MODAL PAPER OF SSC PUBLIC EXAMINATIONS 2024-25 BY SSC BOARD(AP)

MATHEMATICS (ENGLISH VERSION)

1. Find the prime factorization of 30.

Sol: $30 = 2 \times 3 \times 5$

2. Assertion: Sum of the zeroes of a Quadratic polynomial

2x2+3x-4 is -3 /2

Reason: Sum of the zeroes of a Quadratic polynomial $ax^2 + bx + c$ is. c/a

Now, choose the correct answer from the following.

A) Both Assertion and Reason are true, Reason is supporting the assertion.

B) Both Assertion and Reason are true but Reason is not supporting the assertion.

C) Assertion is true, but the Reason is false.

D) Assertion is false, but the reason is true.

Sol: C

3. The general form of linear equation in two variables is

Sol: $ax + by + c = 0\ (a^2 + b^2 \neq 0)$

4. If nth terms of an A.P is an = 2n - 6 then

Match the following.

i) a_2 p) 0

ii) a3 q) 2

iii) a4 r)-2

Choose the correct answer.

A) i- p. ii-r, iii- q

B) i-r, ii-q, iii - p

C) i-r, ii-p, iii- q

D) i-q, ii-r, iii – p

Sol:C

5. Statement-1: All similar triangles are congruent.

Statement-II: All right angled isosceles triangles are similar.

Now, choose the correct answer.

A) Both statements are true.

B) Statement 1 is true and Statement II is false.

C) Statement 1 is false and statement II is true.

D) Both statements are false.

Sol: C

6. **A person standing 20 meters away from the base of a building observes that the angle of elevation to the top of the building is 45° then the height of the building is ………**

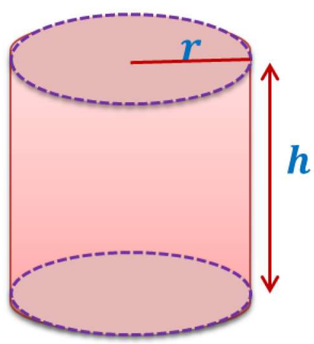
Sol: 20m

7. **How many tangents can a circle have?**

Sol: Infinite.

8. **Draw a rough figure of cylinder with height h cm and base radius r cm.**

Sol:



9. **If p(E) =0.05, what is the probability of 'not E'?**

Sol: $P(\bar{E}) = 1 - P(E) = 1 - 0.05 = 0.95$

10. **Zero of the polynomial of ax + b is**

A)b/a B)a/b C)-a/b D)-b/a

Sol: D

11. **If 4 cot A=3 then tan A =**

A)3/5 B)4/5 C)4/3 D)3/4

Sol: C

12. **If x=1/x then the roots are**

A) 1 B) -1 C) A, B D) None ()

Sol: C

SECTION-II

Note: i) Answer all the questions. 8x2=16 M

ii) Each question carries 2 marks.

13. Find the volume of a cylinder with radius of base 6 cm and height 7 cm.

Sol: $Volume\ of\ cylinder = \pi r^2 h = \frac{22}{7} \times 6 \times 6 \times 7 = 22 \times 36 = 792\ cm^2$

14. Find a Quadratic polynomial whose sum and product of the zeroes are 3 and 2 respectively.

Sol: $\alpha + \beta = -3$

$\alpha\beta = 2$

$p(x) = k[x^2 - (\alpha + \beta)x + \alpha\beta]$

$= k[x^2 - (-3)x + 2]$

$= k[x^2 + 3x + 2]$

One quadratic polynomial $= [x^2 + 3x + 2]$ (When k=1)

15. Check whether the following are Quadratic Equations or not.

i) $(x-2)^2+1=2x-3$

Sol: $(x-2)^2 + 1 = 2x - 3$

$\Rightarrow x^2 - 4x + 4 + 1 - 2x + 3 = 0$

$\Rightarrow x^2 - 6x + 8 = 0$

It is of the form $ax^2 + bx + c = 0$ $(a = 1, b = -6, c = 8)$

The given equation is a quadratic equation.

ii) $x(x+1)+8=(x+2)(x-2)$

Sol: $x(x+1) + 8 = (x+2)(x-2)$

$\Rightarrow x^2 + x + 8 = x^2 - 2^2$

$\Rightarrow x^2 + x + 8 - x^2 + 4 = 0$

$\Rightarrow x + 12 = 0$

It is not of the form $ax^2 + bx + c = 0$

The given equation is not a quadratic equation

16. Give an example for

i) Similar figures

ii) non similar figures

Sol:

(i) Similar figures:

Example: 1. All squares 2. All circles. 3. All equilateral triangles.

