Set No-2

Series DA2AB/2

Q.P.Code 430/2/2

Roll No. | | | | | | | | |

Candidates must write the Q.P. Code on the title page of the answer-book.

(i) Please check that this question paper contains 17 printed pages.
(ii) Please check that this question paper contains 38 questions.
(iii) 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) Please write down the serial number of the question in the answer book before attempting it.
(v) 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.

MATHEMATICS (BASIC) THEORY

HINTS & SOLUTIONS

Time allowed: 3 hours **Maximum Marks: 80**

General Instructions:

Read the following instructions carefully and follow them:

(i) This question paper contains 38 questions. All questions are compulsory.
(ii) This 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-I (SA-I) type questions of 2 marks each.
(v) In Section-C question number 26 to 31 are Short Answer-II (SA-II) 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 / Passage based integrated units of assessment 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 question in Section-E.
(ix) Draw neat figures wherever required. Take $\pi = 22/7$ wherever required if not stated.
(x) Use of calculator is NOT allowed

SECTION-A **20 × 1 = 20**

(Multiple Choice Questions)

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

1. 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

Ans. (B) 462 cm^2

Sol. $\theta = 120^o$ r = 21 cm

Area of mirror sector = $\frac{\theta}{360^o} \times \pi r^2$

$= \frac{120^o}{360^o} \times \frac{22}{7} \times 21 \times 21 = 462$ cm

Area of major sector = $\frac{240}{360} \times \frac{22}{7} \times 21 \times 21 = 924\ cm^2$

difference = 924 – 462 = 462 cm^2

2. 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 :

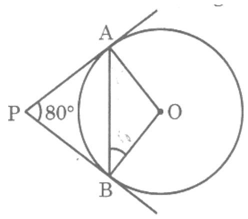
(A) 10 (B) 15 (C) 20 (D) 30

Ans. (C) 20

Sol. Modal class – 0 — 10 difference = 30 – 10

Median class – 20 — 30 = 20

3. In the given figure, tangents PA and PB from a point P to a circle with centre 0 are inclined to each other at an angle of 80°. ∠ABO is equal to **1**



(A) 40° (B) 80° (C) 100° (D) 50°

Ans. (A) 40°

Sol. In quadrilateral PAOB

$\angle P + \angle A + \angle O + \angle B = 360^o$

$80^o + 90^o + \angle O + 90^o = 360^o$

$\angle O = 100^o$

In isosceles ΔAOB

$\angle B + \angle A + \angle O = 180^o$

$x + x + 100^o = 180^o$

$2x + 100^o = 180^o$

$2x = 80^o$

$x = 40^o$

4. $\frac{1+\tan^2 A}{1+\cot^2 A}$ is equal to **1**

(A) $\sec^2 A$ (B) –1 (C) $\cot^2 A$ (D) $\tan^2 A$

Ans. (D) $\tan^2 A$

Sol. $\frac{1+\tan^2 A}{1+\cot^2 A} = \frac{\sec^2 A}{\text{cosec}^2 A} = \tan^2 A$

5. If $\sin^2\theta = \frac{3}{4}$, then θ is **1**

(A) 30º (B) 45º (C) 60º (D) 90º

Ans. (C) 60º

Sol. $\sin^2\theta = \frac{3}{4}$

$\sin\theta = \pm\sqrt{\frac{3}{4}}$

$\sin\theta = \frac{\sqrt{3}}{2}$

$\theta = 60º$

6. The zeroes of the polynomial $3x^2 - 5x - 2$, are : **1**

(A) $\frac{1}{3}, 2$ (B) $\frac{-1}{3}, 2$ (C) $\frac{-1}{3}, -2$ (D) $\frac{1}{3}, -2$

Ans. (B) $\frac{-1}{3}, 2$

Sol. $3x^2 - 5x - 2$

$3x^2 - 6x + x - 2$

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

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

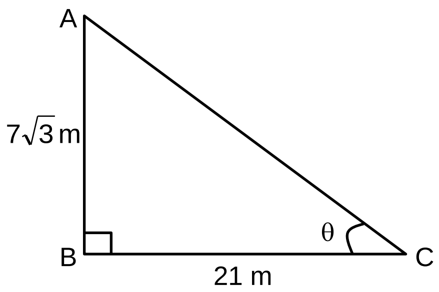
$x = 2 \quad x = -1/3$

7. A pole $7\sqrt{3}$ m high casts a shadow 21 m long on the ground, then the sun's elevation is : **1**

(A) 30º (B) 45º (C) 60º (D) 90º

Ans. (A) 30º

Sol.



