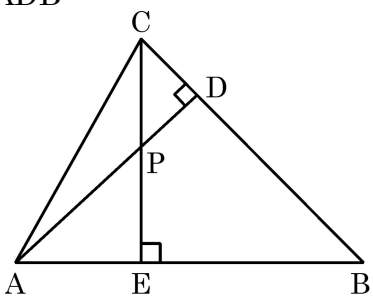
33. (a) In the given figure, altitudes CE and AD of ΔABC intersect each other at the point P. **1+2+2**

Show that

(i) Δ AEP ~ Δ CDP

(ii) Δ ABD ~ Δ CBE

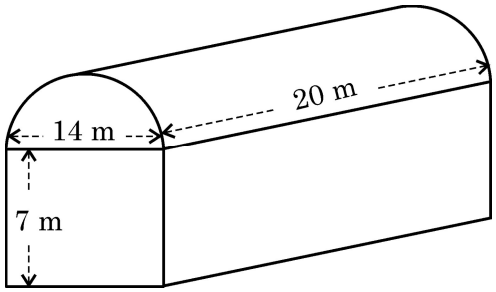
(iii) Δ AEP ~ Δ ADB



OR

(b) AD and PM are medians of triangles ABC and PQR, respectively, where Δ ABC ~ Δ PQR. Prove that $\frac{AB}{PQ}=\frac{AD}{PM}$. **5**

34. (a) **5**



A textile industry runs in a shed. This shed is in the shape of a cuboid surmounted by a half cylinder. If the base of the industry is of dimensions 14 m × 20 m and the height of the cuboidal portion is 7 m, find the volume of air that the industry can hold. Further, suppose the machinery in the industry occupies a total space of 400 m^3. Then, how much space is left in the industry ?

OR

(b) From a solid cylinder of height 8 cm and radius 6 cm, a conical cavity of the same height and same radius is carved out. Find the total surface area of the remaining solid. (Take π = 3.14) **5**

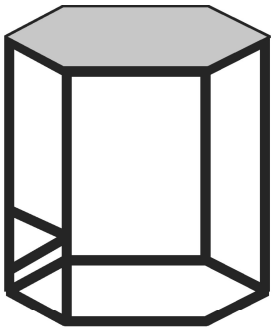
35. The area of a rectangular plot is 528 m^2. The length of the plot (in metres) is one more than twice the breadth. Find the length and breadth of the plot. Also, find the cost of levelling the plot at the rate of ₹ 80 per square metre. **5**

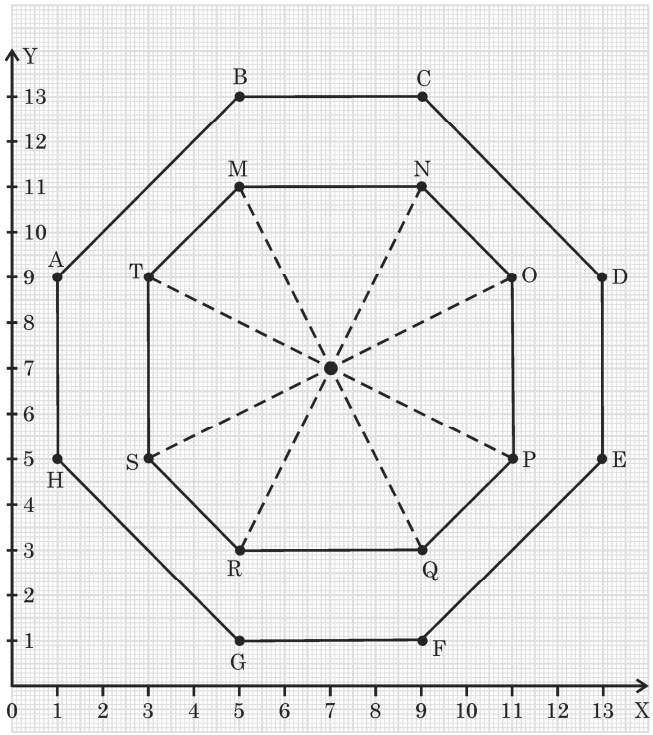
खण्ड – ङ

(प्रकरण अध्ययन आधारित प्रश्न)

प्रश्न संख्या **36** से **38** तक प्रकरण अध्ययन आधारित प्रश्न हैं । प्रत्येक प्रश्न के **4** अंक हैं ।