(ii) Non-similar figures:

Examples: 1. Square, Rectangle 2. Rectangle, Rhombus

17. **Find the coordinates of mid point of the line segment joining (cos 0, 0) and (0, sin 90°)**

Sol: $(\cos 0, 0) = (1,0)\ \ and\ (0, \sin 90°) = (0,1)$

$$Midpoint = \left(\frac{1+0}{2}, \frac{0+1}{2}\right) = \left(\frac{1}{2}, \frac{1}{2}\right)$$

18. Express the ratios cos A and tan A in terms of sin A.

Sol: $\cos A = \sqrt{1 - sin^2 A}$

$$\tan A = \frac{\sin A}{\cos A} = \frac{\sin A}{\sqrt{1 - sin^2 A}}$$

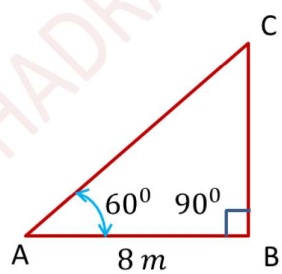
19. **Draw a diagram for the following situation. A boy observed the top of an eletric pole at an angle of elevation of 60° when the observation point is 8 meters away from the foot of the pole.**

Sol:

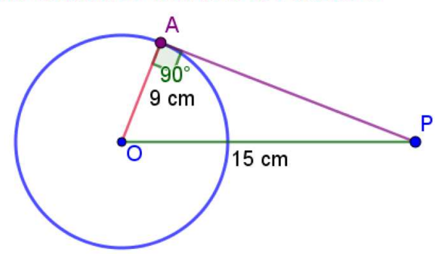
Electric pole=BC

Observation point=A

Angle of elevation =∠BAC= 60°



20. **Calculate the length of tangent from a point 15 cm. away from the centre of a circle of radius 9 cm.**



Sol: Distance (d)=15 cm ; radius(r)=9cm

$$\text{length of tangent}(l) = \sqrt{d^2 - r^2}$$

$$= \sqrt{15^2 - 9^2}$$

$$= \sqrt{225 - 81}$$

$$= \sqrt{144} = 12cm$$

SECTION-III 8x432 M

Note: i) Answer all the questions.

ii) Each question carries 4 marks.

21. **One card is drawn from a well-shuffled deck of 52 cards. Find the probability of getting**

i) a king of black colour

ii) a red face card.

Sol: Total number of cards=52, n(S)=52

$$P(E) = \frac{\text{Number of outcomes favourable to E}}{\text{Number of all possible outcomes}} = \frac{n(E)}{n(S)}$$

(i) K=Event getting a king of red colour card

n(K)=2

$$P(a\ king\ of\ red\ colour) = P(K) = \frac{2}{52} = \frac{1}{26}$$

(ii) F=Event getting a red face card

n(F)=6

$$P(a\ red\ face\ card) = \frac{6}{52} = \frac{3}{26}$$

22. **Write the formula to find the mode of a grouped data and explain the terms involved in it.**

Sol:Fist we locate a class with the maximum frequency, called the modal class.