A pole –

In ΔABC

$\tan\theta = \frac{P}{B}$

$\tan\theta = \frac{7\sqrt{3}}{21} = \frac{\sqrt{3}}{3} = \frac{1}{\sqrt{3}}$

$\tan\theta = \frac{1}{\sqrt{3}}$

$\theta = 30º$

8. The HCF of smallest 2–digit number and the smallest composite number is : **1**

(A) 2 (B) 20 (C) 40 (D) 4

Ans. (A) 2

Sol. smallest two digit no. is 10

smallest composite number is 4

HCF (4, 10) = 2

9. The total surface area of a solid hemisphere of radius 7 cm is : **1**

(A) $98\,\pi\ cm^2$ (B) $147\,\pi\ cm^2$ (C) $196\,\pi\ cm^2$ (D) $228\frac{2}{3}\pi\ cm^2$

Ans. (B) $147\,\pi\ cm^2$

Sol. T.S.A. of hemisphere $= 3\pi r^2 = 3\pi \times 7 \times 7 = 147\pi$

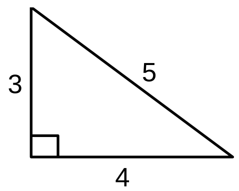
$$= 3 \times \frac{22}{7} \times 7 \times 7 = 462\ cm^2$$

10. If $\sin A = \frac{3}{5}$, then value of cot A is : **1**

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

Ans. (B) $\frac{4}{3}$

Sol.



$\sin A = \frac{3}{5}$

$\sin A = \frac{P}{H}$

$\cot A = \frac{B}{P} = \frac{4}{3}$

11. 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) $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

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

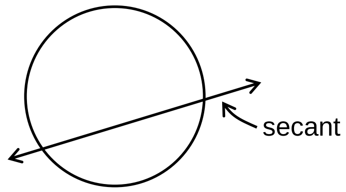
Sol. Condition for parallel lines be $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

12. A line intersecting a circle in two distinct point is called a **1**

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

Ans. (A) secant

Sol. Secont



13. The value of 'k' for which the pair of linear equations $x + y - 4 = 0$ and $2x + ky - 8 = 0$ has infinitely many solutions, is **1**

(A) $k \neq 2$ (B) $k \neq -2$ (C) $k = 2$ (D) $k = -2$

Ans. (C) $k = 2$

Sol. $x + y - 4 = 0$

$2x + ky - 8 = 0$

for infinitely sol^n

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$$

$x + y - 4 = 0$

$2x + ky - 8 = 0$

$$\frac{1}{2} = \frac{1}{k} = \frac{-4}{-8}$$

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

$k = 2$

14. 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) $-x^2 + 5x + 6$

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

Sol. quadratic poly^n x^2 – (sum of zeroes)x + produce

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

$x^2 + 5x + 6$

15. 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) $-1 \leq P(A) \leq 1$

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

Sol. $0 \leq P(A) \leq 1$

16. Which of the following quadratic equations has –1 as a root? **1**

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

Ans. (A) $x^2 - 4x - 5 = 0$

Sol. $x^2 - 4x - 5 = 0$

$x^2 - 5x + x - 5 = 0$

$x(x - 5) + 1(x - 5) = 0$

$(x + 1)(x - 5) = 0$

$x = -1$ & $x = 5$

17. The distance of the point (3, 4) from the origin is **1**

(A) 25 (B) 5 (C) 7 (D) 1

Ans. (B) 5

Sol. Distance of a point (x, y) from origin is $\sqrt{x^2 + y^2}$

$\sqrt{3^2 + 4^2} = \sqrt{9 + 16} = \sqrt{25} = 5$

18. If the first term of an AP is –3 and common, difference –2, then the seventh term is **1**

(A) –9 (B) 9 (C) –17 (D) –15

Ans. (D) –15

Sol. $a = -3$ $d = -2$

$a_7 = a + (6d)$

$= -3 + 6 \times (-2)$

$a_6 = -3 - 12 = -15$

(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) :** The point (0, 4) lies on y-axis. **1**

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).

