

## Sample Question Paper (2023-24)

Class – X

Basic Mathematics (241)

Time Allowed: 3 Hrs

Maximum Marks: 80

### General Instructions:

1. This Question Paper has 5 Sections A, B, C, D, and E.
2. Section A has 20 Multiple Choice Questions (MCQs) carrying 1 mark each.
3. Section B has 5 Short Answer-I (SA-I) type questions carrying 2 marks each.
4. Section C has 6 Short Answer-II (SA-II) type questions carrying 3 marks each.
5. Section D has 4 Long Answer (LA) type questions carrying 5 marks each.
6. Section E has 3 sourced based/Case Based/passage based/integrated units of assessment (4 marks each) with sub-parts of the values of 1, 1 and 2 marks each respectively.
7. All Questions are compulsory. However, an internal choice in 2 Qs of 2 marks, 2 Qs of 3 marks and 2 Questions of 5 marks has been provided. An internal choice has been provided in the 2 marks questions of Section E.
8. Draw neat figures wherever required. Take  $\pi = 22/7$  wherever required if not stated.

### SECTION A

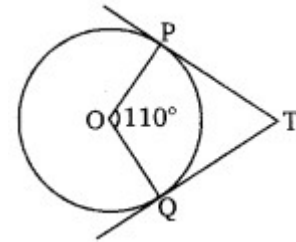
1. If two positive integers a and b are written as  $a = x^3y^2$  and  $b = xy^3$ ; where x, y are prime numbers, then HCF (a,b) is:  
a) xy      b)  $xy^2$       c)  $x^3y^3$       d)  $x^2y^2$
2. The LCM of smallest two digit composite number and smallest composite number is:  
a) 12      b) 4      c) 20      d) 44
3. If  $x = 3$  is one of the roots of the quadratic equation  $x^2 - 2kx - 6 = 0$ , then the value of k is  
a)  $-\frac{1}{2}$       b)  $\frac{1}{2}$       c) 3      d) 2
4. The pair of equations  $y = 0$  and  $y = -7$  has:  
a) one solution      b) two solutions      c) infinitely many solutions      d) no solution
5. Value(s) of k for which the quadratic equation  $2x^2 - kx + k = 0$  has equal roots is :  
a) 0 only      b) 4      c) 8 only      d) 0,8
6. The distance of the point(3, 5) from x-axis is k units, then k equals:  
a) 3      b) 4      c) 5      d) 8
7. If in  $\Delta ABC$  and  $\Delta PQR$ ,  $\frac{AB}{QR} = \frac{BC}{PR} = \frac{CA}{PQ}$  then:  
a)  $\Delta PQR \sim \Delta CAB$       b)  $\Delta PQR \sim \Delta ABC$       c)  $\Delta CBA \sim \Delta PQR$       d)  $\Delta BCA \sim \Delta PQR$

8. Which of the following is NOT a similarity criterion of triangles?

- a) AA      b) SAS      c) AAA      d) RHS

9. In figure, if TP and TQ are the two tangents to a circle with centre O so that  $\angle POQ = 110^\circ$ , then  $\angle PTQ$  is equal to

- (a)  $60^\circ$       (b)  $70^\circ$       (c)  $80^\circ$       (d)  $90^\circ$



10. If  $\cos A = \frac{4}{5}$  then  $\tan A$  is:

- a)  $\frac{3}{5}$       b)  $\frac{3}{4}$       c)  $\frac{4}{3}$       d)  $\frac{1}{8}$

11. If the height of the tower is equal to the length of its shadow, then the angle of elevation of the sun is \_\_\_\_\_

- a)  $30^\circ$       b)  $45^\circ$       c)  $60^\circ$       d)  $90^\circ$

12.  $(1 - \cos^2 A)$  is equal to

- a)  $\sin^2 A$       b)  $\tan^2 A$       c)  $1 - \sin^2 A$       d)  $\sec^2 A$

13. The radius of a circle is same as the side of a square. Their perimeters are in the ratio

- a) 1 : 1      b)  $2 : \pi$       c)  $\pi : 2$       d)  $\sqrt{\pi} : 2$

14. The area of the circle is  $154\text{cm}^2$ . The radius of the circle is

- a) 7cm      b) 14cm      c) 3.5cm      d) 17.5cm

15. When a dice is thrown once, the probability of getting an even number less than 4 is

- a)  $\frac{1}{4}$       b) 0      c)  $\frac{1}{2}$       d)  $\frac{1}{6}$

16. For the following distribution:

Class	0-5	5-10	10-15	15-20	20-25
Frequency	10	15	12	20	9

The lower limit of modal class is:

- a) 15      b) 20      c) 10      d) 5

17. A rectangular sheet of paper 40cm x 22cm, is rolled to form a hollow cylinder of height 40cm. The radius of the cylinder(in cm) is :

- a) 3.5      b) 7      c)  $\frac{80}{7}$       d) 5

18. Consider the following frequency distribution:

Class	0-6	6-12	12-18	18-24	24-30
Frequency	12	10	15	8	11

The median class is:

- a) 6-12      b) 12-18      c) 18-24      d) 24-30

19. Assertion (A): The point (0, 4) lies on y-axis.

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

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

20. Assertion (A): The HCF of two numbers is 5 and their product is 150. Then their LCM is 40.

Reason(R): For any two positive integers a and b,  $HCF(a, b) \times LCM(a, b) = a \times b$ .