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

Where $l = lower\ limit\ of\ the\ modal\ class$

$f_1 = frequency\ of\ the\ modal\ class$

$f_0 = frequency\ of\ the\ class\ preceding\ the\ modal\ class$

$f_2 = frequency\ of\ the\ class\ succeeding\ the\ modal\ class$

$h = size\ of\ the\ modal\ class$

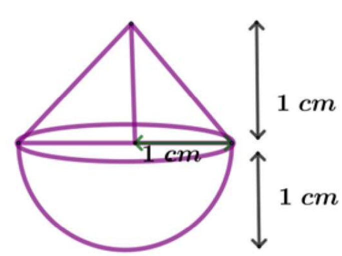
23. **A solid is in the shape of a cone standing on a hemisphere with both their radii being equal to 1 cm and the height of the cone is equal to its radius. Find the volume of the solid in terms of π.**

Sol: Cone: r=1 cm, h=1 cm

Hemisphere: r=1cm

Volume of the solid

= volume of the conical part + volume of the hemispherical part



$$= \frac{1}{3}\pi r^2 h + \frac{2}{3}\pi r^3$$

$$= \frac{1}{3}\pi \times 1 \times 1 \times 1 + \frac{2}{3}\pi \times 1 \times 1 \times 1$$

$= \frac{1}{3}\pi + \frac{2}{3}\pi$

$= \frac{3}{3}\pi = \pi\ cm^3$

24. Find two numbers whose sum is 27 and product is 182.

Sol: Let one number $= x$, The second number $= 27 - x$

Product of numbers=182

$x(27 - x) = 182$

$27x - x^2 = 182$

$-x^2 + 27x - 182 = 0$

$x^2 - 27x + 182 = 0$

$x^2 - 13x - 14x + 182 = 0$

$x(x - 13) - 14(x - 13) = 0$

$(x - 13)(x - 14) = 0$

$x - 13 = 0 \quad or \quad x - 14 = 0$

$x = 13 \quad or \quad x = 14$

If $x = 13$ the required numbers are 13 and 14.

If $x = 14$ the required numbers are 14 and 13.

25. Prove that $\frac{\cot A - \cos A}{\cot A + \cos A} = \frac{cosec\ A - 1}{cosec\ A + 1}$

Sol: $\frac{\cot A - \cos A}{\cot A + \cos A} = \frac{\frac{\cos A}{\sin A} - \cos A}{\frac{\cos A}{\sin A} + \cos A}$

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

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

$= \frac{cosec\ A - 1}{cosec\ A + 1}$

26. Find the sum of odd numbers between 0 and 50.

Sol: The odd numbers lying between 0 and 50 are 1, 3, 5, 7, 9 ... 49

These odd numbers are in an A.P.

$a = 1; \quad d = 2; \quad l = 49$

We know that nth term of AP, $a_n = l = a + (n - 1)d$

$49 = 1 + (n - 1)\, 2$

$48 = 2(n - 1)$

$n - 1 = 24$

$n = 25$

$S_n = \frac{n}{2}[a + l]$

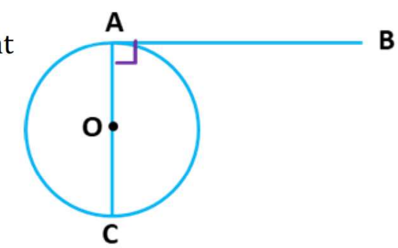
$S_{25} = \frac{25}{2}(1 + 49)$

$= \frac{25}{2} \times 50$

$= 25 \times 25$

$= 625$

27. Prove that the perpendicular at the point of contact to the tangent to a circle passes through the centre.



Sol: O is the centre of the circle and AB is the tangent to the circle at the point A.

Draw $AC \perp AB$ at point A

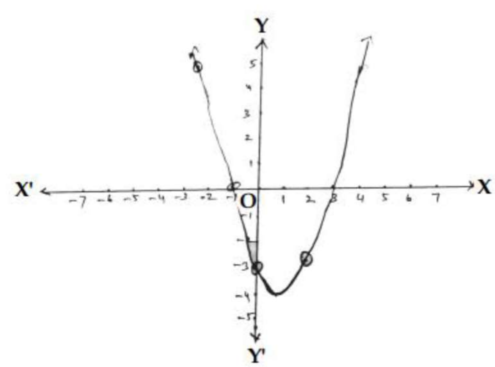
$\angle BAC = 90^0$

But $\angle BAO = 90^0$(Tangent is perpendicular to the radius at the point of contact)

O is lie on AC

The perpendicular at the point of contact to the tangent to a circle passes through the centre

28. Due to heavy storm an electric wire got bent as shown in the figure. It followed a mathematical shape. Answer the following questions below.



a) Name the shape in which the wire is bent.

