Class X Session 2025-26
Subject - Mathematics (Standard)
Sample Question Paper - 05

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

General Instructions:

Read the following instructions carefully and follow them:

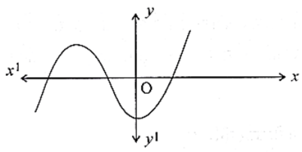
1. This question paper contains 38 questions.
2. This Question Paper is divided into 5 Sections A, B, C, D and E.
3. In Section A, Questions no. 1-18 are multiple choice questions (MCQs) and questions no. 19 and 20 are Assertion-Reason based questions of 1 mark each.
4. In Section B, Questions no. 21-25 are very short answer (VSA) type questions, carrying 02 marks each.
5. In Section C, Questions no. 26-31 are short answer (SA) type questions, carrying 03 marks each.
6. In Section D, Questions no. 32-35 are long answer (LA) type questions, carrying 05 marks each.
7. In Section E, Questions no. 36-38 are case study-based questions carrying 4 marks each with sub-parts of the values of 1,1 and 2 marks each respectively.
8. All Questions are compulsory. However, an internal choice in 2 Questions of Section B, 2 Questions of Section C and 2 Questions of Section D has been provided. An internal choice has been provided in all the 2 marks questions of Section E.
9. Draw neat and clean figures wherever required.
10. Take $\pi = 22/7$ wherever required if not stated.
11. Use of calculators is not allowed.

Section A

1. According to the Fundamental Theorem of Arithmetic, if p (a prime number) divides b^2 and b is positive, then ________. **[1]**

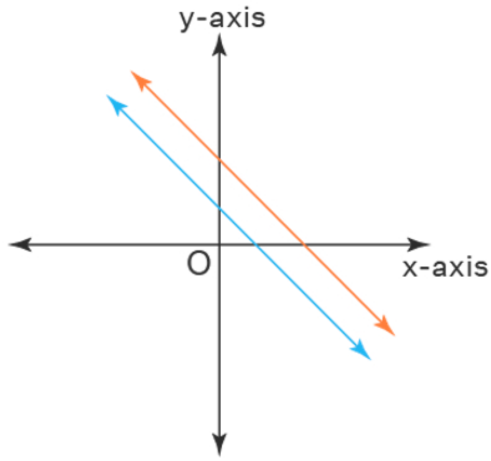
a) p divides b
b) b divides p
c) p^2 divides b
d) b^2 divides p

2. The graph of a polynomial is shown in Figure, then the number of its zeroes is: **[1]**



a) 1
b) 4
c) 2
d) 3

3. A system of linear equations is said to be inconsistent if it has **[1]**



a) one solution

b) at least one solution

c) two solutions

d) no solution

4. The roots of a quadratic equation are 5 and -2. Then, the equation is **[1]**

a) $x^2 + 3x - 10 = 0$

b) $x^2 - 3x - 10 = 0$

c) $x^2 + 3x + 10 = 0$

d) $x^2 - 3x + 10 = 0$

5. In an AP, if d = -4, n = 7 and $a_n = 4$, then the value of a is **[1]**

a) 28

b) 6

c) 20

d) 7

6. Distance of point P(4, - 3) from origin is: **[1]**

a) 4 units

b) 3 units

c) 5 units

d) ± 5 units

7. If P($\frac{a}{3}$, 4) is the mid-point of the line segment joining the points Q (-6, 5) and R (-2, 3), then the value of a is **[1]**

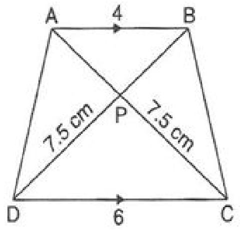
a) -6

b) -12

c) 12

d) -4

8. In the given figure, if AB||DC, then AP is equal to **[1]**



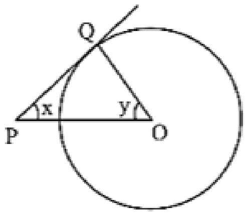
a) 7 cm.

b) 5 cm.

c) 5.5 cm.

d) 6 cm.

9. In the given figure, PQ is a tangent to the circle with centre O. If ∠OPQ = x, ∠POQ = y, then x + y is: **[1]**



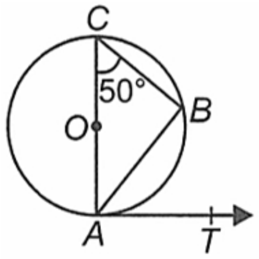
a) 60^o

b) 90^o

c) 180^o

d) 45^o

10. If O is the centre of a circle, AOC is its diameter and B is a point on the circle such that $\angle ACB = 50^o$. If AT is the tangent to the circle at the point A, then $\angle BAT$ = **[1]**



a) 40^o

b) 60^o

c) 50^o

d) 65^o

11. If x = 4 sin θ, y = 4 cos θ, then the value of $(x^2 + y^2)$ is: **[1]**

a) $\frac{1}{4}$

b) 4

c) $\frac{1}{16}$

d) 16

12. If tanθ = $\frac{m}{n}$, then $\frac{m \sin \theta - n \cos \theta}{m \sin \theta + n \cos \theta}$ = **[1]**

a) 1

b) $\frac{n^2-m^2}{n^2+m^2}$

c) $\frac{m^2+n^2}{m^2-n^2}$

d) $\frac{m^2-n^2}{m^2+n^2}$

13. The shadow of a 5 m long stick is 2 m long. At the same time, the length of the shadow of a 12.5 m high tree is **[1]**