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

### SECTION B

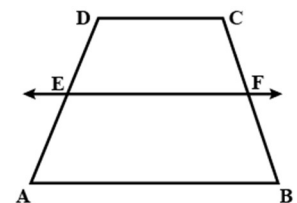
21. Find whether the following pair of linear equations is consistent or inconsistent:

$$3x + 2y = 8$$

$$6x - 4y = 9$$

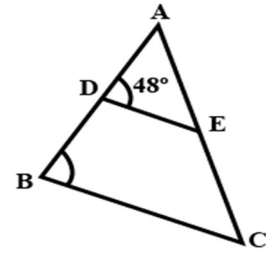
22. In the given figure, if ABCD is a trapezium in which  $AB \parallel CD \parallel EF$ ,

then prove that  $\frac{AE}{ED} = \frac{BF}{FC}$ .



OR

In figure, if  $AD = 6\text{cm}$ ,  $DB = 9\text{cm}$ ,  $AE = 8\text{cm}$  and  $EC = 12\text{cm}$  and  $\angle ADE = 48^\circ$ . Find  $\angle ABC$ .



23. The length of a tangent from a point A at distance 5cm from the centre of the circle is 4cm. Find the radius of the circle.

24. Evaluate:  $\sin^2 60^\circ + 2\tan 45^\circ - \cos^2 30^\circ$ .

25. Find the diameter of a circle whose area is equal to the sum of the areas of two circles of radii 40cm and 9cm.

OR

A chord of a circle of radius 10cm subtends a right angle at the centre. Find the area of minor segment. (Use  $\pi = 3.14$ )

### SECTION C

26. Prove that  $\sqrt{3}$  is an irrational number.

27. Find the zeroes of the quadratic polynomial  $4s^2 - 4s + 1$  and verify the relationship between the zeroes and the coefficients.

28. The coach of a cricket team buys 4 bats and 1 ball for Rs. 2050. Later, she buys 3 bats and 2 balls for ₹1600. Find the cost of each bat and each ball.

OR

A lending library has a fixed charge for the first three days and an additional charge for each day thereafter. Saritha paid ₹27 for a book kept for seven days, while Susy paid ₹21 for the book she kept for five days. Find the fixed charge and the charge for each extra day.

29. A circle touches all the four sides of quadrilateral ABCD. Prove that  $AB + CD = AD + BC$ .

30. Prove that

$$(\operatorname{cosec} \theta - \cot \theta)^2 = \frac{1 - \cos \theta}{1 + \cos \theta}$$

OR

Prove that  $\sec A (1 - \sin A) (\sec A + \tan A) = 1$ .

31. A bag contains 6 red, 4 black and some white balls.

(i) Find the number of white balls in the bag if the probability of drawing a white ball is  $\frac{1}{3}$ .

(ii) How many red balls should be removed from the bag for the probability of drawing a white ball to be  $\frac{1}{2}$ ?

### SECTION D

32. A train travels 360km at a uniform speed. If the speed had been 5km/h more, it would have taken 1 hour less for the same journey. Find the speed of the train.

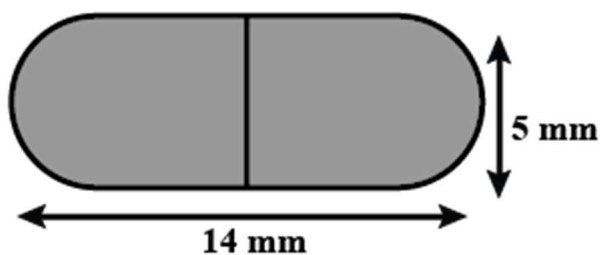
OR

A motor boat whose speed is 18km/h in still water takes 1 hour more to go 24km upstream than to return downstream to the same spot. Find the speed of the stream.

33. Prove that If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, the other two sides are divided in the same ratio.

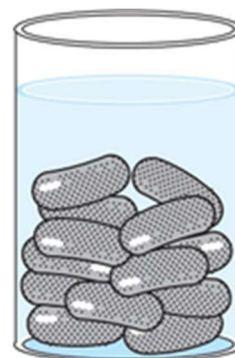
In  $\Delta PQR$ , S and T are points on PQ and PR respectively.  $\frac{PS}{SQ} = \frac{PT}{TR}$  and  $\angle PST = \angle PRQ$ . Prove that PQR is an isosceles triangle.