Sol: Parabola.

b) How many zeroes are there for the polynomial (Shape of the wire)

Sol: Two.

c) The zeroes of the polynomial are

Sol: -1 and 3

d) Sum of the zeroes of the polynomial

Sol: -1+3=2

SECTION - IV

Note: i) Answer all the questions.

ii) Each question carries 8 marks.

iii) There is an internal choice for each question.

29. a) Prove that 2+5√3 is irrational.

Sol: Let us assume that$2+5\sqrt{3}$ is rational.

Let $2+5\sqrt{3} \;=\frac{a}{b}$ $(\,a, b\ are\ coprimes)$

$$5\sqrt{3}=\frac{a}{b}-2=\frac{a-2b}{b}$$

$$\sqrt{3}=\frac{a-2b}{5b}\rightarrow(1)$$

$Since\ 2,3, a\ and\ b\ are\ integers\ the\ R.H.S\ of\ \ (1) ie\ \frac{a-2b}{5b} is\ rational$

$So\ the$ L. H. S $\sqrt{3}$ $also\ rational.$

But this contradicts the fact that 3 is irrational.

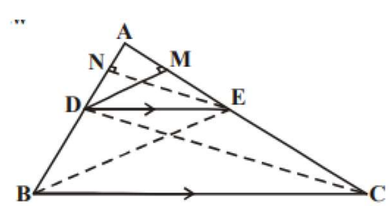
Thus our assumption is false.

So, we conclude that $2+5\sqrt{3}$ is irrational

OR

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

Given: In ΔABC, DE ∥ BC which intersects sides AB and A C at D and E respectively



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

Construction: Join B, E and C, D and then draw DM ⊥ AC and EN ⊥ AB.

Proof: $Area\ of\ \Delta ADE\ =\frac{1}{2}\times AD\ \times EN$

$Area\ of\ \Delta BDE\ =\frac{1}{2}\times BD\ \times EN$

$So, \frac{ar(\Delta ADE)}{ar(\Delta BDE)} = \frac{\frac{1}{2} \times AD \times EN}{\frac{1}{2} \times BD \times EN} = \frac{AD}{DB} \rightarrow (1)$

$Area\ of\ \Delta ADE = \frac{1}{2} \times AE \times DM$

$Area\ of\ \Delta CDE = \frac{1}{2} \times EC \times DM$

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

> *Area of triangle*
> $= \frac{1}{2} \times Base \times Height$

But ΔBDE and ΔCDE are on the same base DE and between same parallels BC and DE.

So $ar(\Delta BDE) = ar(\Delta CDE) \rightarrow (3)$

From (1) (2) and (3), we have

$$\frac{ar(\Delta ADE)}{ar(\Delta BDE)} = \frac{ar(\Delta ADE)}{ar(\Delta CDE)}$$

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

Hence proved

30. a) **Find the area of a rhombus if its vertices are (-4, -7), (-1, 2), (8, 5) and (5, -4) taken in order.**

Sol: Given points $A(-4, -7)$, $B(-1,2)$, $C(8,5)$, $D(5, -4)$

$A(-4,-7) = (x_1, y_1), C(8,5) = (x_2, y_2)$

$d_1 = AC = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$= \sqrt{(8+4)^2 + (5+7)^2}$

$= \sqrt{(12)^2 + (12)^2}$

$= \sqrt{144 + 144} = \sqrt{288}\ units$

$B(-1,2) = (x_1, y_1), D(5,-4) = (x_2, y_2)$

$d_2 = BD = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$= \sqrt{(5+1)^2 + (-4-2)^2}$

$= \sqrt{(6)^2 + (-6)^2}$

$= \sqrt{36 + 36} = \sqrt{72}\ units$

Area of rhombus $= \frac{1}{2} \times d_1 \times d_2 = \frac{1}{2} \times AC \times BD$