36. एक मेज का शीर्ष आकार में षट्कोणीय है ।





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

(i) A और B के निर्देशांक लिखिए । **1**

(ii) C और D को जोड़ने वाले रेखाखंड के मध्य-बिंदु के निर्देशांक लिखिए । **1**

(iii) (a) M और Q के बीच की दूरी ज्ञात कीजिए । **2**

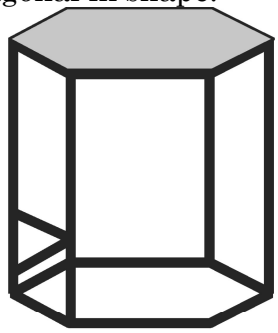
अथवा

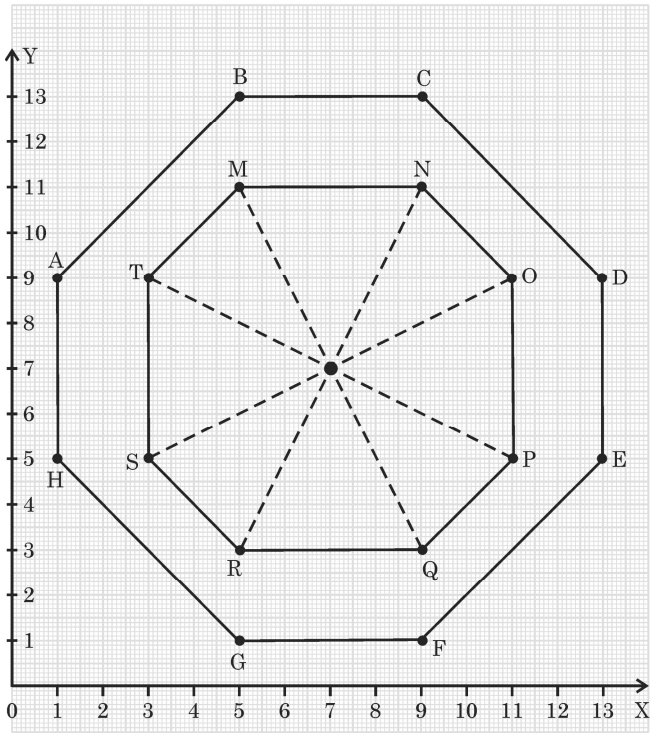
(iii) (b) उस बिंदु के निर्देशांक ज्ञात कीजिए जो M और N को जोड़ने वाले रेखाखंड को 1:3 के अनुपात में आंतरिक रूप से विभाजित करता है । **2**

Section – E
(Case Study based Questions)

Q. Nos. **36** to **38** are Case Study based Questions of **4** marks each.

36. The top of a table is hexagonal in shape.





On the basis of the information given above, answer the following questions :

(i) Write the coordinates of A and B. **1**

(ii) Write the coordinates of the mid-point of line segment joining C and D. **1**

(iii) (a) Find the distance between M and Q. **2**

OR

(iii) (b) Find the coordinates of the point which divides the line segment joining M and N in the ratio 1:3 internally. **2**

37. पैसा बचाना एक अच्छी आदत है और इसे बच्चों में शुरू से ही डालना चाहिए। रेहान की माँ रेहान के लिए गुल्लक लेकर आई और पहले दिन अपनी बचत में से एक ₹ 5 का सिक्का गुल्लक में डालती है। वह प्रतिदिन उसकी बचत में ₹ 5 का एक सिक्का बढ़ाती है।

उपरोक्त जानकारी के आधार पर, निम्न प्रश्नों का उत्तर दीजिए :

(i) 8वें दिन गुल्लक में कितने सिक्के डाले गए ? **1**

(ii) 8 दिनों के बाद गुल्लक में कितनी राशि होगी ? **1**

(iii) (a) यदि गुल्लक में ₹ 5 के कुल 120 सिक्के आ सकते हों, तो माँ को कितने दिनों तक ₹ 5 के सिक्के गुल्लक में डालने होंगे ? **2**

अथवा

(iii) (b) बचत की कुल राशि ज्ञात कीजिए, जब गुल्लक पूरी भर जाए। **2**

37. Saving money is a good habit and it should be inculcated in children right from the beginning. Rehan's mother brought a piggy bank for Rehan and puts one ₹ 5 coin of her savings in the piggy bank on the first day. She increases his savings by one ₹ 5 coin daily.

Based on the above information, answer the following questions :

(i) How many coins were added to the piggy bank on 8^{th} day ? **1**

(ii) How much money will be there in the piggy bank after 8 days ? **1**

(iii) (a) If the piggy bank can hold one hundred twenty ₹ 5 coins in all, find the number of days she can contribute to put ₹ 5 coins into it. **2**

OR

(iii) (b) Find the total money saved, when the piggy bank is full. **2**

38. हृदय दर : हृदय गति मानव शरीर में स्वास्थ्य के "महत्त्वपूर्ण संकेतों" में से एक है । यह प्रति मिनट हृदय के सिकुड़ने या धड़कने की संख्या को मापता है । जबकि सामान्य हृदय गति यह गारंटी नहीं देती है कि कोई व्यक्ति स्वास्थ्य समस्याओं से मुक्त है, यह कई स्वास्थ्य समस्याओं की पहचान करने के लिए एक उपयोगी बेंचमार्क है ।

एम्स के डॉक्टरों द्वारा 30 महिलाओं की जाँच की गई और प्रति मिनट हृदय की धड़कन की संख्या दर्ज़ की गई और उसका सारांश इस प्रकार दिया गया :

प्रति मिनट हृदय की धड़कनों की संख्या	महिलाओं की संख्या
65 – 68	2
68 – 71	4
71 – 74	3
74 – 77	8
77 – 80	7
80 – 83	4
83 – 86	2

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

(i) कितनी महिलाओं की हृदय की धड़कन 68 – 77 रेंज में है ? **1**

(ii) इन महिलाओं के लिए प्रति मिनट हृदय की धड़कन का माध्यक वर्ग क्या है ? **1**

(iii) (a) इन महिलाओं के लिए प्रति मिनट हृदय की धड़कन का बहुलक ज्ञात कीजिए । **2**

अथवा

(iii) (b) इन महिलाओं के लिए प्रति मिनट हृदय की धड़कन का माध्यक ज्ञात कीजिए । **2**

38. Heart Rate : The heart rate is one of the 'vital signs' of health in the human body. It measures the number of times per minute that the heart contracts or beats. While a normal heart rate does not guarantee that a person is free of health problems, it is a useful benchmark for identifying a range of health issues.