20. **Assertion (A) :** A line drawn parallel to anyone 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.

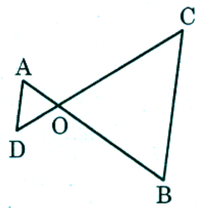
Ans. (C) Assertion (A) is true, but Reason (R) is false.

Section-B

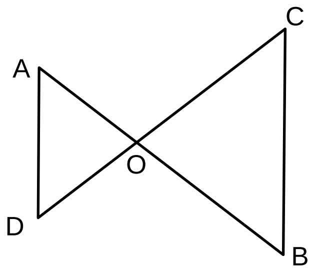
(Very Short Answer Type Questions)

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

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



Sol. Given OA. OB = OC. OD



To prove : ΔAOD ~ ΔCOB

In ΔAOD and ΔCOB

As OA. OB = OC.OD (Given)

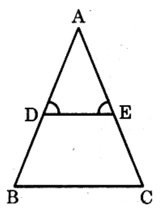
$\frac{OA}{OC} = \frac{OD}{OB}$

∠AOD = ∠BOC (Vertically opposite angles)

∴ ΔAOD ~ ΔCOB (SAS)

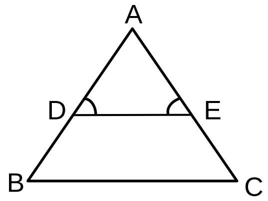
OR

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



Sol. Given $\angle D = \angle E$

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



To prove : ΔABC is isosceles

In ΔADE

$\angle D = \angle E$

$\Rightarrow AE = AE$ ……(i)

sides opposite to equal angles of a triangle are equal

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

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

$\therefore$ DB = EC ……(ii)

Now, Add (i) and (ii)

AD + DB = AE + EC

AB = AC

$\therefore$ ΔABC is isosceles

22. A lot consists of 165 ball pens of which 30 are defective and the others are good. Rakshita will buy a pen if it is good. The shopkeeper draws-one pen at random and gives it to Rakshita. What is the probability that she will buy it? **2**

Sol. Out of 165 balls pens 30 are defective $\Rightarrow$ 135 are good.

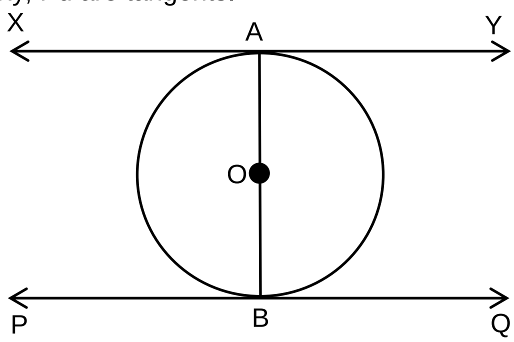
Rakshita only buys good pens so probability of buying the pen will be equal to the probability of drawing a good ball pen

So $\quad P = \frac{13.5}{165} = \frac{9}{11}$

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

Sol. Given : AB is diameter

xy, Pd are tangents.



To prove : XY || PQ

Now, $\angle OAY = 90°$

Line drawn from center to point or contact is 1 to the tangent

Similarly, $\angle OBP = 90°$

$\angle OAY = \angle OBQ$

They also form alternate interior angle.