$= \frac{1}{2} \times \sqrt{288} \times \sqrt{72}$

$= \frac{1}{2} \times \sqrt{144 \times 2} \times \sqrt{36 \times 2}$

$= \frac{1}{2} \times 12 \times \sqrt{2} \times 6 \times \sqrt{2}$

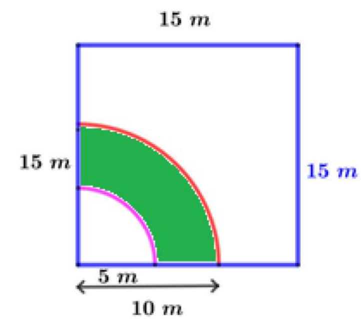
$= 72$ sq. units

OR

b) A horse is tied to a peg at one corner of a square shaped grass field of side 15 m by means of a 5 m long rope. Find

i) the area of that part of the field in which the horse can graze.

ii) the increse in the gazing area if the rope was 10 m log instead of 5 m.



Sol: (i)Area that can be grazed by the horse when rope is 5 m long

$= \frac{\theta}{360} \times \pi r^2$

$= \frac{90}{360_4} \times 3.14 \times 5 \times 5$

$= \frac{78.5}{4} = 19.625\ m^2$

Area that can be grazed by the horse when rope is 10 m long

$= \frac{90}{360_4} \times 3.14 \times 10 \times 10$

$= 78.5\ m^2$

(ii) Increasing in the grazing area $= 78.5 - 19.625 = 58.875\ m^2$

31.a) A box contains 100 discs which are numbered from 1 to 100. If one disc is drawn at random from the box, find the probability that it bears (i) a two-digit number (ii) a perfect square (iii) a number divisible by 5. (iv) a number divisible by 10.

Sol: A box contains 100 discs which are numbered from 1 to 100.

S={1,2,3,4,.....,99,100}, n(S)=100

$P(E) = \frac{Number\ of\ outcomes\ favourable\ to\ E}{Number\ of\ all\ possible\ outcomes} = \frac{n(E)}{n(S)}$

(i) A= Event getting a two digit number

A={10,11,12,13,....,99,100}; n(A)=91

$P(\ a\ two\ digit\ number) = P(A) = \frac{91}{100}$

(ii) B= Event getting Perfect square number

B={1,4,9,16,25,36,49,64,81,100} , n(B)=10

$P(\ Perfect\ square\ number) = P(B) = \frac{10}{100} = \frac{1}{10}$

(iii) C=Event getting a numbers divisible by 5

C={5,10,15,20,25,30,35,40,45,50,55,60,65,70,75,80,85,90,95,100}; n(C)= 20

$$P(a\ number\ divisible\ by\ 5) = P(C) = \frac{20}{100} = \frac{1}{5}$$

(iv) D= Event getting a numbers divisible by 10

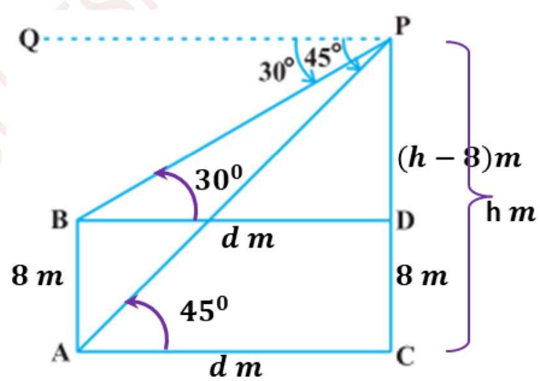
D={10,20,30,40,50,60,70,80,90,100}; n(D)=10

$$P(\ a\ number\ divisible\ by\ 10) = P(D) = \frac{10}{100} = \frac{1}{10}$$

OR

b) The angles of depression of the top and bottom of an 8 m tall building from the top of a multi-storeyed building are 30° and 45" respectively. Find the height of the multi-storeyed building and the distance between the two buildings.

