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Class: 10
Subject: Mathematics
Topic: Pair of Linear equations in two variables
No. of Questions: 25

Q1. The coach of a cricket team buys 3 bats and 6 balls for Rs.3900. Later, he buys another bat and 3 more balls of same kind for Rs. 1300. Represent this situation algebraically and geometrically.

Sol. **:** Let the price of bat be x and ball be y.
According to the question,
$3x + 6y = 3900$
$3y = 1300$

x	100	1000
y	400	100

x +

x	1300	0
y	0	650

For different values of x, there are different values of y. Plot them on graph. The two lines intersect at point (1300, 0).

Q2. Solve the system of equations graphically: $2x – y – 4=0$; $x + y + 1=0$.

(CBSE-2002)

Sol. $2x – y – 4=0$ or $y= 2x – 4$
$x + y + 4=0$ or $x= - y -1$
$2x – y – 4=0$

x	-1	0
y	0	-1

$x + y + 4=0$

x	0	2
y	-4	0

Plot the values of x and y on the graph. The two lines intersect at points x=1, y=-2

Q3. Draw the graph of $2x + y=6$ and $2x – y + 2=0$. Shade the region bounded by these lines and x-axis. Find the area of the shaded region. (CBSE-2002)

x	0	3
y	6	0

x	0	-1
y	2	0

Sol. $2x + y=6$ $2x – y + 2=0$

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Both lines intersect at point (1,4)
Hence, x=1, y=4
Area= 1/2 * b * h= 1/2 * 4 * 4= 8 sq. units

Q4. Determine graphically the vertices of a trapezium, the equations of whose sides are: x=0, y=0, y=4 and 2x + y=6. Also determine the area.

Sol. Clearly, x-0 represents y- axis and y=0 represents x- axis.

x	3	0
y	0	6

2x + y=6

Represent the lines on the graph and as a result, the coordinates of trapezium comes out to be (0,0); (3,0); (1,4); (0,4)
Area of trapezium= 1/2 * (3+1) * 4= 8 sq. units

Q5. Solve: 3(2u+v) =7uv; 3(u+3v) =11uv

Sol. 3(2u+v) =7uv or 6u + 3v=7uv
3(u+3v) = 11uv or 3u + 9v=11uv
Dividing both the equations by uv.

6/v + 3/u=7
3/v + 9/u=11
Taking 1/v=x and 1/u= y

6x+ 3y=7	;	3x+9y=11
(2x+y)=7/3	;	x+3y=11/3
y=7/3-2x	;	x+3(7/3-2x) =11/3
y=7/3-2 * 2/3	;	x+7-6x=11/3
y=1	;	x=2/3

x=1/v=2/3
v=3/2
y=1/u=1
u=1
Also, if we put u=0 in either of the two equations, we get v=0

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Q6. Solve: $\frac{4}{x}$ +3y=8; $\frac{6}{x}$ -4y=-5 (CBSE- 2010)

Sol. Putting 1/x=a

4a + 3y=8	;	6a – 3y=-5
a=(8-3y)/4	;	6(8-3y)/4 – 4y=-5
a=2/4= 1/2	;	(24-9y-8y)/2=-5
		y=2

a=1/x= 1/2
x=2

Q.7 Solve: x + 2y + z=7; x + 3z=11; and 2x – 3y=1

Sol. x + 2y + z=7 or z=7 – x – 2y
Substituting z=7 – x – 2y in x + 3z=11
x+ 3(7 – x – 2y)=11
x + 21 – 3x – 6y= 11
-2x – 6y=-10

Add -2x – 6y=-10 and 2x – 3y=1
-9y=-9
y=1
Put y=1 in 2x – 3y=1, we get x=2
Put x=2, y=1 in z=7 – x – 2y, we get z= 3

Q8. Solve for x and y; 7(y+3) – 2(x+2) =14; 4(y – 2) + 3(x – 3) =2

Sol. 7(y+3) – 2(x+2) =14
7y + 21 – 2x – 4=14
7y – 2x + 17=14
7y – 2x=-3

4(y-2) + 3(x-3) =2
4y-8+3x-9=2
4y + 3x-17=2
3x + 4y=19

7y- 2x=-3	;	3x + 4y=19
y= (-3+2x)/7	;	3x + 4(-3+2x)/7=19
y= (-3+2*5)/7	;	21x-12+8x=19 * 7
y=1	;	29x=145