a) 5 m

b) 3 m

c) 4.5 m

d) 3.5 m

14. A pendulum swings through an angle of 30^o and describes an arc 8.8 cm in length. Find the length of the pendulum. **[1]**

a) 17 cm

b) 8.8 cm

c) 15.8 cm

d) 16.8 cm

15. If the area of a sector of a circle is $\frac{7}{20}$ of the area of the circle, then the angle at the centre is equal to **[1]**

a) 126°

b) 110°

c) 130°

d) 100°

16. The king, queen and jack of clubs are removed from a deck of 52 cards and the remaining cards are shuffled. A card is drawn from the remaining cards. The probability of getting a king is **[1]**

a) $\frac{3}{52}$

b) $\frac{3}{49}$

c) $\frac{4}{49}$

d) $\frac{4}{52}$

17. One card is drawn at random from a well-shuffled deck of 52 playing cards. What is the probability of getting a black king? **[1]**

a) $\frac{1}{2}$

b) $\frac{1}{52}$

c) $\frac{1}{13}$

d) $\frac{1}{26}$

18. Consider the following frequency distribution: **[1]**

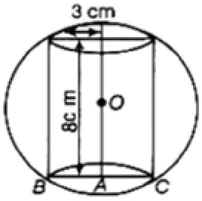
Class	65-85	85-105	105-125	125--145	145-165	165-185	185-205
Frequency	4	5	13	20	14	7	4

The difference of the upper limit of the median class and the lower limit of the modal class is

a) 0 b) 19

c) 20 d) 38

19. **Assertion (A):** In the given figure, a sphere circumscribes a right cylinder whose height is 8 cm and radius of the base is 3 cm. The ratio of the volumes of the sphere and the cylinder is 125 : 54 **[1]**



Reason (R): Ratio of their volume = $\frac{Volume\ of\ sphere}{Volume\ of\ cylinder}$

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

20. **Assertion (A):** $\sqrt{3}, 2\sqrt{3}, 3\sqrt{3}, 4\sqrt{3}$ this series forms an A.P. **[1]**

Reason (R): Since common difference is same and equal to $\sqrt{3}$ therefore given series is an AP.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

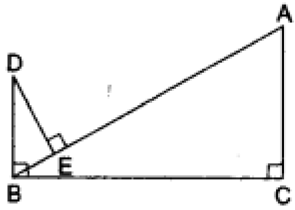
d) A is false but R is true.

Section B

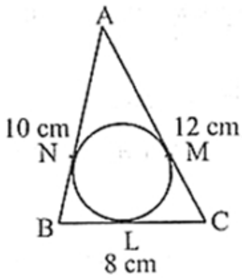
21. Find HCF of 81445 and 687897. **[2]**

22. In the given figure, $DB \perp BC$, $DE \perp AB$ and $AC \perp BC$. **[2]**

Prove that $\frac{BE}{DE} = \frac{AC}{BC}$



23. In Fig., a circle is inscribed in a $\triangle$ABC having sides BC = 8 cm, AB = 10 cm and AC = 12 cm. Find the lengths BL, CM and AN. **[2]**



24. If $x = a\cos^3\theta, y = b\sin^3\theta$, prove that $\left(\frac{x}{a}\right)^{2/3} + \left(\frac{y}{b}\right)^{2/3} = 1$ **[2]**

OR

Prove the identity: $\frac{\sin^2\theta}{1-\cos\theta} = \frac{1+\sec\theta}{\sec\theta}$

25. The short and long hands of a clock are 4 cm and 6 cm long respectively. Find the sum of distances travelled by their tips in 2 days. [Take π = 3.14.] **[2]**

OR

What is the diameter of a circle whose area is equal to the sum of the areas of two circles of diameters 10 cm and 24 cm.

Section C

26. In a school there are two sections, namely A and B, of class X. There are 30 students in section A and 28 students in section B. Find the minimum number of books required for their class library so that they can be distributed equally among students of section A or section B. **[3]**

27. Find the zeros of f(x) = x^2 - 2x - 8 and verify the relationship between the zeros and its coefficients. **[3]**

28. Graph the following pairs of equations. State whether the equations are consistent, inconsistent or dependent. x + 2y = 3; 2x + 4y = 8 **[3]**

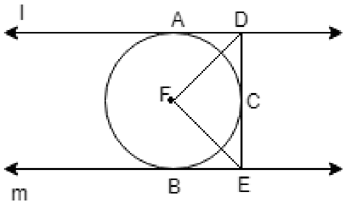
OR

Solve 2x +3y = 11 and 2x - 4y =− 24 and hence find the value of 'm' for which y = mx +3.

29. If a hexagon ABCDEF circumscribe a circle, prove that AB + CD + EF = BC + DE + FA. **[3]**

OR

In Fig. l and m are two parallel tangents at A and B. The tangent at C makes an intercept DE between l and m. Prove that $\angle DFE$ = 90^o.