34. A medicine capsule is in the shape of a cylinder with two hemispheres stuck at each of its ends. The length of the entire capsule is 14mm and the diameter of the capsule is 5mm. Find its surface area.



OR

A gulab jamun, contains sugar syrup up to about 30% of its volume. Find approximately how much syrup would be found in 45 gulab jamuns, each shaped like cylinder with two hemispherical ends with length 5cm and diameter 2.8cm.



35. The following table gives the distribution of the life time of 400 neon lamps:

Life time (in hours)	Number of lamps
1500-2000	14
2000-2500	56
2500-3000	60
3000-3500	86
3500-4000	74
4000-4500	62
4500-5000	48

Find the average life time of a lamp.

### SECTION E

#### 36. CASE STUDY 1

India is competitive manufacturing location due to the low cost of manpower and strong technical and engineering capabilities contributing to higher quality production runs. The production of TV sets in a factory increases uniformly by a fixed number every year. It produced 16000 sets in 6th year and 22600 in 9th year.



- 1) In which year, the production is 29,200 sets?
- 2) Find the production in the 8<sup>th</sup> year.

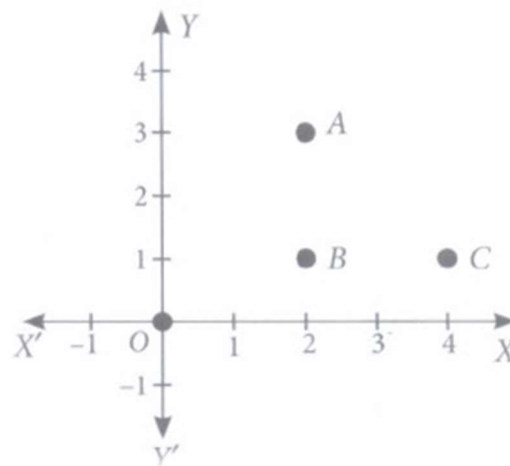
OR

Find the production in first 3 years.

- 3) Find the difference of the production in 7th year and 4th year.

### 37. CASE STUDY 2

Alia and Shagun are friends living on the same street in Patel Nagar. Shagun's house is at the intersection of one street with another street on which there is a library. They both study in the same school and that is not far from Shagun's house. Suppose the school is situated at the point O, i.e., the origin, Alia's house is at A. Shagun's house is at B and library is at C. Based on the above information, answer the following questions.



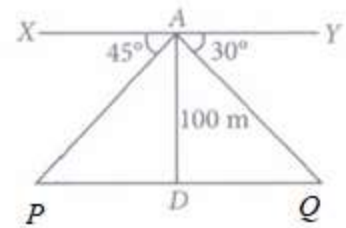
- (i) How far is Alia's house from Shagun's house?
- (ii) How far is the library from Shagun's house?
- (iii) Show that for Shagun, school is farther compared to Alia's house and library.

OR

Show that Alia's house, shagun's house and library form an isosceles right triangle.

### 38. CASE STUDY 3

A boy is standing on the top of light house. He observed that boat P and boat Q are approaching the light house from opposite directions. He finds that angle of depression of boat P is  $45^\circ$  and angle of depression of boat Q is  $30^\circ$ . He also knows that height of the light house is 100 m.



Based on the above information, answer the following questions.

- (i) What is the measure of  $\angle APD$ ?
- (ii) If  $\angle YAQ = 30^\circ$ , then  $\angle AQD$  is also  $30^\circ$ , Why?
- (iii) Find length of PD  
OR  
Find length of DQ



**Basic Mathematics (241)**  
**Marking Scheme**  
**2023-24**

**Section A**

1) (b) $xy^2$	1
2) (c) 20	1
3) (b) $\frac{1}{2}$	1
4) (d) No Solution	1
5) (d) 0,8	1
6) (c) 5 Unit	1
7) (a) $\Delta PQR \sim \Delta CAB$	1
8) (d) RHS	1
9) (b) $70^\circ$	1
10) (b) $\frac{3}{4}$	1
11) (b) $45^\circ$	1
12) (a) $\sin^2 A$	1
13) (c) $\pi : 2$	1
14) (a) 7 cm	1
15) (d) $\frac{1}{6}$	1
16) (a) 15	1
17) (a) 3.5 cm	1
18) (b) 12-18	1
19) (a) Both assertion and reason are true and reason is the correct explanation of assertion.	1
20) (d) Assertion (A) is false but reason(R) is true.	1

## SECTION B

21)  $3x+2y = 8$

$6x-4y = 9$

$a_1=3, \quad b_1=2, \quad c_1 = 8$

$a_2=6, \quad b_2=-4, \quad c_2 = 9$

$\frac{a_1}{a_2} = \frac{3}{6} = \frac{1}{2} \quad \frac{b_1}{b_2} = \frac{2}{-4} = \frac{-1}{2} \quad \frac{c_1}{c_2} = \frac{8}{9}$

$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

The given pair of linear equations are consistent.