Thirty women were examined by doctors of AIIMS and the number of heart beats per minute were recorded and summarized as follows :

Number of heart beats per minute	Number of Women
65 – 68	2
68 – 71	4
71 – 74	3
74 – 77	8
77 – 80	7
80 – 83	4
83 – 86	2

Based on the above information, answer the following questions :

(i) How many women are having heart beat in the range 68 – 77 ? **1**

(ii) What is the median class of heart beats per minute for these women ? **1**

(iii) (a) Find the modal value of heart beats per minute for these women. **2**

OR

(iii) (b) Find the median value of heart beats per minute for these women. **2**

Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2024
SUBJECT NAME MATHEMATICS (BASIC) (Q.P. CODE 430/2/3)

General Instructions: -	
1	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully.
2	**"Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, evaluation done and several other aspects. Its leakage to public in any manner could lead to derailment of the examination system and affect the life and future of millions of candidates. Sharing this policy/document to anyone, publishing in any magazine and printing in News Paper/Website etc. may invite action under various rules of the Board and IPC."**
3	Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one's own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. **However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and due marks be awarded to them. In class-X, while evaluating two competency-based questions, please try to understand given answer and even if reply is not from marking scheme but correct competency is enumerated by the candidate, due marks should be awarded.**
4	The Marking scheme carries only suggested value points for the answers. These are in the nature of Guidelines only and do not constitute the complete answer. The students can have their own expression and if the expression is correct, the due marks should be awarded accordingly.
5	The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. If there is any variation, the same should be zero after deliberation and discussion. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.
6	Evaluators will mark(✓) wherever answer is correct. For wrong answer CROSS 'X" be marked. Evaluators will not put right (✓)while evaluating which gives an impression that answer is correct and no marks are awarded. **This is 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.

Set 430/2/3

MARKING SCHEME
MATHEMATICS (BASIC)

SECTION A

1. The total surface area of a cube of side 20 cm is

(A) $240\ cm^2$ (B) $160\ cm^2$

(C) $2400\ cm^2$ (D) $1600\ cm^2$

Ans. (C) $2400\ cm^2$ *1*

---

2. The zeroes of the polynomial $3x^2 + 8x - 3$ are :

(A) $\frac{1}{3}, 3$ (B) $\frac{1}{3}, -3$

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

Ans. (B) $\frac{1}{3}, -3$ *1*

---

3. The graph of a pair of linear equations $a_1x + b_1y = c_1$ and $a_2x + b_2y = c_2$ in two variables x and y represents parallel lines, if

(A) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ (B) $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

(C) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2} = \frac{c_1}{c_2}$ (D) $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

Ans. (D) $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$ *1*

---

4. The distance of the point (5, 4) from the origin is

(A) 41 (B) $\sqrt{41}$

(C) 3 (D) 9

Ans. (B) $\sqrt{41}$ *1*

---

5. $\frac{2\tan 30°}{1-\tan^2 30°}$ is equal to

(A) $\cos 60°$ (B) $\sin 60°$

(C) $\tan 60°$ (D) $\sin 30°$

Ans. (C) $\tan 60°$ *1*

---

6. If a pole 6 m high casts a shadow $2\sqrt{3}$ m long on the ground, then the sun's elevation is :

(A) $30°$ (B) $45°$

(C) $60°$ (D) $90°$

Ans. (C) $60°$ *1*

---

7. If P(A) denotes the probability of an event A, then

(A) $P(A) < 0$ (B) $P(A) > 1$

(C) $0 \leq P(A) \leq 1$ (D) $-1 \leq P(A) \leq 1$

Ans. (C) $0 \leq P(A) \leq 1$ *1*

---

8. A line intersecting a circle in two distinct points is called a

(A) secant (B) chord

(C) diameter (D) tangent

Ans. (A) secant *1*

---

9. If n is any natural number, then which of the following numbers ends with digit 0 ?

(A) $(3 \times 2)^n$ (B) $(5 \times 2)^n$

(C) $(6 \times 2)^n$ (D) $(4 \times 2)^n$

Ans. (B) $(5 \times 2)^n$ *1*

---

10. If $5 \cos A - 4 = 0$, then the value of tan A is

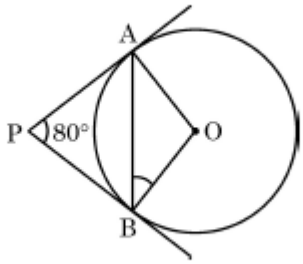
(A) $\frac{3}{4}$ (B) $\frac{4}{3}$

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

Ans. (A) $\frac{3}{4}$ *1*

---

11. In the given figure, tangents PA and PB from a point P to a circle with centre O are inclined to each other at an angle of 80°. ∠ABO is equal to