30. If $\sin\theta$ - $\cos\theta$ = $\frac{1}{2}$, then find the value of $\frac{1}{\sin\theta+\cos\theta}$. **[3]**

31. Calculate the median from the following data: **[3]**

Rent (in Rs.)	15-25	25-35	35-45	45-55	55-65	65-75	75-85	85-95
No. of Houses	8	10	15	25	40	20	15	7

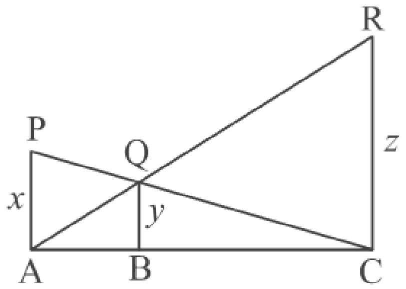
Section D

32. In a flight of 600 km, the speed of the aircraft was slowed down due to bad weather. The average speed of the trip was decreased by 200 km/hr and thus the time of flight increased by 30 minutes. Find the average speed of the aircraft originally. **[5]**

OR

A plane left 30 minutes later than the scheduled time and in order to reach its destination 1500 km away on time, it has to increase its speed by 250 km/hr from its usual speed. Find the usual speed of the plane.

33. In the given figure PA, QB and RC are each perpendicular to AC. If AP = x, BQ = y and CR = z, then prove that $\frac{1}{x} + \frac{1}{z} = \frac{1}{y}$ **[5]**



34. A lead pencil consists of a cylinder of wood with a solid cylinder of graphite filled into it. The diameter of the pencil is 7 mm, the diameter of the graphite is 1 mm and the length of the pencil is 10 cm. Calculate the weight of the whole pencil, if the specific gravity of the wood is 0.7 gm/cm^3 and that of the graphite is 2.1 $gm/\ cm^3$. **[5]**

OR

A solid iron pole consists of a solid cylinder of height 200 cm and base diameter 28 cm, which is surmounted by another cylinder of height 50 cm and radius 7 cm. Find the mass of the pole, given that 1 cm^3 of iron has approximately 8 g mass.

35. Find the missing frequencies in the following distribution, if the sum of the frequencies is 120 and the mean is 50. **[5]**

Class	0-20	20-40	40-60	60-80	80-100
Frequency	17	f_1	32	f_2	19

Section E

36. **Read the following text carefully and answer the questions that follow:** **[4]**

The students of a school decided to beautify the school on an annual day by fixing colourful flags on the straight passage of the school. They have 27 flags to be fixed at intervals of every 2 metre. The flags are stored at the position of the middlemost flag. Ruchi was given the responsibility of placing the flags. Ruchi kept her books where the flags were stored. She could carry only one flag at a time.

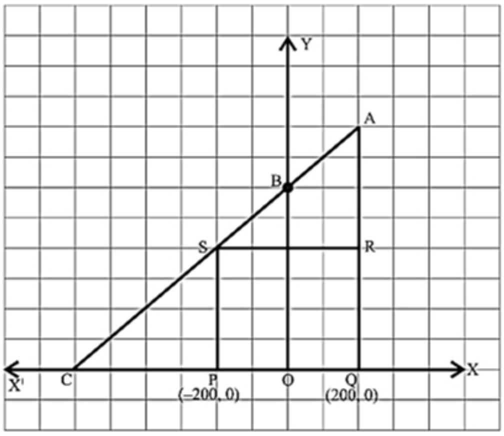
i. How much distance did she cover in pacing 6 flags on either side of center point? (1)
ii. Represent above information in Arithmetic progression. (1)
iii. How much distance did she cover in completing this job and returning to collect her books? (2)

OR

What is the maximum distance she travelled carrying a flag? (2)

37. **Read the following text carefully and answer the questions that follow:** **[4]**

Jagdish has a field which is in the shape of a right angled triangle AQC. He wants to leave a space in the form of a square PQRS inside the field for growing wheat and the remaining for growing vegetables (as shown in the figure). In the field, there is a pole marked as O.



i. Taking O as origin, coordinates of P are (-200, 0) and of Q are (200, 0). PQRS being a square, what are the coordinates of R and S? (1)

ii. What is the area of square PQRS? (1)

iii. What is the length of diagonal PR in square PQRS? (2)

OR

If S divides CA in the ratio K : 1, what is the value of K, where point A is (200, 800)? (2)

38. **Read the following text carefully and answer the questions that follow:** **[4]**

Totem poles are made from large trees. These poles are carved with symbols or figures and mostly found in western Canada and northwestern United States.

In the given picture, two such poles of equal heights are standing 28 m apart. From a point somewhere between them in the same line, the angles of elevation of the top of the two poles are 60^{o} and 30^{o} respectively.

i. Draw a neat labelled diagram. (1)

ii. Find the height of the poles. (1)

iii. If the distances of the top of the poles from the point of observation are taken as p and q, then find a relation between p and q. (2)

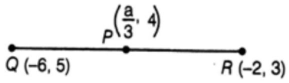
OR

Find the location of the point of observation. (2)

Solution

Section A

1. **(a)** p divides b
   Explanation:
   If p divides b^2, then p also divides b.
2. **(d)** 3
   Explanation:
   The graph of given polynomial cuts the x-axis at 3 distinct points.
   therefore, No. of zeroes are 3.
3. **(d)** no solution
   Explanation:
   A system of linear equations is said to be inconsistent if it has no solution means two lines are running parallel and not cutting each other at any point.
4. **(b)** $x^2 - 3x - 10 = 0$
   Explanation:
   Sum of the roots = 5 + (-2) = 3, product of roots = $5 \times (-2) = -10$.
   $\therefore x^2$ - (sum of roots) x + product of roots = 0.
   Hence, $x^2 - 3x - 10 = 0$.
5. **(a)** 28
   Explanation:
   Given: d = -4, n = 7 and $a_n = 4$
   $\therefore a_n = a + (n - 1)d$
   $\Rightarrow 4 = a + (7 - 1) \times (-4)$
   $\Rightarrow 4 = a + 6 \times -4$
   $\Rightarrow 4 = a - 24$
   $\Rightarrow a = 28$
6. **(c)** 5 units
   Explanation:
   5 units
7. **(b)** -12
   Explanation:
   Given, P is the mid - point of the line segment joining the points Q and R
   Where;
   $P = \left(\frac{a}{3}, 4\right)$
   Q = (- 6, 5)
   R = (- 2, 3)
   Shown in the figure given below;