1

1/2

1/2

22) Given:-  $AB \parallel CD \parallel EF$

To prove:-  $\frac{AE}{ED} = \frac{BF}{FC}$

Construction:- Join BD to intersect EF at G.

Proof:- in  $\triangle ABD$

$EG \parallel AB$  (  $EF \parallel AB$  )

$\frac{AE}{ED} = \frac{BG}{GD}$  ( by BPT ) \_\_\_\_\_ (1)

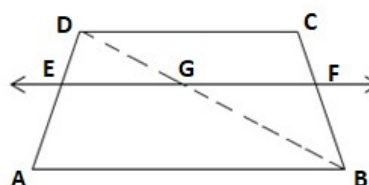
In  $\triangle DBC$

$GF \parallel CD$  (  $EF \parallel CD$  )

$\frac{BF}{FC} = \frac{BG}{GD}$  ( by BPT ) \_\_\_\_\_ (2)

from (1) & (2)

$\frac{AE}{ED} = \frac{BF}{FC}$



1/2

1/2

1/2

1/2

OR

Given  $AD=6\text{cm}, DB=9\text{cm}$

$AE=8\text{cm}, EC=12\text{cm}, \angle ADE=48^\circ$

To find:-  $\angle ABC=?$

Proof:

In  $\triangle ABC$

$\frac{AD}{DB} = \frac{6}{9} = \frac{2}{3}$  .....(1)

$\frac{AE}{EC} = \frac{8}{12} = \frac{2}{3}$  .....(2)

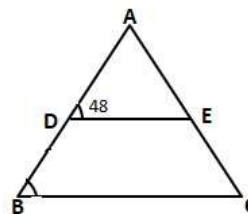
From (1) & (2)

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

$DE \parallel BC$  (Converse of BPT)

$\angle ADE = \angle ABC$  (Corresponding angles)

$\Rightarrow \angle ABC = 48^\circ$



1

1

23) In  $\Delta OTA$ ,  $\angle OTA = 90^\circ$

By Pythagoras theorem

$$OA^2 = OT^2 + AT^2$$

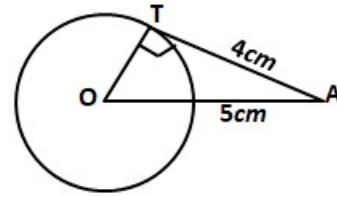
$$(5)^2 = OT^2 + (4)^2$$

$$25 - 16 = OT^2$$

$$9 = OT^2$$

$$OT = 3\text{cm}$$

radius of circle = 3cm.



1/2

1/2

1

24)  $\sin^2 60^\circ + 2 \tan 45^\circ - \cos^2 30^\circ$

$$= \left(\frac{\sqrt{3}}{2}\right)^2 + 2(1) - \left(\frac{\sqrt{3}}{2}\right)^2$$

$$= \frac{3}{4} + 2 - \frac{3}{4}$$

$$= 2$$

1

1

25) Area of the circle = sum of areas of 2 circles

$$\pi R^2 = \pi(40)^2 + \pi(9)^2$$

$$\pi R^2 = \pi \times (40^2 + 9^2)$$

$$R^2 = 1600 + 81$$

$$R^2 = 1681$$

$$R = 41 \text{ cm.}$$

$$\text{Diameter of given circle} = 41 \times 2 = 82 \text{ cm}$$

1/2

1/2

1/2

1/2

OR

radius of circle = 10cm,  $\theta = 90^\circ$

$$\text{Area of minor segment} = \frac{\theta}{360^\circ} \pi r^2 - \text{Area of } \Delta$$

$$= \frac{\theta}{360^\circ} \times \pi r^2 - \frac{1}{2} \times b \times h$$

$$= \frac{90^\circ}{360^\circ} \times 3.14 \times 10 \times 10 - \frac{1}{2} \times 10 \times 10$$

$$= \frac{314}{4} - 50$$

$$= 78.5 - 50 = 28.5 \text{ cm}^2$$

$$\text{Area of minor segment} = 28.5 \text{ cm}^2$$

1/2

1/2

1/2

1/2

### Section C

26) Let us assume that  $\sqrt{3}$  be a rational number

$$\sqrt{3} = \frac{a}{b} \quad \text{where } a \text{ and } b \text{ are co-prime.}$$

squaring both the sides

$$(\sqrt{3})^2 = \left(\frac{a}{b}\right)^2$$

$$3 = \frac{a^2}{b^2} \Rightarrow a^2 = 3b^2$$

$a^2$  is divisible by 3 so  $a$  is also divisible by 3 \_\_\_\_\_(1)

let  $a=3c$  for any integer  $c$ .

$$(3c)^2 = 3b^2$$

$$9c^2 = 3b^2$$

$$b^2 = 3c^2$$

since  $b^2$  is divisible by 3 so,  $b$  is also divisible by 3 \_\_\_\_\_(2)

From (1) & (2) we can say that 3 is a factor of  $a$  and  $b$

which is contradicting the fact that  $a$  and  $b$  are co-prime.