$\therefore$ XY || PQ

24. Find the HCF of 84 and 144 by prime factorisation method. **2**

Sol. $84 = 2 \times 2 \times 3 \times 7$

$144 = 2 \times 2 \times 2 \times 2 \times 3 \times 3$

$HCF = 2 \times 2 \times 3 = 12$

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

Sol. Let number = a, b

According to question $a + b = 70$ … (i)

also $a - b = 30$ … (ii)

from (i) & (ii) $a = 50$ & $b = 20$

OR

(b) Solve for x and y :

$x - 3y = 7$

$3x - 3y = 5$

Sol. $x - 3y = 7$ … (i)

$3x - 3y = 5$ … (ii)

by (i) + (ii)

$4x = 12$

$\Rightarrow x = 3$

by putting $x = 3$ in eqn (i)

$3 - 3y = 7$

$3y = 3 - 7 = -4$

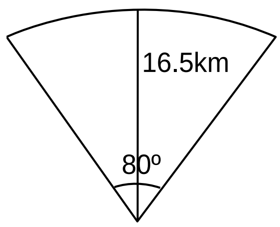
$y = -\frac{4}{3}$

Section-C
(Short Answer Type Questions)

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

26. To warn ships for underwater rocks, a light house spreads a red coloured light over a sector of angle 80º to a distance of 16.5 km. Find the area of the sea over which the ships are warned. (Use $\pi = 3.14$) **3**

Sol.



Distance over which light spread radius (r) = 16.5 km

Angle made by the sector = 80°

area of the sea over which the ships are warned.

= area of the sector

$= \frac{80^o}{360^o} \times pr^2 \text{ km}^2$

$= \frac{80^o}{360^o} \times p(16.5)^2$

$= 189.97 \text{ km}^2$

27. **(a)** Zeroes of the quadratic polynomial $x^2 + x - 6$ are 'α' and 'β. Construct a quadratic polynomial whose zeroes are $\frac{1}{\alpha}$ and $\frac{1}{\beta}$. **3**

Sol. Given zeros of quadratic polynomial $x^2 + x - 6$ are α and β

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

$\alpha\beta = \frac{c}{a} = \frac{-6}{1} = -6$

polynomial whose zeros are $\frac{1}{\alpha}$ and $\frac{1}{\beta}$

x^2 – (sum of zeros)x + product of zeros

$x^2 - \left(\frac{1}{\alpha} + \frac{1}{\beta}\right)x + \frac{1}{\alpha}.\frac{1}{\beta}$

$x^2 - \left(\frac{\alpha+\beta}{\alpha\beta}\right)x + \frac{1}{\alpha\beta}$

$x^2 - \frac{(-1)}{(-6)}x + \frac{1}{-6}$

$x^2 - \frac{1}{6}x - \frac{1}{6}$

OR

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

Sol. Given polynomial is $2x^2 + 3x - 2$

here a = 2, b = 3, c = – 2

for zeros $2x^2 + 3x - 2 = 0$

$2x^2 + (4 - 1)x - 2 = 0$

$2x^2 + 4x - x - 2 = 0$

$2x(x + 2) - 1(x + 2) = 0$

$(x + 2)(2x - 1) = 0$

$x = -2,\ x = \frac{1}{2}$

for verification relationship b/w zeros and coefficient.

sum of zeros $\alpha + \beta = -b/a = -\frac{3}{2}$

$\alpha + \beta = -2 + \frac{1}{2} = \frac{-4+1}{2} = \frac{-3}{2}$

product of zeroes $\alpha\beta = \frac{c}{a} = \frac{-2}{2} = -1$

$ab = (-2)\left(\frac{1}{2}\right)$

$= -1$

28. Prove that $\frac{\tan\theta}{1-\cot\theta}+\frac{\cot\theta}{1-\tan\theta}$ = 1 + secθ cosec θ **3**

Sol. L.H.S = $\frac{\tan\theta}{1-\cot\theta}+\frac{\cot\theta}{1-\tan\theta}$

$$= \frac{\frac{\sin\theta}{\cos\theta}}{1-\frac{\cos\theta}{\sin\theta}}+\frac{\frac{\cos\theta}{\sin\theta}}{1-\frac{\sin\theta}{\cos\theta}}$$

$$= \frac{\frac{\sin\theta}{\cos\theta}}{\frac{\sin\theta-\cos\theta}{\sin\theta}}+\frac{\frac{\cos\theta}{\sin\theta}}{\frac{\cos\theta-\sin\theta}{\cos\theta}}$$

$$= \frac{\sin^2\theta}{\cos\theta(\sin\theta-\cos\theta)}+\frac{\cos^2\theta}{\sin\theta(\cos\theta-\sin\theta)}$$