$\therefore$ Mid - point of QR = P$\left(\frac{-6-2}{2}, \frac{5+3}{2}\right)$ = (-4, 4)

P = (- 4, 4)

Since, midpoint of line segment having points (x_1, y_1) and (x_2, y_2);

= $\left(\frac{(x_1+x_2)}{2}, \frac{(y_1+y_2)}{2}\right)$

But given coordinates of mid - point P is $\left(\frac{a}{3}, 4\right)$;

$\therefore$ $\left(\frac{a}{3}, 4\right)$ = (- 4, 4)

On comparing the coordinates, we get

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

$\therefore$ a = - 12

Hence, the required value of a = - 12

8.

(b) 5 cm.

Explanation:

In triangles APB and CPD,

$\angle$APB = $\angle$CPD [Vertically opposite angles] $\angle$BAP = $\angle$ACD [Alternate angles as $AB||CD$]

$\therefore\Delta$APB $\sim$ ΔCPD [AA similarity]

$\therefore \frac{\text{AB}}{\text{CD}} = \frac{\text{CP}}{\text{AP}}$

$\Rightarrow \frac{4}{6} = \frac{\text{AP}}{7.5}$

$\Rightarrow$ AP = $\frac{7.5\times4}{6}$ = 5 cm

9.

(b) 90^o

Explanation:

Given, $\angle$OPQ = x, $\angle$POQ = y

$\angle$OQP = 90^o ($\because$ Radius is perpendicular to the tangent at the point of contact.)

In $\triangle$OPQ,

$\angle$OPQ + $\angle$POQ + $\angle$OQP = 180^o (angle sum property)

$\Rightarrow$ x + y + 90^o = 180^o

$\Rightarrow$ x + y = 180^o - 90^o = 90^o

10.

(c) 50^o

Explanation:

$\angle$ABC = 90^o [Angle in semicircle]

In $\triangle$ABC, we have

$\angle ACB + \angle CAB + \angle ABC = 180^\circ$

$\Rightarrow 50^\circ + \angle CAB + 90^\circ = 180^\circ$

$\Rightarrow \angle CAB = 40^\circ$

Now, $\angle CAT = 90^\circ \Rightarrow \angle CAB + \angle BAT = 90^\circ$

$\Rightarrow 40^\circ + \angle BAT = 90^\circ \Rightarrow \angle BAT = 50^\circ$

11.

(d) 16

Explanation:

x = 4 sinθ
y = 4 cosθ
now,
$x^2 + y^2 = (4\sin\theta)^2 + (4\cos\theta)^2$
$= 16\sin^2\theta + 16\cos^2\theta$
$= 16\left(\sin^2\theta + \cos^2\theta\right)$
= 16(1) = 6

12.
(d) $\frac{m^2-n^2}{m^2+n^2}$
Explanation:
Given: tanθ = $\frac{m}{n}$
Dividing all the terms of $\frac{m\sin\theta - n\cos\theta}{m\sin\theta + n\cos\theta}$ by $\cos\theta$,
= $\frac{m\tan\theta - n}{m\tan\theta + n}$
= $\frac{m\times\frac{m}{n} - n}{m\times\frac{m}{n} + n}$
= $\frac{m^2-n^2}{m^2+n^2}$

13. **(a)** 5 m
Explanation:
Ratio of lengths of objects = ratio of lengths of their shadows.
Let the length of shadow of the tree be x m. Then,
$\frac{5}{12.5} = \frac{2}{x} \Rightarrow$ 5x = 2 × 12.5 = 25
$\Rightarrow$ x = 5

14.
(d) 16.8 cm
Explanation:
Length of the pendulum = Radius of a sector of the circle
Arc length = 8.8
{tex}\frac{θ}{360} (2πr){/tex} = 8.8
$\frac{30}{360} \times 2 \times \frac{22}{7} \times r$ = 8.8
r = 16.8 cm

15. **(a)** 126°
Explanation:
We have given that area of the sector is $\frac{7}{20}$ of the area of the circle.
Therefore, area of the sector $= \frac{7}{20} \times$ area of the circle
$\therefore \frac{\theta}{360} \times \pi r^2 = \frac{7}{20} \times \pi r^2$
Now we will simplify the equation as below,
$\frac{\theta}{360} = \frac{7}{20}$
Now we will multiply both sides of the equation by 360,
$\therefore \theta = \frac{7}{20} \times 360$
$\therefore \theta = 126$
Therefore, sector angle is 126°.

16.
(b) $\frac{3}{49}$
Explanation:
K , Q , J of clubs i.e 3 cards are removed , therefore remaining cards = 52 - 3 = 49
3 kings are left in the pack
Number of possible outcomes = 3

Number of total outcomes = 52 - 3 = 49

$\therefore$ Required Probability = $\frac{3}{49}$

17.

