

Linear Equation Formative assessment

Question 1. Which of these equation have i) Unique solution ii) Infinite solutions iii) no solutions

a) $152x - 378y = -74$, $-378x + 152y = -604$

b) $x + 2y = 10$, $3x + 6y = 30$

c) $3x + 4y = 6$, $12x + 16y = 30$

d) $7x - 11y = 53$, $19x - 17y = 456$

e) $x = 7$, $y = -2$

f) $ax + by = a - b$, $bx - ay = a + b$

g) $2x + 3y = 0$, $124x + 13y = 0$

h) $y = 11$, $y = -11$

Solution

Condition	Algebraic interpretation
$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$	One unique solution only.
$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$	Infinite solution.
$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$	No solution

One unique solution: (a), (d), (e), (f), (d)

Infinite solution :(b)

No solution: (c), (h)

Question 2. Using substitution method solve the below equation

a) $x-2y+300=0$, $6x-y-70=0$

b) $5x-y=5$, $3x-y=3$

Solution

1	Method of elimination by substitution	1) Suppose the equation are $a_1x+b_1y+c_1=0$ $a_2x+b_2y+c_2=0$ 2) Find the value of variable of either x or y in other variable term in first equation 3) Substitute the value of that variable in second equation 4) Now this is a linear equation in one variable. Find the value of the variable 5) Substitute this value in first equation and get the second variable
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a) From 1st equation

$$x=2y-300$$

Substituting this in second equation

$$6(2y-300) - y - 70 = 0 \Rightarrow y = 170$$

Putting this 1st equation

$$x \Rightarrow 40$$

$$b) (1, 0)$$

Question 3. Using elimination method, solve the following

$$a) x+y-40=0, 7x+3y=180$$

$$b) x+10y=68, x+15y=98$$

Solution

2	Method of elimination by equating the coefficients	1) Suppose the equations are $a_1x+b_1y+c_1=0$ $a_2x+b_2y+c_2=0$ 2) Find the LCM of a_1 and a_2 . Let it be k . 3) Multiply the first equation by the value k/a_1 4) Multiply the second equation by the value k/a_2 4) Subtract the equation obtained. This way one variable will be eliminated and we can solve to get the value of variable y 5) Substitute this value in the first equation and get the second variable
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$$a) x+y-40=0 \quad \text{---(1)}$$

$$7x+3y=180 \quad \text{---(2)}$$

Multiplying equation (1) by 7

$$7x+7y-280=0 \quad \text{---(3)}$$

Subtracting equation 2 from equation 3

$$7x+7y-280=0$$

$$7x+3y=180$$

We get

$$4y=100 \Rightarrow y=25$$

Substituting this in (1), we get $x=15$

b) (8,6)

Question 4 Solve the below linear equation using cross-multiplication method

a) $(a-b)x + (a+b)y = a^2 - 2ab - b^2$, $(a+b)(x+y) = a^2 + b^2$

b) $x+y=5$, $2x-3y=4$

Solution

3	Cross Multiplication method	<p>1) Suppose the equation are</p> $a_1x + b_1y + c_1 = 0$ $a_2x + b_2y + c_2 = 0$ <p>2) This can be written as</p> $\frac{x}{\frac{b_1}{b_2} \frac{c_1}{c_2}} = \frac{-y}{\frac{a_1}{a_2} \frac{c_1}{c_2}} = \frac{1}{\frac{a_1}{a_2} \frac{b_1}{b_2}}$ <p>3) This can be written as</p> $\frac{x}{b_1c_2 - b_2c_1} = \frac{-y}{a_1c_2 - a_2c_1} = \frac{1}{a_1b_2 - a_2b_1}$ <p>4) Value of x and y can be find using the</p> <p>$x \Rightarrow$ first and last expression</p> <p>$y \Rightarrow$ second and last expression</p>
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a) The equation can be written as

$$(a-b)x + (a+b)y - (a^2 - 2ab - b^2) = 0$$

$$(a+b)x + (a+b)y - (a^2 + b^2) = 0$$

By cross multiplication we have

$$\frac{x}{-(a+b)(a^2+b^2)+(a+b)(a^2-2ab-b^2)} = \frac{y}{-(a+b)(a^2-2ab-b^2)+(a-b)(a^2+b^2)} = \frac{1}{(a-b)(a+b)-(a+b)^2}$$