(A) 40° (B) 80°
(C) 100° (D) 50°

Ans. (A) 40° *1*

---

12. Which of the following equations has 2 as a root ?

(A) $x^2 - 4x + 5 = 0$ (B) $x^2 + 3x - 12 = 0$
(C) $2x^2 - 7x + 6 = 0$ (D) $3x^2 - 6x - 2 = 0$

Ans. (C) $2x^2 - 7x + 6 = 0$ *1*

---

13. A quadratic polynomial, the sum of whose zeroes is –5 and their product is 6, is

(A) $x^2 + 5x + 6$ (B) $x^2 - 5x + 6$
(C) $x^2 - 5x - 6$ (D) $-x^2 + 5x + 6$

Ans. (A) $x^2 + 5x + 6$ *1*

---

14. The value of 'p' for which the pair of equations $-2x + 3y - 9 = 0$ and $4x + py + 7 = 0$ has a unique solution is

(A) $p \neq 6$ (B) $p = 6$
(C) $p = -6$ (D) $p \neq -6$

Ans. (D) $p \neq -6$ *1*

---

15. $\frac{\text{cosec}^2 A - \cot^2 A}{1 - \sin^2 A}$ is equal to

(A) $\sin^2 A$ (B) $\cos^2 A$
(C) $\sec^2 A$ (D) $\tan^2 A$

Ans. (C) $\sec^2 A$ *1*

---

16. The annual rainfall record of a city for 66 days is given in the following table :

Rainfall (in cm) :	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
Number of days :	22	10	8	15	5	6

The difference of upper limits of modal and median classes is :

(A) 10 (B) 15

(C) 20 (D) 30

Ans. (C) 20 *1*

---

17. The difference of the areas of a minor sector of angle 120° and its corresponding major sector of a circle of radius 21 cm, is

(A) 231 cm^2 (B) 462 cm^2

(C) 346.5 cm^2 (D) 693 cm^2

Ans. (B) 462 cm^2 *1*

---

18. In an A.P., if d = –4 and $a_7 = 4$, then the first term 'a' is equal to

(A) 6 (B) 7

(C) 20 (D) 28

Ans. (D) 28 *1*

---

19. **Assertion (A) :** A line drawn parallel to any one side of a triangle intersects the other two sides in the same ratio.

Reason (R) : Parallel lines cannot be drawn to any side of a triangle.

Ans. (C) Assertion (A) is true, but Reason (R) is false *1*

---

20. **Assertion (A) :** The point (0, 4) lies on y – axis.

Reason (R) : The *x*-coordinate of a point, lying on y – axis, is zero.

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

SECTION B

21. 15 defective pens are accidentally mixed with 145 good ones. One pen is taken out at random from this lot. Determine the probability that the pen taken out is a good one.

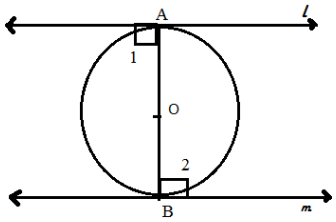
Solution: Total pens = 145 + 15 = 160 *1*

P (Good pen) = $\frac{145}{160}$ or $\frac{29}{32}$ *1*

---

22. **Prove that the tangents drawn at the ends of a diameter of a circle are parallel to each other.**

Solution: Tangents *l* and m are drawn at the end points A & B of diameter of the circle with centre O



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

To prove: $l \parallel m$

Proof → $\angle 1 = 90°$ ($\because$ radius $\perp$ tangent)

$\angle 2 = 90°$ *1*

$\Rightarrow \angle 1 = \angle 2$

But these are alternate interior angles

$\therefore\ l \parallel m$ $\frac{1}{2}$

---

23. **Find the LCM of 231 and 396 by prime factorisation method.**

Ans. $231 = 3 \times 7 \times 11$ $\frac{1}{2}$

$396 = 2 \times 2 \times 3 \times\ 3 \times 11$ $\frac{1}{2}$

$\therefore$ LCM $= 2 \times 2 \times 3 \times 3 \times 7 \times 11 = 2772$ *1*

---

24. (a) **The sum of two natural numbers is 70 and their difference is 10. Find the natural numbers.**

OR

(b) **Solve for *x* and y :**

$x - 3y = 7$

$3x - 3y = 5$

Solution: (a) Let the numbers be x & y

$x + y = 70$ $\frac{1}{2}$

$x - y = 10$ $\frac{1}{2}$

Solving to get $x = 40$ and $y = 30$ $\frac{1}{2} + \frac{1}{2}$

OR

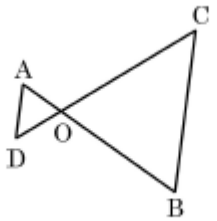
(b) $x - 3y = 7$ & $3x - 3y = 5$

Solving to get $x = -1$ *1*

$y = -\frac{8}{3}$ *1*

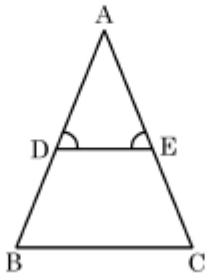
---

25. (a) In the given figure, OA·OB = OC·OD. Prove that ΔAOD ~ ΔCOB.