Thus, our assumption that  $\sqrt{3}$  is a rational number is wrong.

Hence,  $\sqrt{3}$  is an irrational number.

27)  $P(S) = 4S^2 - 4S + 1$

$$4S^2 - 2S - 2S + 1 = 0$$

$$2S(2S-1) - 1(2S-1) = 0$$

$$(2S-1)(2S-1) = 0$$

$$S = \frac{1}{2} \quad S = \frac{1}{2}$$

$$a = 4 \quad b = -4 \quad c = 1 \quad \alpha = \frac{1}{2} \quad \beta = \frac{1}{2}$$

$$\alpha + \beta = \frac{-b}{a}, \quad \alpha \beta = \frac{c}{a}$$

$$\frac{1}{2} + \frac{1}{2} = \frac{-4}{4}, \quad \left(\frac{1}{2}\right)\left(\frac{1}{2}\right) = \frac{1}{4}$$

$$\frac{1+1}{2} = \frac{-4}{4}, \quad \frac{1}{4} = \frac{1}{4}$$

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

$$1 = 1$$

28) Let cost of one bat be Rs  $x$

Let cost of one ball be Rs  $y$

ATQ

$$4x + 1y = 2050 \quad \text{_____ (1)}$$

$$3x + 2y = 1600 \quad \text{_____ (2)}$$

from (1)  $4x + 1y = 2050$

$$y = 2050 - 4x$$

Substitute value of y in (2)

$$3x + 2(2050 - 4x) = 1600$$

$$3x + 4100 - 8x = 1600$$

$$-5x = -2500$$

$$x = 500$$

1/2

Substitute value of x in (1)

$$4x + 1y = 2050$$

$$4(500) + y = 2050$$

$$2000 + y = 2050$$

$$y = 50$$

1/2

Hence

Cost of one bat = Rs. 500

1/2

Cost of one ball = Rs. 50

OR

Let the fixed charge for first 3 days = Rs. x

And additional charge after 3 days = Rs. y

1/2

ATQ

$$x + 4y = 27 \text{-----(1)}$$

$$x + 2y = 21 \text{-----(2)}$$

1/2

Subtract eq<sup>n</sup> (2) from (1)

$$2y = 6$$

$$y = 3$$

1

Substitute value of y in (2)

$$x + 2(3) = 21$$

$$x = 21 - 6$$

$$x = 15$$

1

Fixed charge = Rs. 15

Additional charge per day = Rs. 3

29) Given circle touching sides of ABCD at P, Q, R and S

To prove- AB+CD=AD+BC

Proof-

$$AP=AS \text{-----(1)} \quad \text{tangents from an external point}$$

$$PB=BQ \text{-----(2)} \quad \text{to a circle are equal in length}$$

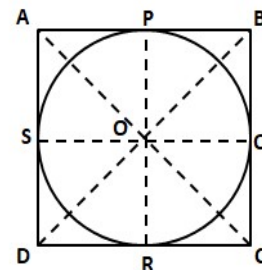
$$DR=DS \text{-----(3)}$$

$$CR=CQ \text{-----(4)}$$

Adding eq<sup>n</sup> (1),(2),(3) & (4)

$$AP+BP+DR+CR=AS+DS+BQ+CQ$$

$$AB+DC=AD+BC$$



1

1

1

30)  $(\operatorname{cosec} \theta - \cot \theta)^2 = \frac{1 - \cos \theta}{1 + \cos \theta}$

$$\text{LHS} = (\operatorname{cosec} \theta - \cot \theta)^2$$

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

1/2

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

1/2

$$= \frac{(1 - \cos \theta)^2}{\sin^2 \theta}$$

$$= \frac{(1 - \cos \theta)^2}{1 - \cos^2 \theta} \quad 1$$

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

$$= \frac{1 - \cos \theta}{1 + \cos \theta} = \text{RHS} \quad 1$$

LHS = RHS, Hence Proved

OR

$$\sec A (1 - \sin A)(\sec A + \tan A) = 1$$

$$\text{LHS} = \frac{1}{\cos A} (1 - \sin A) \left( \frac{1}{\cos A} + \frac{\sin A}{\cos A} \right) \quad 1$$