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x=5

Q9. $\frac{5}{x-1}+\frac{1}{y-2}=2; \frac{6}{x-1}-\frac{3}{y-2}=1$, find x and y. (CBSE-2009)

Sol. Let 1/x-1= a and 1/y-2=b
Equations are:
5a + b=2
6a-3b=1

5a+b=2	;	6a-3b=1
b=2-5a	;	6a-3(2-5a)=1
b=2-5/3	;	21a=7
b=1/3	;	a=1/3

1/x-1= 1/3
x-1=3
x=4

1/y-2= 1/3
y-2=3
y=5

Q10. x + y=2xy; $\frac{x-y}{xy}$ =6; x, y≠0, solve for x and y.

Sol. x+y=2xy……(1)
(x-y)/xy=6
x-y=6xy……(2)

Divide (1) by (2)

1/y + 1/x=2……. (3)
1/y – 1/x=6……. (4)

On adding (3) and (4)
2/y=8
y=1/4

Now, 1/(1/4) – 1/x= 6 (from 4)
4-6=1/x

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x= -1/2

Q11. Solve $\frac{x}{a}+\frac{y}{b}=2$; ax – by= a^2-b^2 using cross multiplication.

(CBSE-2005)

Sol. x/a + y/b=2 or bx + ay -2ab=0
ax – by- (a^2-b^2)=0

By cross multiplication method,

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

x/-(a^2+b^2)= -y/-b(-a^2-b^2) = 1/-(a^2+b^2)
x= a; y=b

Q12. Solve: ax + by=a – b; bx – ay=a + b using cross multiplication method. (CBSE-2000)

Sol. ax + by – (a-b) =0
bx – ay – (a+b)=0

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

x/(-b^2-a^2) = -y/(-a^2 – b^2) = 1/-(a^2+b^2)
x=1 and y=-1

Q13. Find the value of k for which the following system of linear equations has infinite solutions: x+ (k+1) y=5; (k+1)x + 9y= 8k – 1

(CBSE-2002)

Sol. 1/(k+1)= (k+1)/9= 5/(8k-1)
a/(k+1)= (k+1)/9 ; (k+1)/9= 5/(8k-1)
9= $(k+1)^2$; (k+1)98k-1)=45

k=2, -4
k=2 satisfies (k+1)(8k-1)=45

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Q14. For what value of k, will the system of equations x + 2y=5 and 3x + ky – 15=0 has a unique solution?

(CBSE-2001)

Sol. $1/3 \neq 2/6$
$k \neq 6$

Q15. Find the values of α and β for which the following system of linear equations has infinite number of solution: 2x + 3y=7; 2αx + (α+β)y=28.

(CBSE-2001)

Sol. $2/2\alpha = 3/(\alpha+\beta) = 7/28$
$1/\alpha = 1/4$; $3/(\alpha+\beta) = 1/4$
$\alpha = 4$; $3/(4+\beta) = 1/4$
$\beta = 8$

Q16. The sum of a 2-digit number and the number obtained by reversing the order of its digits is 165. If the digits differ by 3, find the number?

(CBSE-2002)

Sol. Let the digits at units and tens place be x and y respectively
Number= 10y+x
Number obtained by reversing the order of digits= 10x+y
Acc. to ques.,

(10y+x) +(10x+y)=165
And x-y=3 or y-x=3
On solving we get x=9, y=6 or x=6, y=9
Number= 96 or 69

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Q17. A and B are friends and their ages differ by 2 years. A's father D is twice as old as A and B is twice as old as his sister C. the age of D and C differ by 40 years. Find the ages of A and B.

Sol. Let the age of A be x and B be y
x-y= ±2
age of D= 2x years
age of C= y/2 years

According to question,
2x- y/2=40 or 4x-y=80…… (1)
x-y =2 or x-y=-2……..(2)

On solving we get
x= 26 or 27 1/3
y= 24 or 29 1/3
Therefore, The Age of A= $27\frac{1}{3}$ years or 26 years; Age of B= $29\frac{1}{3}$ years or 24 years.

Q18. X takes 3 hours more than Y to walk 30 km. But, if A doubles his pace, he is ahead of Y by $1\frac{1}{2}$ hours. Find their speed of walking.