(d) $\frac{1}{26}$

Explanation:

black kings = club king + spade king = 2

Number of possible outcomes = 2

Number of Total outcomes = 52

$\therefore$ Required Probability = $\frac{2}{52} = \frac{1}{26}$

18.

(c) 20

Explanation:

Class	Frequency	Cumulative frequency
65-85	4	4
85-105	5	9
105-125	13	22
125-145	20	42
145-165	14	56
165-185	7	63
185-205	4	67

Here, $\frac{N}{2} = \frac{67}{2} = 33.5$ which lies in the interval 125-145.

Hence, upper limit of median class is 145.

Here, we see that the highest frequency is 20 which lies in 125-145.

Hence, the lower limit of modal class is 125.

$\therefore$ Required difference = upper limit of median class - lower limit of modal class

= 145 - 125 = 20

19. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation:

Both A and R are true and R is the correct explanation of A.

20. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation:

Both A and R are true and R is the correct explanation of A.

Section B

21. Two positive integers are 687897 and 81445.

By applying Euclid's division lemma

687897 = 81445$\times$8 + 36337

81445 = 36337$\times$2 + 8771

36337 = 8771$\times$4 + 1253

8771 = 1253$\times$7 + 0

$\therefore$ HCF = 1253

22. In $\triangle BED$ and $\triangle ACB$, we have

$\angle BED = \angle ACB = 90^{\circ}$

$\because \angle B + \angle C = 180^0$

$\therefore BD \| AC$

$\angle EBD = \angle CAB$ (Alternate angles)

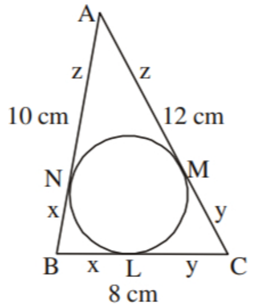
Therefore, by AA similarity theorem, we get

$\triangle BED \sim \triangle ACB$

$\Longrightarrow \frac{BE}{AC} = \frac{DE}{BC}$

$\Longrightarrow \frac{BE}{DE} = \frac{AC}{BC}$

23. Let BL = BN = x (tangents from external points are equal)



CL = CM = y

AN = AM = z

$\therefore$ AB + BC + AC = 2x + 2y + 2z = 30

$\Rightarrow$ x + y + z = 15 ...(i)

Also x + z = 10, x + y = 8 and y + z = 12

Subtracting from equation (i)

y = 5, z = 7 and x = 3

$\therefore$ BL = 3 cm, CM = 5 cm and AN = 7 cm.

24. We have,

$x = a\cos^3\theta, y = b\sin^3\theta$

$\frac{x}{a} = \cos^3\theta \ and \ \frac{y}{b} = \sin^3\theta$

L.H.S $= \left[\frac{x}{a}\right]^{2/3} + \left[\frac{y}{b}\right]^{2/3}$

$= \left[\cos^3\theta\right]^{2/3} + \left[\sin^3\theta\right]^{2/3} \ [\because (a^m)^n = a^{m\times n}]$

$= \cos^2\theta + \sin^2\theta$

= 1 $\left[\because \cos^2\theta + \sin^2\theta = 1\right]$

= R.H.S.

Hence proved.

OR

$\frac{\sin^2\theta}{1-\cos\theta} = \frac{1+\sec\theta}{\sec\theta}$

L.H.S. $= \frac{\sin^2\theta}{1-\cos\theta} = \frac{1-\cos^2\theta}{1-\cos\theta} \quad \left[\because \sin^2\theta = 1 - \cos^2\theta\right]$

$= \frac{(1+\cos\theta)(1-\cos\theta)}{(1-\cos\theta)} = 1 + \cos\theta \ldots\ldots (1)$

R. H. S. $= \frac{1+\sec\theta}{\sec\theta} = \frac{1}{\sec\theta} + \frac{\sec\theta}{\sec\theta}$

$= \cos\theta + 1 = 1 + \cos\theta$ .... (2)

From (1) and (2), we have L.H.S. = R.H.S. proved.

25. The hour hand covers 4 complete circles in 2 days (48 hours)

Distance = $2 \times \frac{22}{7} \times 4 \times 4$

= 100.57 cm

The minute hand covers = 48 Circles in 2 days (Each hour = 1 circle)

Distance =$2 \times \frac{22}{7} \times 6 \times 48$

= 1810.23 cm

Total distance = 100.57 + 1810.23

= 1910.8 cm

OR

Let the radius of the large circle be R.

Then, we have

Area of large circle of radius R = Area of a circle of radius 5 cm+ Area of a circle of radius 12 cm

$\Rightarrow \pi R^2 = \left(\pi \times 5^2 + \pi \times 12^2\right)$

$\Rightarrow \pi R^2 = (25\pi + 144\pi)$

$\Rightarrow \pi R^2 = 169\pi$

$\Rightarrow R^2 = 169$

$\Rightarrow$ R = 13 cm

$\Rightarrow$ Diameter = 2R

= 26 cm

Section C

26. As per question, the required number of books are to be distributed equally among the students of section A or B.

There are 30 students in section A and 28 students in section B.

So, the number of these books must be a multiple of 30 as well as that of 28.

Consequently, the required number is LCM(30, 28).

Now, $30 = 2 \times 3 \times 5$

and $28 = 2^2 \times 7$.

$\therefore$ LCM(30, 28) = product of prime factors with highest power

$= 2^2 \times 3 \times 5 \times 7$

$= 4 \times 3 \times 5 \times 7$

= 420

Hence, the required number of books = 420.