Solving

$$\frac{x}{(-2b)(a+b)(a+b)} = \frac{y}{4ab^2} = \frac{1}{-2b(a+b)}$$

$$x=a+b, y=-2ab(a+b)^{-1}$$

$$b) (19/5, 6/5)$$

Question 6 - True or False statement

- a) Line $4x+5y=0$ and $11x+17y=0$ both passes through origin
- b) Pair of lines $117x+14y=30$, $65x+11y=19$ are consistent and have a unique solution
- c) There are infinite solution for equation $17x+12y=30$
- d) $x=0, y=0$ has one unique solution
- e) Lines represented by $x-y=0$ and $x+y=0$ are perpendicular to each other
- f) $2x+6y=12$ and $8x+24y=65$ are consistent pair of equation
- g) $x+6y=12$ and $4x+24y=64$ are inconsistent pair of equation

Solution

- a) True
- b) True
- c) True
- d) True
- e) True
- f) False
- g) True

Multiple choice Questions

Question 7 find the value of p for which the linear pair has infinite solution

$$12x+14y=0$$

$$36x+py=0$$

- a) 14
- b) 28
- c) 56
- d) 42

Solution (d)

For infinite solution

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

So $12/36=14/p \Rightarrow p=42$

Question 8. There are 10 students in XII class. Some are maths and some bio student.. The no of bio students are 4 more then math's students?. Find the no of math's and bio students

- a) 1,9
- b) 4,6
- c) 2,8
- d) 3,7

Solution (d)

Let x be math's students

y be bio students

Then

$$x+y=10$$

$$y=x+4$$

Solving these linear pair through any method we get

$$x=3 \text{ and } y=7$$

Question 9 which of the below pair are consistent pair?

- a) $x-3y=3$, $3x-9y=2$
- b) $51x+68y=110$, $3x+4y=99$
- c) $2x+3y=10$, $9x+11y=12$
- d) None of these

Solution c

For consistent pair

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

Or

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

Analyzing all of them ,we get c as the answer

Question 10. There are two numbers. Two conditions are there for them

- i) Sum of these two numbers are 100
- ii) One number is four time another number.

What are these numbers?

- a) 20,80
- b) 30,70
- c) 40,60
- d) 25,75

Solution (a)

Let x and y are the number

$$x+y=100$$

$$y=4x$$

Solving them we get $x=20$ and $y=80$

Question 11 The number of solution of the linear pair

$$x+37y=123$$

$$21x-41y=125$$

- a) No solution
- b) One solution
- c) infinite many
- d) None of these

Solution (d)

Short answer question

Question 12 The sum of a 2 digit number and number obtained by reversing the order of the digits is 99. If the digits of the number differ by 3. Find the number

Solution 63 or 36

Question 13. Rajdhani train covered the distance between Lucknow and Delhi at a uniform speed. It is observed that if rajdhani would have run slower by 10 km/hr, it would have taken 3 hours more to reach the destination and if rajdhani would have run faster by 10 km/hr, it would have taken 2 hours less. Find the distance Lucknow and Delhi?

Solution

Let x be the speed and t be the original timing, then distance between Lucknow and Delhi

$$\text{Distance} = \text{speed} \times \text{time} = xy$$

Now from first observation

$$xy = (x-10)(y+3) \Rightarrow 3x-10y-30=0$$

From second observation

$$xy = (x+10)(y-2) \Rightarrow 2x-10y+20=0$$

Solving both we get

$x=50\text{km/hr}$

$y=12\text{hours}$

So distance between Lucknow and Delhi= $50 \times 12=600$ Km

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