OR

(b) In the given figure, $\angle D = \angle E$ and $\frac{AD}{DB} = \frac{AE}{EC}$. Prove that ΔABC is isosceles.



Solution: (a) $OA \cdot OB = OC \cdot OD$

$\Rightarrow \frac{OA}{OC} = \frac{OD}{OB}$ _____ (i) $\frac{1}{2}$

In Δ AOD and Δ COB

$\frac{OA}{OC} = \frac{OD}{OB}$ (from (i))

$\angle AOD = \angle BOC$ (Vertically opp. angles) *1*

$\therefore$ Δ AOD ~ Δ COB (SAS similarity) $\frac{1}{2}$

OR

(b) In Δ ADE,

$$\frac{AD}{DB} = \frac{AE}{EC} \text{ (Given)}$$

$\Rightarrow$ DE // BC (by converse of B. P. T.) $\frac{1}{2}$

$\Rightarrow \angle D = \angle B$ & $\angle E = \angle C$ (Corresponding angles) $\frac{1}{2}$

But $\angle D = \angle E$ (given)

$\therefore \angle B = \angle C$ $\frac{1}{2}$

$\Rightarrow$ AB = AC (sides opposite to equal angles of a triangle) $\frac{1}{2}$

$\Rightarrow \Delta$ ABC is isosceles.

SECTION C

26. (a) Zeroes of the quadratic polynomial $x^2 - 3x + 2$ are α and β. Construct a quadratic polynomial whose zeroes are $2\alpha + 1$ and $2\beta + 1$.

OR

(b) Find the zeroes of the polynomial $4x^2 - 4x + 1$ and verify the relationship between the zeroes and the coefficients.

Solution: (a) $p(x) = x^2 - 3x + 2$

α, β are its zeroes

$\therefore \alpha + \beta = \frac{-b}{a} = 3$ $\frac{1}{2}$

$\alpha\beta = 2$ $\frac{1}{2}$

Required sum of zeroes = $(2\alpha+1) + (2\beta+1) = 2(\alpha + \beta) + 2 = 8$ $\frac{1}{2}$

Required product of zeroes = $(2\alpha+1)(2\beta+1) = 4\alpha\beta + 2(\alpha + \beta) + 1$

$= 4 \times 2 + 2 \times 3 + 1 = 15$ *1*

Required quadratic polynomial is $k(x^2 - 8x + 15)$ or $x^2 - 8x + 15$ $\frac{1}{2}$

OR

(b) $p(x) = 4x^2 - 4x + 1 = (2x - 1)(2x - 1)$ *1*

$\therefore$ Zeroes are $\frac{1}{2}$ and $\frac{1}{2}$ *1*

Sum of zeroes $= \frac{1}{2} + \frac{1}{2} = 1 = \frac{-(-4)}{(4)} = \frac{-Coeff.\ of\ x}{Coeff.\ of\ x^2}$ $\frac{1}{2}$

Product of zeroes $= \left(\frac{1}{2}\right)\left(\frac{1}{2}\right) = \frac{1}{4} = \frac{Constant\ term}{Coeff.\ of\ x^2}$ $\frac{1}{2}$

---

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

Solution: (a) $r = 21$ cm, $\theta = 120°$ $\frac{1}{2}$

Area cleaned by one wiper $= \frac{\pi r^2 \theta}{360^\circ}$

$= \frac{22}{7} \times 21 \times 21 \times \frac{120}{360}$ $1\frac{1}{2}$

$= 462\ cm^2$ $\frac{1}{2}$

Hence, total area cleaned by two wipers

$= 2 \times 462 = 924\ cm^2$ $\frac{1}{2}$

---

28. **All the kings and queens are removed from a deck of 52 playing cards. Remaining cards are well shuffled and then a card is drawn at random. Find the probability that the drawn card is** **1+1+1**

(a) an ace of hearts

(b) a black card

(c) a jack of spades

Solution. Total playing cards $= 52 - 8 = 44$

(i) P(ace of hearts) $= \frac{1}{44}$ *1*

(ii) P(Black card) $= \frac{22}{44}$ or $\frac{1}{2}$ *1*

(iii) P(jack of spades) = $\frac{1}{44}$ *1*

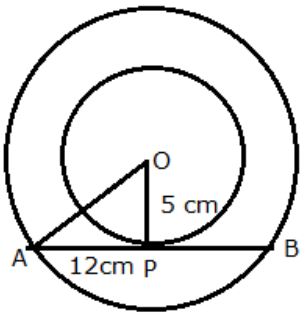
---

29. (a) In two concentric circles, a chord of length 24 cm of larger circle touches the smaller circle, whose radius is 5 cm. Find the radius of the larger circle.

OR

(b) Prove that the angle between the two tangents drawn from an external point to a circle is supplementary to the angle subtended by the line segment joining the points of contact at the centre.

Solution:



For fig. $\frac{1}{2}$

(a) In Δ OAP,

AP = $\frac{1}{2}$ (24) = 12 *1*

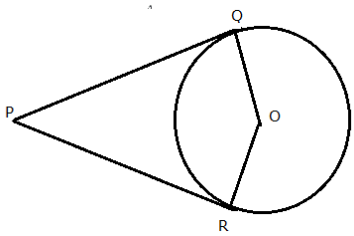
$(OA)^2 = (5)^2 + (12)^2$ *1*

OA = 13 $\frac{1}{2}$

∴ radius of the larger circle is 13 cm

OR

(b)



For fig. $\frac{1}{2}$

Let PQ and PR be the tangents drawn from an external point P to the circle with centre O.