27. $f(x) = x^2 - 2x - 8$

$= x^2 - 4x + 2x - 8$

= x(x - 4) + 2(x - 4)

= (x + 2) (x - 4)

f(x) = 0 if x+2 = 0 or x-4 = 0

x = -2 or 4

So the zeroes of the polynomials are -2 and 4.

For the Polynomial $f(x)=x^2 - 2x - 8$

a=1,b=-2, c=-8

Sum of the zeroes = - 2 + 4 = 2 = $-\frac{b}{a}$

Product of zeros =(-2)(4) = -8 = $\frac{c}{a}$

Hence, the relationship between the zeros and coefficients is verified.

28. x + 2y = 3 $\Rightarrow y = \frac{3-x}{2}$

x	1	-1	3
y	1	2	0

Points are (1, 1), (-1, 2) and (3, 0)

2x + 4y = 8 $\Rightarrow y = \frac{8-2x}{4}$

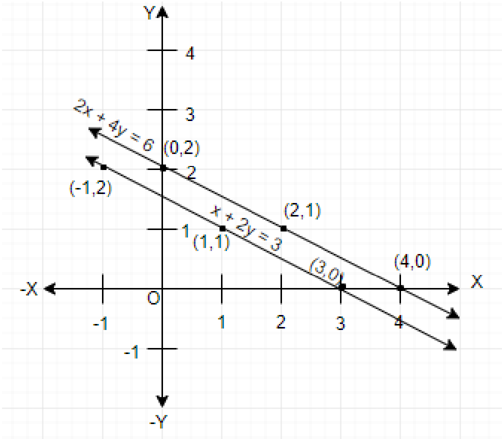
x	0	2	4
y	2	1	0

Points are (0, 2), (2, 1) and (4, 0)

The graph of the two equations represent a pair of parallel lines.

There is no common solution.

Hence, the pair of equations is inconsistent.



OR

2x +3y =11 .... (1)

2x−4y =−24 .... (2)

Using equation (2), we can say that

2x =−24 + 4y

⇒ x =−12 + 2y

Putting this in equation (1), we get

2(−12 + 2y)+3y =11 ⇒ −24 + 4y + 3y =11

⇒ 7y =35 ⇒ y =5

Putting value of y in equation (1), we get

2x +3(5)=11 ⇒ 2x +15=11

⇒ 2x =11 - 15=−4 ⇒ x =−2

Therefore, x =−and y =5

Putting values of x and y in y =mx +3, we get

5=m (−2) + 3 ⇒ 5 =−2m +3

⇒ −2m =2 ⇒ m =−1

29. Hexagon ABCDEF touches a circle at G, H, I, J, K, L. So, from the external point tangents drawn on the circle are equal in length.

If A is external point and AG and AL are tangents, so

AG = AL ...(i)

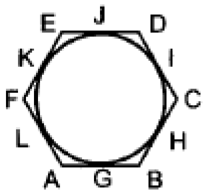
Similarly for B, BG = BH ...(ii)

Similarly for C, Cl = CH ... (iii)

Similarly for D, DI = DJ ... (iv)

EK = EJ ... (v)

and FK = FL ... (vi)



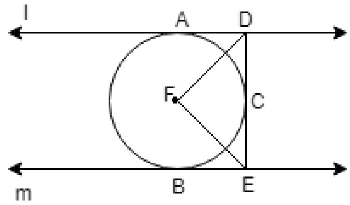
Adding (i), (ii), (iii), (iv), (v) and (vi), we get

$AG + BG + CI + ID + EK + FK = BH + CH + DJ + EJ + FL + AL$

$\Rightarrow (AG + BG) + (CI + ID) + (EK + FK) = (BH + CH) + (JD + EJ) + (FL + AL)$

$\Rightarrow AB + CD + EF = BC + DE + FA.$

OR



Since tangents drawn from an external point to a circle are equal. Therefore, DA = DC.

Thus, in triangles ADF and DFC, we have
DA = DC
DF = DF Common]
AF = CF (radii of the circle)
So, by SSS-criterion of congruence, we obtain
$\Delta ADF \cong \Delta DFC$
$\Rightarrow \quad \angle ADF = \angle CDF$
$\Rightarrow \quad \angle ADC = 2\angle CDF$ ...(i)
Similarly, we can prove that
$\angle BEF = \angle CEF$
$\Rightarrow \quad \angle CEB = 2\angle CEF$ .....(ii)
Now, $\angle ADC + \angle CEB$ = 180° (Sum of the interior angles on the same side of transversal is 180^{o})
$\Rightarrow 2\angle CDF + 2\angle CEF$ = 180° [Using equations (i) and (ii)]
$\Rightarrow \angle CDF + \angle CEF$ = 90°
$\Rightarrow 180^\circ - \angle DFE = 90^\circ \left[\begin{array}{l}\because \angle CDF, \angle CEF \text{ and } \angle DFE \text{ are angles of a triangle} \\ \therefore \angle CDF + \angle CEF + \angle DFE = 180^\circ\end{array}\right.$
$\Rightarrow \quad \angle DFE = 90^\circ$