$$= \frac{\sin^2\theta}{\cos\theta(\sin\theta-\cos\theta)}-\frac{\cos^2\theta}{\sin\theta(\sin\theta-\cos\theta)}$$

$$= \frac{1}{(\sin\theta-\cos\theta)}\left[\frac{\sin^2\theta}{\cos\theta}-\frac{\cos^2\theta}{\sin\theta}\right]$$

$$= \frac{1}{\sin\theta-\cos\theta}\left[\frac{\sin^3\theta-\cos^3\theta}{\sin\theta\cos\theta}\right]$$

$$= \frac{(\sin\theta-\cos\theta)(\sin^2\theta+\cos^2\theta+\sin\theta\text{con}\theta)}{(\sin\theta-\cos\theta)\sin\theta\cos\theta}$$

$$= \frac{1+\sin\theta\text{con}\theta}{\sin\theta\cos\theta}$$

$$= \frac{1}{\sin\theta\cos\theta}+1$$

= 1 + secθ cosecθ

29. Two dice are tossed simultaneously. Find the probability of getting **3**

(a) an even number on both the dice.

(b) the sum of two numbers more than 9.

Sol. Total number are on a dice {1, 2, 3, 4, 5, 6}
when two dice are tossed
(a) then total numbers of outcomes = 6 × 6 = 36
total numbers when even numbers on both the dice are = 9
(2, 2), (2, 4), (2, 6), (4, 2), (4, 4), (4, 6), (6, 2), (6, 4), (6, 6)

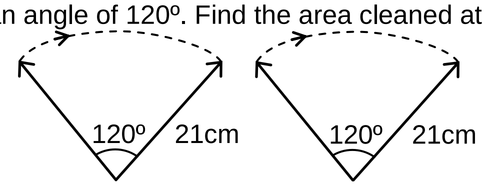
$\therefore$ probability of getting an even number on both the dice = $\frac{9}{36}$ **=** $\frac{1}{4}$

(b) favorable outcomes sum of two numbers more than (9) = 6
(6, 4), (6, 5), (6, 6), (5, 5), (5, 6), (4, 6)

$\therefore$ probability of sum more then (9) = $\frac{6}{36}$ = $\frac{1}{6}$

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

Sol.



area of sector = $\frac{120^\circ}{360^\circ} \times \pi r^2$

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

$= \frac{1}{3} \times \frac{22}{7} \times 21 \times 21$

$\frac{1}{3} \times 22 \times 3 \times 21$

$= 22 \times 21$

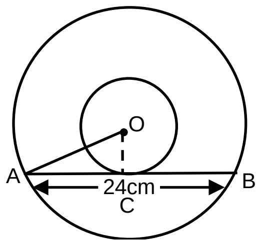
= 22 × 21

= 462 cm^2

∴ total area cleaned by both wipers = 2 × 462 = 924 cm^2

31. (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**

Sol. Given :-



Radius of smaller circle = 5 cm

Length of chord of larger circle = 24 cm.

In ΔOAC

$OA^2 = AC + CO^2$

$= 12^2 + 5^2$

= 144 + 25

$OA^2 = 169$

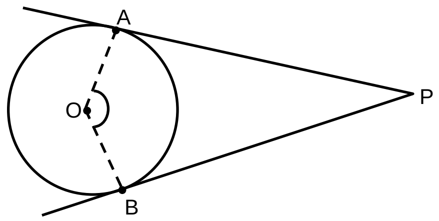
OA = 13 cm

∴ radius of larger circle = OA = 13 cm.

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**

Sol. To prove



$\angle AOB + \angle APB = 180^\circ$

We know that at point of contact radius is perpendicular at point of contact.