Solution : Height of tall building=AB=8 m



The height of the multi-storeyed building=PC=h m

The distance between the two buildings=AC

BD ||AC

Let BD = AC = d m

AB = CD = 8 m

PD = PC − DC = (h − 8)m

$\angle PAC = \angle QPA = 45^0 (Alternate\ interior\ angles)$

$\angle PBD = \angle QPB = 30^0$(Alternate interior angles)

From ΔPDB

$$\tan 30^0 = \frac{PD}{BD}$$

$$\frac{1}{\sqrt{3}} = \frac{h-8}{d}$$

$d = (h-8)\sqrt{3} \rightarrow (1)$

From ΔPCA

$$\tan 45^0 = \frac{PC}{AC}$$

$1 = \frac{h}{d}$

$d = h \rightarrow (2)$

From (1) and (2)

$h = (h - 8)\sqrt{3}$

$h = h\sqrt{3} - 8\sqrt{3}$

$h\sqrt{3} - h = 8\sqrt{3}$

$h(\sqrt{3} - 1) = 8\sqrt{3}$

$h = \frac{8\sqrt{3}}{\sqrt{3}-1} \times \frac{\sqrt{3}+1}{\sqrt{3}+1}$

$= \frac{8(3+\sqrt{3})}{3-1}$

$= \frac{8(3+\sqrt{3})}{2}$

$= 4(3+\sqrt{3})$

The height of the multi – storeyed building $= h = 4(3+\sqrt{3})$ m

The distance between the two buildings $= d = 4(3+\sqrt{3})$ m

32.a) The distribution below gives the weights of 30 students of a class. Find the median weight of the students.

Weight (in kg)	40-45	45-50	50-55	55-60	60-65	65-70	70-75
Number of students	2	3	8	6	6	3	2

Sol:

Weight (in kg)	Number of students	Cumulative frequency
40-45	2	2
45-50	3	5
50-55	8	$13 \rightarrow cf$
55-60	$6 \rightarrow f$	19
60-65	6	25
65-70	3	28
70-75	2	30
	$n = \sum f_i = 30$	

n =30, $\frac{n}{2} = \frac{30}{2} = 15$. So median class is 55-60.

$l = 55, \quad cf = 13, \quad f = 6, \quad h = 5$

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

$$= 55 + \left(\frac{15 - 13}{6}\right) \times 5$$

$$= 55 + \frac{2 \times 5}{6}$$

$$= 55 + \frac{5}{3}$$

$$= 55 + 1.67$$

$$= 56.67$$

Median weight=56.67 kg.

OR

b) If the sum of first 7 terms of an A.P is 49 and that of 17 terms is 289, find the sum of first n terms.

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

$S_7 = 49 \Rightarrow \frac{7}{2}[2a + (7-1)d] = 49$

$\Rightarrow [2a + 6d] = \frac{2 \times 49}{7}$

$\Rightarrow 2a + 6d = 14$

$\Rightarrow a + 3d = 7 \rightarrow (1)$

$S_{17} = 289 \Rightarrow \frac{17}{2}[2a + (17-1)d] = 289$

$\Rightarrow [2a + 16d] = \frac{2 \times 289}{17}$

$\Rightarrow 2a + 16d = 34$

$\Rightarrow a + 8d = 17 \rightarrow (2)$

$(2) - (1) \Rightarrow a + 8d = 17$

$a + 3d = 7$

$(-)\ (-)\quad (-)$

$5d = 10$

$d = 2$

Substitute d=2 in (1)

$a + 3 \times 2 = 7 \Rightarrow a + 6 = 7 \Rightarrow a = 1$

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

$= \frac{n}{2}[2 \times 1 + (n-1)2]$

$= \frac{n}{2}[2 + 2n - 2]$

$= \frac{n}{2} \times 2n = n^2$

33. a) Solve the following pair of linear equations graphically.