To Prove: ∠ QPR + ∠ QOR = 180°

Proof – ∠ OQP = 90°

∠ ORP = 90° (radius ⊥ tangent) } *1*

In Quadrilateral OQPR,

∠ OQP + ∠ QPR + ∠ ORP + ∠ QOR = 360° *1*

$90° + \angle QPR + 90° + \angle QOR = 360°$

$\angle QPR + \angle QOR = 180°$ $\frac{1}{2}$

---

30. Prove that $\frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta} = 1 + \sec\theta \operatorname{cosec}\theta$

Solution: LHS $= \frac{\tan^2\theta}{\tan\theta - 1} + \frac{1}{\tan\theta(1-\tan\theta)}$ $\frac{1}{2}$

$= \frac{\tan^3\theta - 1}{\tan\theta(\tan\theta - 1)}$ $\frac{1}{2}$

$= \frac{(\tan\theta - 1)(\tan^2\theta + \tan\theta + 1)}{\tan\theta(\tan\theta - 1)}$ $\frac{1}{2}$

$= \frac{(\sec^2\theta + \tan\theta)}{\tan\theta}$ $\frac{1}{2}$

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

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

---

31. Prove that $5\sqrt{2} - 3$ is an irrational number, given that $\sqrt{2}$ is an irrational number.

Solution. Let us assume that $x = 5\sqrt{2} - 3$ is a rational number *1*

$\therefore \sqrt{2} = \frac{x+3}{5}$ *1*

RHS is a rational number

$\Rightarrow \sqrt{2}$ is rational

Which contradicts the fact that $\sqrt{2}$ is an irrational number *1*

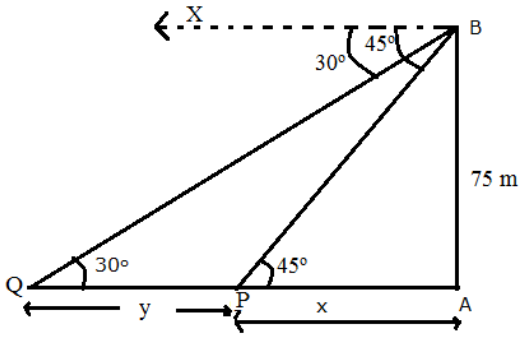
$\therefore$ our assumption is wrong.

Hence, $5\sqrt{2} - 3$ is irrational

SECTION D

32. As observed from the top of a 75 m light house from the sea-level, the angles of depression of two ships are 30° and 45°. If one ship is exactly behind the other on the same side of the light house, find the distance between the two ships. [Use $\sqrt{3} = 1.732$]

Solution:



For fig.: *1*

In Δ ABP, $\tan 45° = \frac{75}{x} \Rightarrow x = 75$ m *1+$\frac{1}{2}$*

In Δ ABQ, $\tan 30° = \frac{75}{x + y} \Rightarrow \frac{1}{\sqrt{3}} = \frac{75}{x + y}$ *1+$\frac{1}{2}$*

$x + y = 75\sqrt{3}$

$y = 75\sqrt{3} - 75$

$= 54.9$ *1*

∴ distance between two ships = 54.9 m

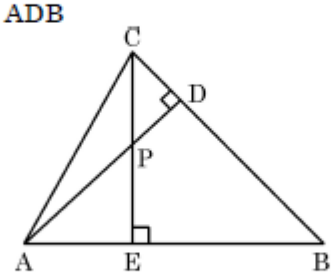
33. (a) In the given figure, altitudes CE and AD of ΔABC intersect each other at the point P. **1+2+2**

Show that

(i) Δ AEP ~ Δ CDP

(ii) Δ ABD ~ Δ CBE

(iii) Δ AEP ~ Δ ADB



OR

(b) AD and PM are medians of triangles ABC and PQR, respectively, where Δ ABC ~ Δ PQR. Prove that $\frac{AB}{PQ} = \frac{AD}{PM}$. **5**

Solution: (a) (i) In Δ AEP and Δ CDP,

$\angle$ APE = $\angle$ CPD (vertically opposite angles) *$\frac{1}{2}$*

$\angle AEP = \angle CDP$ (each 90°)

$\therefore \Delta AEP \sim \Delta CDP$ (AA similarity) $\frac{1}{2}$

(ii) In ΔABD and ΔCBE,

$\angle B = \angle B$ (common) $\frac{1}{2}$

$\angle ADB = \angle BEC$ (each 90°) *1*

$\therefore \Delta ABD \sim \Delta CBE$ (AA similarity) $\frac{1}{2}$

(iii) In ΔAEP and ΔADB,

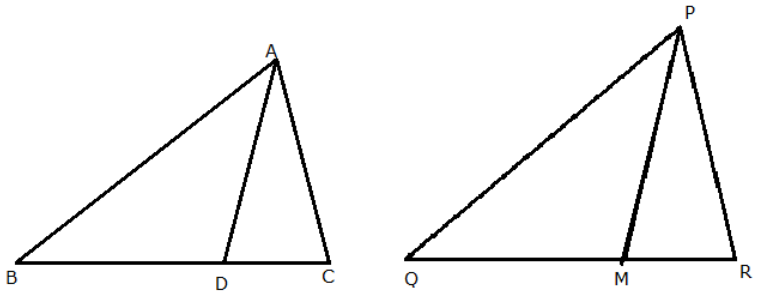
$\angle A = \angle A$ (common) $\frac{1}{2}$