$$= \frac{(1 - \sin A)(1 + \sin A)}{\cos A \cos A}$$

$$= \frac{(1 - \sin A)(1 + \sin A)}{\cos^2 A}$$

$$= \frac{1 - \sin^2 A}{\cos^2 A} \quad (1 - \sin^2 A = \cos^2 A) \quad 1$$

$$= \frac{\cos^2 A}{\cos^2 A}$$

$$= 1 = \text{RHS} \quad 1$$

LHS=RHS. Hence Proved

31) (i) Red balls = 6, Black balls = 4, White balls = x

$$P(\text{white ball}) = \frac{x}{10+x} = \frac{1}{3} \quad 1$$

$$\Rightarrow 3x = 10 + x \Rightarrow x = 5 \text{ white balls} \quad 1/2$$

(ii) Let y red balls be removed, black balls = 4, white balls = 5

$$P(\text{white balls}) = \frac{5}{(6-y)+4+5} = \frac{1}{2} \quad 1$$

$$\Rightarrow \frac{5}{15-y} = \frac{1}{2} \Rightarrow 10 = 15 - y \Rightarrow y = 5 \quad 1/2$$

So 5 balls should be removed.

### Section D

32) Let the speed of train be  $x$  km/hr

1/2

distance = 360 km

$$\text{Speed} = \frac{\text{distance}}{\text{time}}$$

$$\text{Time} = \frac{360}{x}$$

1/2

New speed =  $(x + 5)$  km/hr

$$\text{Time} = \frac{D}{S}$$

$$x + 5 = \frac{360}{\left(\frac{360}{x} - 1\right)} \quad 1$$

$$(x + 5) \left( \frac{360}{x} - 1 \right) = 360$$

$$(x + 5)(360 - x) = 360x$$

$$-x^2 - 5x + 1800 = 0$$

$$x^2 + 5x - 1800 = 0$$

$$x^2 + 45x - 40x - 1800 = 0$$

$$x(x + 45) - 40(x + 45) = 0$$

$$(x + 45)(x - 40) = 0$$

$$x + 45 = 0 \quad , \quad x - 40 = 0$$

$$x = -45 \quad , \quad x = 40$$

Speed cannot be negative

Speed of train = 40 km/hr

1

1

1

OR

Let the speed of the stream =  $x$  km/hr

Speed of boat = 18 km/hr

Upstream speed =  $(18 - x)$  km/hr

Downstream speed =  $(18 + x)$  km/hr

$$\text{Time taken (upstream)} = \frac{24}{(18-x)}$$

$$\text{Time taken (downstream)} = \frac{24}{(18+x)}$$

ATQ

$$\frac{24}{(18-x)} = \frac{24}{(18+x)} + 1$$

$$\frac{24}{(18-x)} - \frac{24}{(18+x)} = 1$$

$$24(18 + x) - 24(18 - x) = (18 - x)(18 + x)$$

$$24(18 + x - 18 + x) = (18)^2 - x^2$$

$$24(2x) = 324 - x^2$$

$$48x - 324 + x^2 = 0$$

$$x^2 + 48x - 324 = 0$$

$$x^2 - 6x + 54x - 324 = 0$$

$$x(x - 6) + 54(x - 6) = 0$$

$$(x - 6)(x + 54) = 0$$

$$x - 6 = 0 \quad , \quad x + 54 = 0$$

$$x = 6 \quad , \quad x = -54$$

Speed cannot be negative

Speed of stream = 6 km/hr

1/2

1/2

1

1

1

1

33) Given  $\Delta ABC$ ,  $DE \parallel BC$

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

Construction: join BE and CD

Draw  $DM \perp AC$  and  $EN \perp AB$

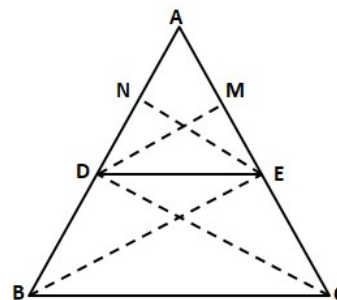
Proof: Area of  $\Delta ADE = \frac{1}{2} \times b \times h$

$$= \frac{1}{2} \times AD \times EN \text{-----(1)}$$

$$\text{Area}(\Delta DBE) = \frac{1}{2} \times DB \times EN \text{-----(2)}$$

Divide eq<sup>n</sup> (1) by (2)

$$\frac{\text{ar} \Delta ADE}{\text{ar} \Delta DBE} = \frac{\frac{1}{2} \times AD \times EN}{\frac{1}{2} \times DB \times EN} = \frac{AD}{DB} \text{-----(3)}$$



1/2

1

$$\text{area } \triangle ADE = \frac{1}{2} \times AE \times DM \text{ -----(4)}$$

$$\text{area } \triangle DEC = \frac{1}{2} \times EC \times DM \text{ -----(5)}$$