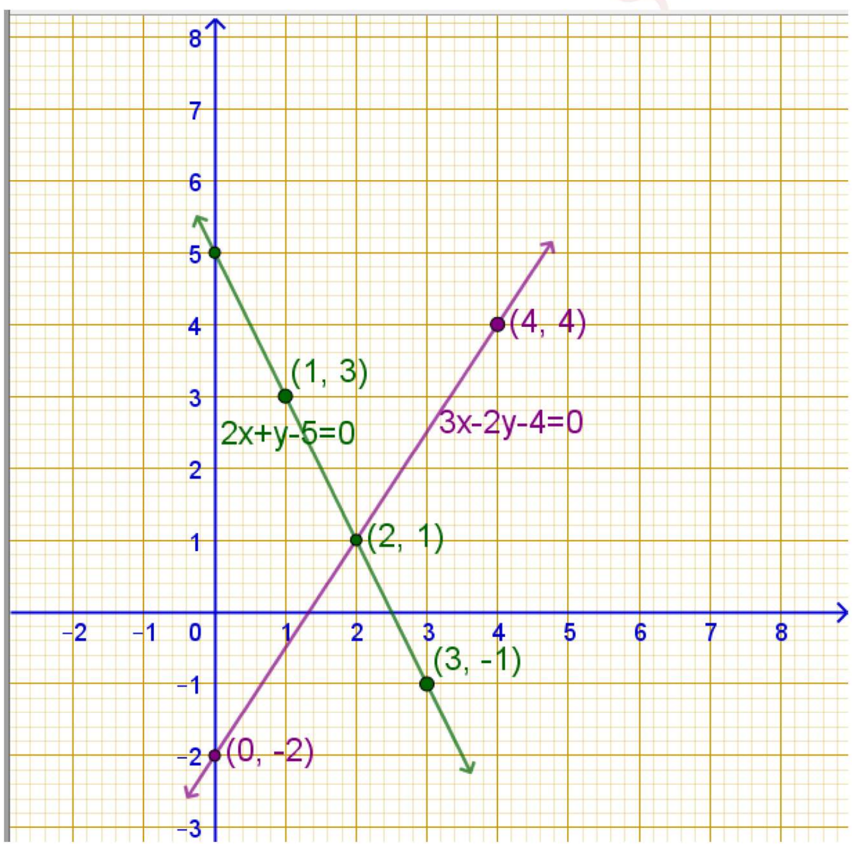
2x+y-5=0; 3x-2y-4=0

Sol:

For equation $2x + y - 5 = 0$		
x	$y = 5 - 2x$	(x, y)
1	$y = 5 - 2(1) = 5 - 2 = 3$	(1,3)

2	$y = 5 - 2(2) = 5 - 4 = 1$	(2,1)
3	$y = 5 - 2(3) = 5 - 6 = -1$	$(3, -1)$

For equation: $3x - 2y - 4 = 0$		
x	$y = \frac{3x-4}{2}$	(x, y)
0	$y = \frac{3(0)-4}{2} = \frac{0-4}{2} = \frac{-4}{2} = -2$	$(0, -2)$
2	$y = \frac{3(2)-4}{2} = \frac{6-4}{2} = \frac{2}{2} = 1$	(2,1)
4	$y = \frac{3(4)-4}{2} = \frac{12-4}{2} = \frac{8}{2} = 4$	(4,4)



The two lines intersect at the point (2, 1).

So, x = 2, y = 1 is the required solution of the pair of linear equations.

OR

b) Form the pair of linear equations in the following situation and find their solution graphically.

3 pens and 4 pencils together coast ₹44 whereas 4 pens and 3 pencils together cost ₹47.

Sol: Let the cost of 1 pen=₹ x and the cost of 1 pencil=₹y

3 pens + 4 pencils = ₹ 44 ⇒ 3x + 4y = 44 → (1)

4 pens + 3 pencils = ₹ 47 ⇒ 4x + 3y = 47 → (2)