∴ $\angle OAP = \angle OBP = 90^\circ$

In quadrilateral APBO

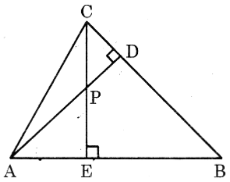
$\angle OAP + \angle APB + \angle PBO + \angle BOA = 360^\circ$

$90^\circ + \angle APB + 90^\circ + \angle BOA = 360^\circ$

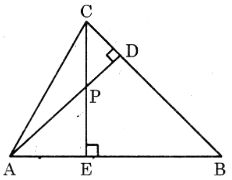
$\angle APB + \angle BOA = 180^\circ$ **Hence Prove.**

Section- D
(Long Answer Type Questions)
Q. Nos. 32 to 35 are Long Answer type questions of 5 marks each.

32. (a) In the given figure, altitudes CE and AD of ΔABC intersect each other at the point P. **1 + 2 + 2**
Show that
(i) ΔAEP ~ ΔCDP
(ii) ΔABD ~ ΔCBE
(iii) ΔAEP ~ ΔADB



Sol. Altitudes CE and AD to D ABC intersect each other at the point P.
(a) (i) In ΔAEP an ΔCDP
$\angle APE = \angle CPD$



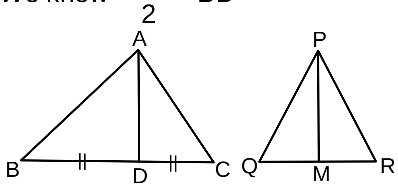
(Vertically opposite angle)
$\angle AEP = \angle CDP$ [90º]
by angle sum property $\angle APE = \angle CPD$ by AAA (similarity)
ΔAEP ~ ΔCDP Proved
(ii) In ΔABD and ΔCBE
$\angle ADB = \angle CEB$ [90º]
$\angle ABD = \angle CBE$ (Common angle)
By (AA similarity)
ΔABD ~ ΔCBE
(iii) In ΔAEP and ΔADB
$\angle PAE = \angle DAB$
$\angle PEA = \angle ADB$
(By AA similarity)
ΔAEP ~ ΔADB

OR

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

Sol. (b) AD and PM are median of triangle we know that ΔABC ~ ΔPQR then we can say $\frac{AB}{PQ} = \frac{AC}{PR} = \frac{BC}{QR}$.

We know $\frac{BC}{2} = BD$

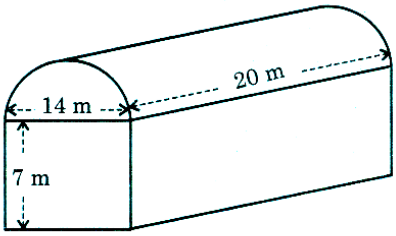


$\frac{QR}{2} = QM$

$\frac{AB}{PQ} = \frac{BD}{QM}$ ....(1)

$\angle ABD = \angle PQM$ .... (2)
because ΔABC ~ ΔPQR

33. (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? **5**

Sol. Base of the industry is of dimensions 14 m × 20m.

L = 14 m

B = 20 m

H = 7m

Total volume of air that industry hold

= volume of cuboidal partition + volume of half cylinder.

$= L \times B \times H + \frac{\pi R^2 h}{2}$

$= 14 \times 20 \times 7 + \frac{77}{2} \times \frac{7 \times 7 \times 20}{2}$

= 1960 + 1540

= 3500

Machinery occupies a total space = 400m^3

Space left in industry = 3500 – 400 = 3100 m^3

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**

Sol. Height of cylinder = 8 cm

radius of cylinder = 6 cm

a conical cavity of same height and same height is carved out .

Radius of cone = 6cm

height of cone = 8 cm

saint height = $\sqrt{8^2 + 6^2} = \sqrt{100}$ = 10 cm

Total surface area of the remaining solid

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

$= 2 \times \frac{22}{7} \times 6 \times 8 + \frac{22}{7} \times 6 \times 6 + \frac{22}{7} \times 6 \times 10$

$= \frac{22}{7} \times 6\, [16 + 6 + 10]$

$= \frac{22}{7} \times 6 \times 32$

= 603.42 cm^2

34. From the top of a 7 m high building, the angle of elevation of the top of a cable tower is, 60º and the angle of depression of its foot is 45°. Determine the height of the tower. (Use $\sqrt{3}$ = 1.732) **5**