$\angle AEP = \angle ADB$ (each 90°) *1*

$\therefore \Delta AEP \sim \Delta ADB$ (AA similarity) $\frac{1}{2}$

OR

(b)



For fig. *1*

Given: $\Delta ABC \sim \Delta PQR$. AD and PM are medians of ΔABC and ΔPQR, respectively

To Prove: $\frac{AB}{PQ} = \frac{AD}{PM}$

Proof: $\because \Delta ABC \sim \Delta PQR$ (Given)

$\therefore \frac{AB}{PQ} = \frac{BC}{QR}$ *1*

$\Rightarrow \frac{AB}{PQ} = \frac{2BD}{2QM}$ ($\because$ D & E are mid-points of BC & QR, respectively)

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

Now, In ΔABD and ΔPQM

$\frac{AB}{PQ} = \frac{BD}{QM}$ (Proved above) $\frac{1}{2}$

$\angle B = \angle Q$ $(\Delta ABC \sim \Delta PQR)$ $\frac{1}{2}$

$\therefore$ $\Delta ABD \sim \Delta PQM$ (SAS similarity) $\frac{1}{2}$

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

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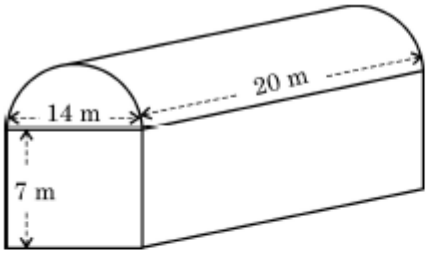
34. (a)



A textile industry runs in a shed. This shed is in the shape of a cuboid surmounted by a half cylinder. If the base of the industry is of dimensions 14 m × 20 m and the height of the cuboidal portion is 7 m, find the volume of air that the industry can hold. Further, suppose the machinery in the industry occupies a total space of 400 m^3. Then, how much space is left in the industry ?

OR

(b) From a solid cylinder of height 8 cm and radius 6 cm, a conical cavity of the same height and same radius is carved out. Find the total surface area of the remaining solid. (Take $\pi = 3.14$)

Solution: (a) Volume of cuboid = $20 \times 14 \times 7 = 1960\ m^3$ *1*

For half cylinder: $r = \frac{14}{2}$ m, h = 20 m *1*

Volume of half cylinder = $\frac{1}{2} \pi r^2 h$

$= \frac{1}{2} \times \frac{22}{7} \times 7 \times 7 \times 20 = 1540\ m^3$ *2*

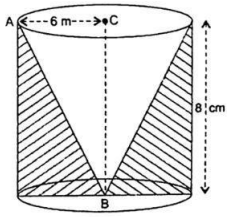
$\therefore$ Required volume of air $= 1960 + 1540 = 3500\ m^3$ $\frac{1}{2}$

Space occupied by machinery = $400\ m^3$

$\therefore$ Space left = $3500 - 400$

$= 3100\ m^3$ $\frac{1}{2}$

(b) **OR**



$l = \sqrt{6^2 + 8^2} = 10$ cm *1*

Required Surface Area of the remaining solid = $2\pi rh + \pi r^2 + \pi rl$

$= 2\pi (6) \cdot 8 + \pi (6)^2 + \pi \times 6 \times 10$ *2* $\frac{1}{2}$

$= 192\ \pi$ *1*

$= 602.88\ m^2$ $\frac{1}{2}$

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35. **The area of a rectangular plot is 528 m^2. The length of the plot (in metres) is one more than twice the breadth. Find the length and breadth of the plot. Also, find the cost of levelling the plot at the rate of ₹ 80 per square metre.**

Solution: Let breadth of the plot = x m

$\therefore$ length of the plot = (2x + 1) m *1*

$(2x + 1)x = 528$ *1*

$2x^2 + x - 528 = 0$

$(x - 16)(2x + 33) = 0$ *1*

$\Rightarrow x = 16,\ x = -\frac{33}{2}$ (not possible) *1*

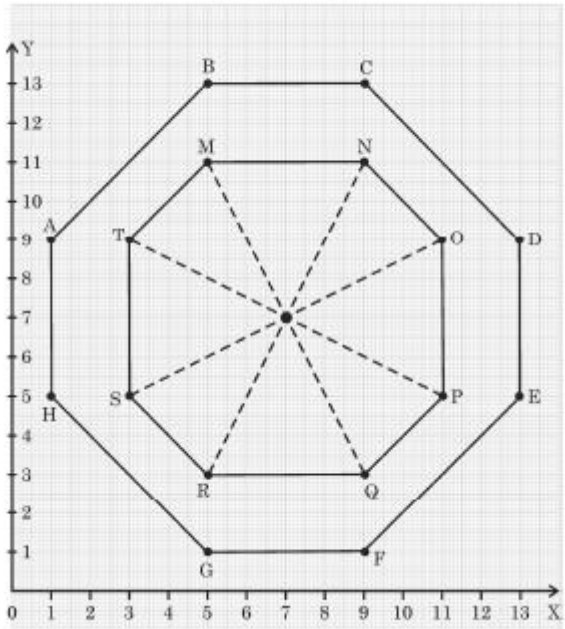
$\therefore$ length of the plot = 33 m $\frac{1}{2}$