Divide eq<sup>n</sup> (4) by (5)

$$\frac{\text{ar } \triangle ADE}{\text{ar } \triangle DEC} = \frac{\frac{1}{2} \times AE \times DM}{\frac{1}{2} \times EC \times DM} = \frac{AE}{EC} \text{-----(6)}$$

$\triangle BDE$  and  $\triangle DEC$  are on the same base DE and between same parallel lines BC and DE

$$\therefore \text{area } (\triangle DBE) = \text{ar } (DEC)$$

hence

$$\frac{\text{ar}(\triangle ADE)}{\text{ar}(\triangle DBE)} = \frac{\text{ar}(\triangle ADE)}{\text{ar}(\triangle DEC)} \quad [\text{LHS of (3) = RHS of (6)}]$$

$$\frac{AD}{DB} = \frac{AE}{EC} \quad [\text{RHS of (3) = RHS of (6)}]$$

Since  $\frac{PS}{SQ} = \frac{PT}{TR} \therefore ST \parallel QR$  (by converse of BPT)

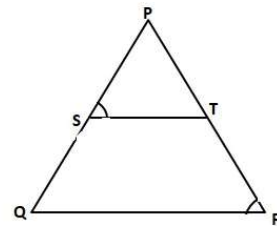
$\angle PST = \angle PQR$  (Corresponding angles)

But  $\angle PST = \angle PRQ$  (given)

$\angle PQR = \angle PRQ$

$PR = PQ$  ( sides opposite to equal angles are equal

Hence  $\triangle PQR$  is isosceles.



1

1/2

1

1

34) Diameter of cylinder and hemisphere = 5mm radius,  $(r) = \frac{5}{2}$

Total length = 14mm

Height of cylinder = 14 - 5 = 9mm

CSA of cylinder =  $2\pi rh$

$$= 2 \times \frac{22}{7} \times \frac{5}{2} \times 9$$

$$= \frac{990}{7} \text{ mm}^2$$

CSA of hemispheres =  $2\pi r^2$

$$= 2 \times \frac{22}{7} \times \left(\frac{5}{2}\right)^2$$

$$= \frac{275}{7} \text{ mm}^2$$

CSA of 2 hemispheres =  $2 \times \frac{275}{7}$

$$= \frac{550}{7} \text{ mm}^2$$

Total area of capsule =  $\frac{990}{7} + \frac{550}{7}$

$$= \frac{1540}{7}$$

$$= 220 \text{ mm}^2$$

1

1

1

1

1

OR



Diameter of cylinder = 2.8 cm

$$\text{radius of cylinder} = \frac{2.8}{2} = 1.4 \text{ cm}$$

radius of cylinder = radius of hemisphere = 1.4 cm

Height of cylinder = 5 - 2.8

$$= 2.2 \text{ cm}$$

Volume of 1 Gulab jamun = vol. of cylinder + 2 x vol. of hemisphere

$$= \pi r^2 h + 2 \times \frac{2}{3} \pi r^3$$

$$\frac{22}{7} \times (1.4)^2 \times 2.2 + 2 \times \frac{2}{3} \times \frac{22}{7} \times (1.4)^3$$

$$= 13.55 + 11.50$$

$$= 25.05 \text{ cm}^3$$

volume of 45 Gulab jamun = 45 x 25.05

syrup in 45 Gulab jamun = 30% x 45 x 25.05

$$= \frac{30}{100} \times 45 \times 25.05$$

$$= 338.175 \text{ cm}^3$$

$$\approx 338 \text{ cm}^3$$

1

1

1

1

35)

Life time (in hours)	Number of lamps(f)	Mid x	d	fd
1500-2000	14	1750	-1500	-21000
2000-2500	56	2250	-1000	-56000
2500-3000	60	2750	-500	-30000
3000-3500	86	3250	0	0
3500-4000	74	3750	500	37000
4000-4500	62	4250	1000	62000
4500-5000	48	4750	1500	72000
	400			64000

2

$$\text{Mean} = a + \frac{\sum fd}{\sum f}$$

1/2

$$a = 3250$$

1/2

$$\text{Mean} = 3250 + \frac{64000}{400}$$

$$= 3250 + 160$$

$$= 3410$$

Average life of lamp is 3410 hr

1

1

### Section E

36)  $a_6 = 16000$      $a_9 = 22600$

$$a + 5d = 16000 \text{-----(1)}$$

$$a + 8d = 22600 \text{-----(2)}$$

substitute  $a = 1600 - 5d$  from (1)