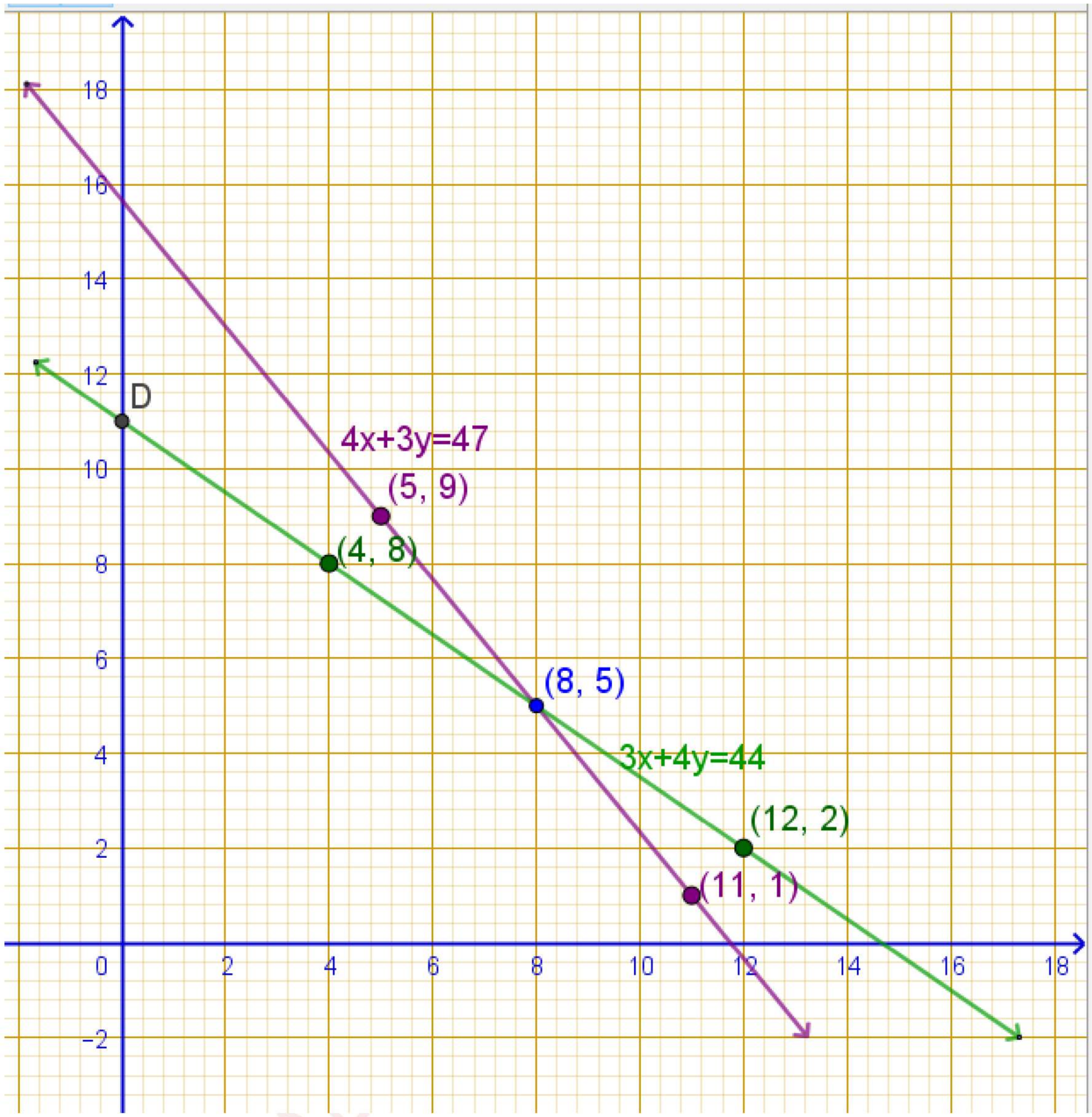
For equation $3x + 4y = 44$		
x	$y = \frac{44 - 3x}{4}$	(x, y)
4	$y = \frac{44 - 3(4)}{4} = \frac{44 - 12}{4} = \frac{32}{4} = 8$	(4,8)
8	$y = \frac{44 - 3(8)}{4} = \frac{44 - 24}{4} = \frac{20}{4} = 5$	(8,5)
12	$y = \frac{44 - 3(12)}{4} = \frac{44 - 36}{4} = \frac{8}{4} = 2$	(12,2)

For equation $4x + 3y = 47$		
x	$y = \frac{47 - 4x}{3}$	(x, y)
5	$y = \frac{47 - 4(5)}{3} = \frac{47 - 20}{3} = \frac{27}{3} = 9$	(5,9)
8	$y = \frac{47 - 4(8)}{3} = \frac{47 - 32}{3} = \frac{15}{3} = 5$	(8,5)
11	$y = \frac{47 - 4(11)}{3} = \frac{47 - 44}{3} = \frac{3}{3} = 1$	(11,1)

The two lines intersect at the point (8, 5).

So, x = 8, y = 5 is the required solution of the pair of linear equations.

The cost of 1 pen=₹ 8 and the cost of 1 pencil=₹5



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