30. Here, sin θ - cos θ = $\frac{1}{2}$
Squaring both sides, we get
(sin θ - cos $\theta)^2$ = $\left(\frac{1}{2}\right)^2$
$\Rightarrow$ $\sin^2\theta$ + $\cos^2\theta$ - 2 sin θ . cos θ = $\frac{1}{4}$
1 - 2 sin θ . cos θ = $\frac{1}{4}$ ($\therefore$ $\sin^2\theta$. $\cos^2\theta$ = 1)
$\Rightarrow$ 1 - $\frac{1}{4}$ = 2 sin θ . cos θ
$\Rightarrow$ 2 sin θ . cos θ = $\frac{3}{4}$ ...(i)
Now (sin θ + cos $\theta)^2$ = $\sin^2\theta$ + $\cos^2\theta$ + 2sin θ cos θ
= 1 + $\frac{3}{4}$ (using (i)
$\Rightarrow$ (sin θ + cos θ) = $\sqrt{\frac{7}{4}}$
$\Rightarrow \frac{1}{\sin\theta+\cos\theta} = \frac{2}{\sqrt{7}} = \frac{2\sqrt{7}}{7}$

31.

Class interval	Frequency	Cumulative frequency
15-25	8	8
25-35	10	18
35-45	15	33
45-55	25	58(F)
55-65	40(f)	98
65-75	20	118
75-85	15	133
85-95	7	140
	$N = 140$	

$N = 140$
$\therefore \quad \frac{N}{2} = \frac{140}{2} = 70$
The cumulative frequency just greater than $\frac{N}{2}$ is 98.
$\therefore$ median class is 55-65 .
$l = 55, f = 40, F = 58, h = 65 - 55 = 10$
$\therefore$ Median $= l + \frac{\frac{N}{2} - F}{f} \times h$

$= 55 + \frac{70-58}{40} \times 10$
$= 55 + 3$
$= 58$

Section D

32. Let average speed of aircraft be x km/h

$\frac{600}{x-200} - \frac{600}{x} = \frac{1}{2}$

x^2 - 200x – 240000 = 0

(x - 600) (x + 400) = 0

x = 600 km/h

∴ Original speed = 600 km/h

OR

Let the usual speed of the plane be x km/hr.

Then, time taken to cover 1500 km with the usual speed = $\frac{Distance}{Speed}$ = $\frac{1500}{x} hrs$

Increased speed be (x + 250) km/hr

Time taken to cover 1500 km with the increased speed = $\frac{1500}{x+250} hrs$

According to the question

$\frac{1500}{x} - \frac{1500}{x+250} = 30min = \frac{1}{2}$

$\Rightarrow \frac{1500x+1500\times250-1500x}{x(x+250)} = \frac{1}{2}$

$\Rightarrow \frac{1500\times250}{x^2+250x} = \frac{1}{2}$

$\Rightarrow$ x^2 + 250x - 750000 = 0

$\Rightarrow$ x^2 + 1000x - 750x - 750000 = 0

$\Rightarrow$ x(x + 1000) - 750 (x + 1000) = 0

$\Rightarrow$ (x + 1000) (x - 750) = 0

Either x + 1000 = 0 or x - 750 = 0

$\Rightarrow$ x = -1000, 750

But speed of the plane cannot be negative. So, x = 750.

Hence, the usual speed of the plane is 750 km/hr.

33. $\Delta PAC \sim \Delta QBC$

∴ $\frac{x}{y} = \frac{AC}{BC}$ or $\frac{y}{x} = \frac{BC}{AC}$ ...(i)

$\Delta RCA \sim \Delta QBA$

∴ $\frac{z}{y} = \frac{AC}{AB}$ or $\frac{y}{z} = \frac{AB}{AC}$ ...(ii)

Adding (i) and (ii)

$\frac{y}{x} + \frac{y}{z} = \frac{BC+AB}{AC}$

$\Rightarrow \frac{1}{x} + \frac{1}{z} = \frac{1}{y}$

34. We have, Diameter of the graphite cylinder = 1 mm = $\frac{1}{10}$ cm

∴ Radius of graphite (r) = $\frac{1}{20}$cm = 0.05 cm

Length of the graphite cylinder =10 cm

Volume of the graphite cylinder = $\frac{22}{7} \times (0.05)^2 \times 10$

= 0.0785 cm^3

Weight of graphite = Volume$\times$ Specific gravity

= 0.0785 $\times 2.1$

= 0.164 gm

Diameter of pencil = $7\text{mm} = \frac{7}{10}$cm = 0.7 cm

∴ Radius of pencil =$\frac{7}{20}$cm = 0.35 cm

and, Length of pencil = 10 cm

∴ Volume of pencil = {tex}\style{font-size:11px}{\mathrm{πr}^2\mathrm h}{/tex}

= $\frac{22}{7} \times (0.35)^2 \times 10\ \text{cm}^3$ = 3.85 cm^3

Volume of wood = volume of the pencil - volume of graphite

= (3 .85 - 0.164) cm^3= 3. 686 gm

∴ Weight of wood = volume density

$= 3.686 \times 0.7 = 3.73$

Hence, Total weight = (3.73+ 0.164) gm = 3.894gm.

OR

Radius of lower cylinder = 14 cm

Volume of pole $= \frac{22}{7} \times 14 \times 14 \times 200 + \frac{22}{7} \times 7 \times 7 \times 50$

$= 130900 \text{ cm}^3$

Mass of the pole = 8×130900

= 1047200 gm or 1047.2 kg

35.