Sol. Let the speed of X is x km/hr and Y is y km/hr
Time taken by X to cover 30 km=30/x hrs
Time taken by Y to cover 30 km= 30/y hrs

According to question,
30/x- 10/y= 3 or 10/x – 10/y=1
Now speed of X is 2x km/hr
Time taken by X= 30/2x hrs
Time taken by Y= 30/y hrs

30/y – 3//2x= $1\frac{1}{2}$ or -10/x + 20/y=1
On solving we get Speed of X= 10/3 km/hr; Speed of Y= 5 km/hr

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Q19. Students of a class are made to stand in rows. If one student is extra in a row, there would be 2 rows less. If one student is less in a row there would be 3 more rows. Find the number os students in the class.

Sol. Let the number of students be x and number of rows be y
When one student is extra in each row, there are 2 rows less.
(x/y +1) students and (y-2) rows

Total number of students= number of rows * Number of students in each row

x= (x/y +1)(y-2)
-2x/y + y-2=0…….. (1)

If one student is less in each row, then there are 3 rows more

x=(x/y-1)(y+3)
3x/y-y-3=0
On solving, we get x=60

Q20. On selling a tea set at 5% loss and a lemon set at 15% gain, a crockery seller gains Rs. 7. If he sells the tea set at 5% gain and lemon set at 10% gain, he gains Rs.13. find the actual price of the tea set and the lemon set.

Sol. Let the CP of tea set be Rs. X and lemon set be Rs. Y
Case 1: when tea set is sold at 5% loss and lemon set is sold at 5% gain
Loss= Rs. 5x/100= Rs. x/20
Gain= Rs. 15y/100= Rs. 3y/20
Net gain= 3y/20 – x/20
x-3y+140=0…….(1)

Case 2: When tea set is sold at 5% gain and lemon set at 10% gain
Gain on tea set = Rs. x/20
Gain on lemon set = Rs. y/10
Total gain= x/20 + y/10
x+2y-260=0…….(2)

On solving, we get x=100 and y=80
Therefore, cost of tea-set= Rs.100; cost of lemon-set= Rs.80

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Q21. Find the values of p and q for which the following system of equations has infinite number of solution: $2x + 3y=7$; $(p+q)x + (2p-q)y=21$.

(CBSE-2001)

Sol. For infinite number of solutions,

$2/(p+q)= 3/(2p-q)= 7/21$

$2/(p+q)= 1/3$; $3/(2p-q)= 1/3$

$6=p+q$; $2p-q=9$

$(p+q) + (2p-q)= 6+9$

$3p=15$

$p=5$ and $q=1$

Q22. Solve: $ax + by=c$ and $bx + ay=1+c$

Sol. $ax + by=c$ and $bx + cy=1+c$

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

$x= [c(a-b)-b]/[(a-b)(a+b)]$; $y= [c(a-b)+a]/[(a+b)(a-b)]$

$x= [c/(a+b)] – [b/(a^2-b^2)]$; $y=[c/(a+b)]+ [a/(a^2-b^2)]$

Q23. Find the value of k, for which the system of equations has no solution in $3x – 4y + 7=0$; $kx + 3y – 5=0$

Sol. $a_1/a_2 = b_1/b_2 \neq c_1/c_2$

$-4/3 \neq -7/5$

$a_1/a_2 = b_1/b_2$

$3/k= -4/3$

$k= -9/4$

Q24. Determine the value of k, so that the following equations has no solution: $(3k + 1)x + 3y – 2=0$; $(k^2 + 1)x = (k – 2)y – 5=0$

Sol. $(3k+1)/(k^2+1) = 3/(k-2) \neq -2/-5$

$(3k+1)/(k^2+1) = 3/(k-2)$

$(3k+1)(k-2)= 3(k^2+1)$

$3k^2 – 5k – 2= 3k^2 + 3$

$-5k – 2= 3$

$-5k=5$

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k=-1

Q25. A fraction becomes 4/5; if 1 is added to both numerator and denominator. If however, 5 is subtracted from both numerator and denominator, the fraction becomes 1/2. What is the fraction?

Sol. Let the fraction be x/y
According to question,
$(x+1)/(y+1)= 4/5$ and $(x-5)/(y-5)= 1/2$
$5x-4y+1=0$ and $2x-y-5=0$
On solving the equations, we get x=7 and y=9
Fraction= 7/9