$$16000 - 5d + 8d = 22600$$

$$3d = 22600 - 16000$$

$$3d = 6600$$

$$d = \frac{6600}{3} = 2200$$

$$a = 16000 - 5(2200)$$

$$a = 16000 - 11000$$

$$a = 5000$$

(i)  $a_n = 29200$ ,  $a = 5000$ ,  $d = 2200$

$$a_n = a + (n-1)d$$

$$29200 = 5000 + (n - 1)2200$$

$$29200 - 5000 = 2200n - 2200$$

$$24200 + 2200 = 2200n$$

$$26400 = 2200n$$

$$n = \frac{264}{22}$$

$$n = 12$$

in 12<sup>th</sup> year the production was Rs 29200

(ii)  $n = 8$ ,  $a = 5000$ ,  $d = 2200$

$$a_n = a + (n-1)d$$

$$= 5000 + (8-1)2200$$

$$= 5000 + 7 \times 2200$$

$$= 5000 + 15400$$

$$= 20400$$

The production during 8<sup>th</sup> year is = 20400

**OR**

$n = 3$ ,  $a = 5000$ ,  $d = 2200$

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

1/2

1/2

1/2

1/2

1/2

1/2

1/2

$$= \frac{3}{2} [2(5000) + (3-1) 2200]$$

$$S_3 = \frac{3}{2} (10000 + 2 \times 2200)$$

$$= \frac{3}{2} (10000 + 4400)$$

$$= 3 \times 7200$$

$$= 21600$$

The production during first 3 year is 21600

(iii)  $a_4 = a+3d$

$$= 5000 + 3 (2200)$$

$$= 5000 + 6600$$

$$= 11600$$

$$a_7 = a+6d$$

$$= 5000 + 6 \times 2200$$

$$= 5000 + 13200$$

$$= 18200$$

$$a_7 - a_4 = 18200 - 11600 = 6600$$

1/2

1/2

1/2

1/2

1/2

37) coordinates of A (2, 3) Alia's house

coordinates of B (2, 1) Shagun's house

coordinates of C (4,1) Library

(i)  $AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$$= \sqrt{(2 - 2)^2 + (1 - 3)^2}$$

$$= \sqrt{(0)^2 + (-2)^2}$$

$$AB = \sqrt{0 + 4} = \sqrt{4} = 2 \text{ units}$$

Alia's house from shagun's house is 2 units

(ii) C(4,1), B(2,1)

$$CB = \sqrt{(2 - 4)^2 + (1 - 1)^2}$$

$$= \sqrt{(-2)^2 + 0^2}$$

$$= \sqrt{4 + 0} = \sqrt{4} = 2 \text{ unit}$$

(iii) O(0,0), B(2,1)

$$OB = \sqrt{(2 - 0)^2 + (1 - 0)^2}$$

$$= \sqrt{2^2 + 1^2} = \sqrt{4 + 1} = \sqrt{5} \text{ units}$$

Distance between Alia's house and Shagun's house, AB = 2 units

Distance between Library and Shagun's house, CB = 2 units

OB is greater than AB and CB,

For shagun, school [O] is farther than Alia's house [A] and Library [C]

1/2

1/2

1/2

1/2

1

1/2

1/2

OR

C (4, 1), A(2, 3)

$$CA = \sqrt{(2-4)^2 + (3-1)^2}$$

$$= \sqrt{(-2)^2 + 2^2} = \sqrt{4+4} = \sqrt{8}$$

$$= 2\sqrt{2} \text{ units} \quad AC^2 = 8$$

1

Distance between Alia's house and Shagun's house, AB = 2 units

Distance between Library and Shagun's house, CB = 2 units

1/2

$$AB^2 + BC^2 = 2^2 + 2^2 = 4 + 4 = 8 = AC^2$$

1/2

Therefore A, B and C form an isosceles right triangle.

38)

(i) XY || PQ and AP is transversal.

$\angle APD = \angle PAX$  (alternative interior angles)

1/2

$$\angle APD = 45^\circ$$

1/2

(ii) Since XY || PQ and AQ is a transversal

so alternate interior angles are equal

hence  $\angle YAQ = \angle AQP = 30^\circ$

1/2

(iii) In  $\triangle ADP$ ,  $\theta = 45^\circ$

$$\tan \theta = \frac{PD}{AD}$$

$$\tan 45^\circ = \frac{100}{PD}$$

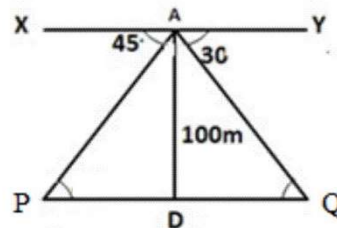
1/2

$$PD = 100 \text{ m}$$

1/2

Boat P is 100 m from the light house

1



OR

In  $\triangle ADQ$ ,  $\theta = 30^\circ$

$$\tan \theta = \frac{AD}{DQ}$$

1/2

$$\tan 30 = \frac{100}{DQ}$$

$$\frac{1}{\sqrt{3}} = \frac{100}{DQ}$$

1/2

$$DQ = 100\sqrt{3} \text{ m}$$

1