Class Interval	**Frequency f_i**	**Mid-value x_i**	**$f_i x_i$**
0-20	17	10	170
20-40	f_1	30	$30f_1$
40-60	32	50	1600
60-80	f_2	70	$70f_2$
80-100	19	90	1710
	$\sum f_i = 68 + f_1 + f_2 = 120$		$\sum f_i x_i = 3480 + 30f_1 + 70f_2$

given mean = 50

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

$\Rightarrow 50 = \frac{3480+30f_1+70f_2}{120}$

$\Rightarrow 6000 = 3480 + 30f_1 + 70f_2$

$\Rightarrow 30f_1 + 70f_2 = 252$ ...(i)

Also,$68 + f_1 + f_2 = 120$

$\Rightarrow f_1 = 52 - f_2$

Substituting in (i), we have

$3(52 - f_2) + 7f_2 = 252$

$\Rightarrow 4f_2 = 96$

$\Rightarrow f_2 = -24$

$\Rightarrow f_1 = 52 - 24 = 28$

Hence, $f_1 = 28$ and $f_2 = 24$

Section E

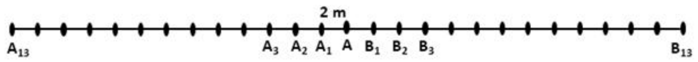
36. i. Distance covered in placing 6 flags on either side of center point is 84 + 84 = 168 m

$S_n = \frac{n}{2}[2a + (n - 1)d]$

$\Rightarrow S_6 = \frac{6}{2}[2 \times 4 + (6 - 1) \times 4]$

$\Rightarrow S_6 = 3[8 + 20]$

$\Rightarrow S_6 = 84$

ii. 

Let A be the position of the middle-most flag.

Now, there are 13 flags (A_1, A_2 ... A_{12}) to the left of A and 13 flags (B_1, B_2, B_3 ... B_{13}) to the right of A.

Distance covered in fixing flag to A_1 = 2 + 2 = 4 m

Distance covered in fixing flag to A_2 = 4 + 4 = 8 m

Distance covered in fixing flag to A_3 = 6 + 6 = 12 m

Distance covered in fixing flag to A_{13} = 26 + 26 = 52 m

This forms an A.P. with,

First term, a = 4

Common difference, d = 4

and n = 13

iii. ∴ Distance covered in fixing 13 flags to the left of A = S_{13}

$S_n = \frac{n}{2}[2a + (n - 1)d]$

$\Rightarrow S_{13} = \frac{13}{2}[2 \times 4 + 12 \times 4]$

$= \frac{13}{2} \times [8 + 48]$

$= \frac{13}{2} \times 56$

= 364

Similarly, distance covered in fixing 13 flags to the right of A = 364

Total distance covered by Ruchi in completing the task

= 364 + 364 = 728 m

OR

Maximum distance travelled by Ruchi in carrying a flag

= Distance from A_{13} to A or B_{13} to A = 26 m

37. i. Since, PQRS is a square

∴ PQ = QR = RS = PS

Length of PQ = 200 - (-200) = 400

∴ The coordinates of R = (200, 400)

and coordinates of S = (-200, 400)

ii. Area of square PQRS = $(\text{side})^2$

$= (PQ)^2$

$= (400)^2$

= 1,60,000 sq. units

iii. By Pythagoras theorem

$(PR)^2 = (PQ)^2 + (QR)^2$

= 1,60,000 + 1,60,000

= 3,20,000

$\Rightarrow PR = \sqrt{3,20,000}$

$= 400 \times \sqrt{2}$ units

OR

Since, point S divides CA in the ratio K : 1

$\therefore \left(\frac{Kx_2+x_1}{K+1}, \frac{Ky_2+y_1}{K+1}\right)$ = (-200, 400)

$\Rightarrow \left(\frac{K(200)+(-600)}{K+1}, \frac{K(800)+0}{K+1}\right)$ = (-200, 400)

$\Rightarrow \left(\frac{200K-600}{K+1}, \frac{800K}{K+1}\right)$ = (-200, 400)

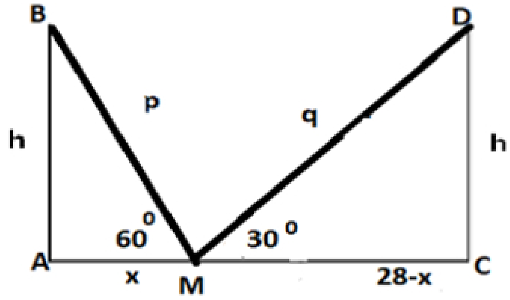
$\therefore \frac{800K}{K+1} = 400$

$\Rightarrow$ 800K = 400K + 400

$\Rightarrow$ 400K = 400

$\Rightarrow$ K = 1

38. i. Let AB and CD be the 2 poles and M be a point somewhere between their bases in the same line.



ii. $\tan 60^o = \frac{h}{x} \Rightarrow h = x\sqrt{3}$

$\tan 30^o = \frac{h}{28-x} \Rightarrow h = \frac{(28-x)}{\sqrt{3}}$

$\therefore h = 7\sqrt{3}$ m

iii. BM = p and DM = q

sin 60^{o} = $\frac{h}{p}$ $\Rightarrow$ h = $\frac{p\sqrt{3}}{2}$

sin 30^{o} = $\frac{h}{q}$ $\Rightarrow$ h = $\frac{q}{2}$

$\therefore$ $\frac{p\sqrt{3}}{2}$ = $\frac{q}{2}$ $\Rightarrow$ q = $\sqrt{3}$p

OR

tan 60^{o} = $\frac{7\sqrt{3}}{x}$ $\Rightarrow$ x = 7m = AM

MC = 28 - x = 21m