Sol. Let the height of tower = HM

We know angle of elevation for tower = 60º

and angle of depression for tower = 45º

In ΔABC $\tan 60^\circ = \frac{H-7}{x}$

$\sqrt{3} = \frac{H-7}{x}$ ....(1)

In ΔBED $\tan 45 = \frac{7}{x}$

$1 = \frac{7}{x}$

x = 7m ....(2)

$\sqrt{3} = \frac{H-7}{7}$ put x = 7 in equation (1)

$7\sqrt{3} = H - 7$

$H = 7\sqrt{3} + 7$

$H = 7(\sqrt{3} + 1)$

35. A cottage industry produces a certain number of pottery articles in a day. It was observed that on a particular day that the cost of production' of each article (in rupees) was 3 more than twice the number of articles produced on that day. If the total cost of production on that day was Rs. 90, find the number of articles produced and the cost of each article. **5**

Sol. Let the number of articles produced in are day = x

Cost of each article will be = (3 + 2x)

Total cost of production = (3 + 2x) x = 90

$3x + 2x^2 = 90$

$2x^2 + 3x - 90 = 0$

$2x^2 + 15x - 12x - 90 = 0$

x[2x + 15] – 6[2x + 15] = 0

(2x + 15) (x - 6) = 0

2x + 15 = 0

$x = \frac{-15}{2}$ and x = 6

articles connot be negative cost of each article = 3 + 2 × 6 = 15 Rs.

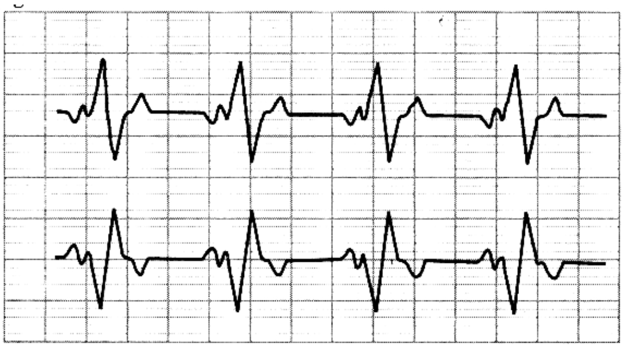
Number of articles = 6

Section- E

(Case Study based Questions)

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

36. 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**

Sol.

Number of heart beat per minute	Number of women	C.F.
65–68	2	2
68–71	4	6
71–74	3	9
74–77	8	17
77–80	7	24
80–83	7	28
83–86	2	30
	$\Sigma fi = 30$	

(i) No. of women are having heart beat in the range 68–77

68 – 71 $\rightarrow$ 4

71 – 74 $\rightarrow$ 3

74 – 77 $\rightarrow$ 8

(68–77) 15

(ii) Median class of heart beats per minute for these women is (74–77) because $\frac{N}{2}$ is $\frac{30}{2} = 15$

(iii) (a) Modal value of heart beat :

Mode = $\ell + \frac{f_1 - f_0}{2f_i - f_0 - f_2} \times h$

Modal class = 74 – 77

$\ell = 74$, h = 68 – 65 = 3

$f_0 = 3$

$f_1 = 8$

$f_2 = 7$

Mode = $74 + \frac{8-3}{16-3-7} \times 3$

$= 74 + \frac{5}{6} \times 3$ = 74 + 2.5

Mode = 76.5

(b) Median value of heart beat's

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

n = 30 So $\frac{n}{2} = \frac{30}{2} = 15$

this observation lie in 74 – 77

then $\ell = 74$

CF (the cumulative frequency of the class precediny 74 –77 = 9

f = 8

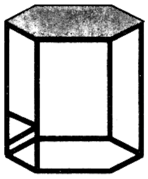
h = 3

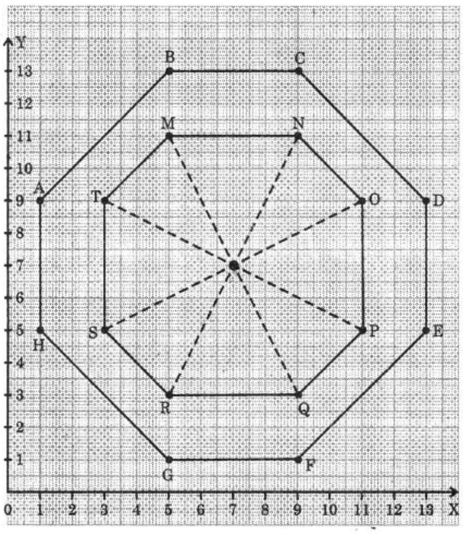
Median = $74 + \frac{(15-9)}{8} \times 3$