Breadth of the plot = 16 m

Cost of levelling the plot = 528 × 80 = ₹42,240 $\frac{1}{2}$

SECTION E

36. The top of a table is hexagonal in shape.



On the basis of the information given above, answer the following questions :

(i) Write the coordinates of A and B.

(ii) Write the coordinates of the mid-point of line segment joining C and D.

(iii) (a) Find the distance between M and Q.

OR

(iii) (b) Find the coordinates of the point which divides the line segment joining M and N in the ratio 1:3 internally.

Solution: (i) A(1, 9) and B(5, 13) $\frac{1}{2}+\frac{1}{2}$

(ii) C(9, 13) and D(13, 9) $\frac{1}{2}$

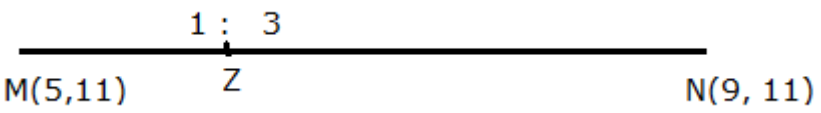
Mid-point of CD is (11, 11) $\frac{1}{2}$

(iii)(a) M(5, 11) and Q(9, 3) *1*

$MQ = \sqrt{(9-5)^2 + (3-11)^2} = \sqrt{80}$ or $4\sqrt{5}$ *1*

OR

(iii)(b) M(5, 11) and N(9, 11) *1*



$Z\left(\frac{1\times 9+3\times 5}{1+3}, \frac{1\times 11+3\times 11}{1+3}\right)$

Z (6, 11) *1*

37. Saving money is a good habit and it should be inculcated in children right from the beginning. Rehan's mother brought a piggy bank for Rehan and puts one ₹ 5 coin of her savings in the piggy bank on the first day. She increases his savings by one ₹ 5 coin daily.

Based on the above information, answer the following questions :

(i) How many coins were added to the piggy bank on 8th day ?

(ii) How much money will be there in the piggy bank after 8 days ?

(iii) (a) If the piggy bank can hold one hundred twenty ₹ 5 coins in all, find the number of days she can contribute to put ₹ 5 coins into it.

OR

(iii) (b) Find the total money saved, when the piggy bank is full.

Solution: (i) 8 coins *1*

(ii) Money in the piggy bank day wise

5, 10, 15, 20 .....

Money after 8 days = ₹180 *1*

(iii) (a) We can have at most 120 coins.

$\frac{n}{2}$ [2(1) + (n – 1) 1] = 120 *1*

$n^2 + n - 240 = 0$ $\frac{1}{2}$

Solving for n, we get, n = 15 as n ≠ – 16 $\frac{1}{2}$

∴ Number of days = 15

OR

(iii) (b) Total money saved = 120 × 5 = ₹600 *1+1*

38. **Heart Rate : The heart rate is one of the 'vital signs' of health in the human body. It measures the number of times per minute that the heart contracts or beats. While a normal heart rate does not guarantee that a person is free of health problems, it is a useful benchmark for identifying a range of health issues.**

Thirty women were examined by doctors of AIIMS and the number of heart beats per minute were recorded and summarized as follows :

Number of heart beats per minute	Number of Women
65 – 68	2
68 – 71	4
71 – 74	3
74 – 77	8
77 – 80	7
80 – 83	4
83 – 86	2

Based on the above information, answer the following questions :

(i) How many women are having heart beat in the range 68 – 77 ? **1**

(ii) What is the median class of heart beats per minute for these women ? **1**

(iii) (a) Find the modal value of heart beats per minute for these women. **2**

OR

(iii) (b) Find the median value of heart beats per minute for these women. **2**

Solution: (i) Women having heart beat in range 68 – 77

$= 4 + 3 + 8 = 15$ *1*

(ii) Median class = 74 – 77 *1*

(iii)(a) Mode $= l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$

$l = 74, f_1 = 8, f_0 = 3, f_2 = 7, h = 3$

$\therefore$ Modal value $= 74 + \left(\frac{8 - 3}{16 - 3 - 7}\right) \times 3$ $1\frac{1}{2}$

$= 76.5$ $\frac{1}{2}$

OR

(iii) (b)

No. of heart beats	f	cf
65 – 68	2	2
68 – 71	4	6
71 – 74	3	9
74 – 77	8	17
77 – 80	7	24
80 – 83	4	28
83 – 86	2	30

For table: $\frac{1}{2}$

$$\text{Median} = l + \frac{\frac{N}{2} - Cf}{f} \times h$$

$$= 74 + \frac{(15 - 9)}{8} \times 3 \qquad 1$$

$$= 76.25 \qquad \frac{1}{2}$$