$= 74 + \frac{6}{8} \times 3 = 74 + \frac{18}{8}$ = 74 + 2.25

Median = 76.25

37. 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**

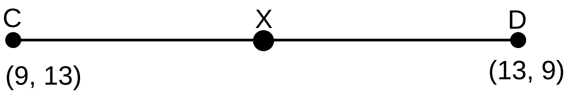
Sol. **(i)** Coordination of A = (1,9)

Coordinates of B = (5, 13)

(ii) Coordinated of point C = (9, 13)

Coordinate of point D = (13, 9)

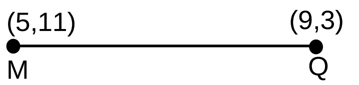
Now, Mid point of line segment joining C and D is X



$X = \frac{9+13}{2}, Y = \frac{13+9}{2}$

$X = \frac{22}{2}, Y = \frac{22}{2}$ Coordinates of point X is $= (11, 11)$

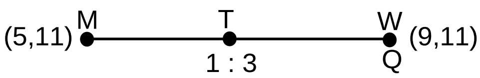
(iii) (a) Distance between M and Q



Distance = $\sqrt{(9-5)^2 + (3-11)^2} = \sqrt{16+24}$

$= \sqrt{80} = 4\sqrt{5}$

(iii) (b)

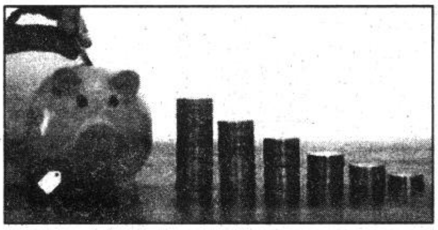


Let point T divide line segment M and N in 1 : 3

$$T = \left(\frac{9\times1+3\times5}{1+3}, \frac{1\times11+3\times11}{1+3}\right)$$

$$= \left(\frac{24}{4}, \frac{44}{4}\right) = (6, 11)$$

38. 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 Rs.5 coin of her savings in the piggy bank on the first day. She increases his savings by one Rs. 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 ays? **1**

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

OR

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

Sol. 5 Rs. coin is as added to piggy bank on first day and one 5 Rs. coin is increased daily so
first day $\rightarrow$ 5 Rs (1 coin)
second day $\rightarrow$ 10 Rs. (2, 5 Rs coin)
third day $\rightarrow$ 15 Rs. (3, 5 Rs. coin)
So AP $\rightarrow$ 5, 10, 15, 20, 25, ……..
(i) Amount added on 8^{th} day = A_8
So $a_8 = a + (n – 1)d$ (here a = 5, n = 8, d = 5)
$a_8 = 5 + 7 \times 5 = 40$

So no. of coin = $\frac{40}{5}$ = 8 coin Ans.

(ii) Total money after 8 days = S_8

$S_8 = \frac{n}{2}[2a + (n – 1)d]$

$S_8 = \frac{8}{2}[10 + 7 \times 5]$

= 4 × 45 = 180 Rs.

(iii) (a) Piggy bank with hold 120 coin
So amount = 120 × 5 = 600 Rs.
So, Sn = 600 Rs.
n = ?

$S_n = \frac{n}{2}[2a + (n – 1)d]$

$600 = \frac{n}{2}[10 + (n – 1)5]$

$600 \times 2 = n[10 + 5n – 5]$
$1200 = 5n + 5n^2$
$\Rightarrow n^2 + n = 240$
$n^2 + n – 240 = 0$
$(n + 16)(n – 15) = 0$
n = 15 & – 16 (×)
So she coin contribute till 15 days.

OR

(b) Total money when piggy bank will full = 120 × 5 = 600 Rs.