Grade 10

Worksheet on Linear Equation in Two Variables

Q1) How many solutions does the following given system of equations have?

a)$5x - y = 7, x - y + 1 = 0.$

b) $2x + 3y = 4, 4x + 6y = 12.$

c) $2x + 3y = 6, 4x + 6y = 12.$

Q2) Solve the following system of equation graphically and find the vertices and area of the polynomial so formed by these lines and the axis.

$2x + y = 2, 2x + y = 6.$

Q3)Solve for $x \; and \; y$. $\frac{2}{3x+2y} + \frac{3}{3x-2y} = \frac{17}{5}, \frac{5}{3x+2y} + \frac{1}{3x-2y} = 2.$

Q4) For what value of k does the system of equation $x + 2y = 3,$

$5x + ky + 7 = 0$ have i) a unique solution, ii) no solution?

Q5) For what value of k does the system of equation $2x + 3y = 7,$

$(k - 1)x + (k + 2)y = 3k$ have infinitely many solutions?

Q6) 8 men and 12 boys can finish a piece of work in 5 days, while 6 men and 8 boys can finish it in 7 days. Find the time taken by one man alone to finish the work and that taken by one boy alone to finish the work.

Q7) A boat goes 10km in 5 hours upstream and 30km in 3 hours downstream. Find its speed in still water and speed of the current.

Solutions

Grade 10 Linear Equation in two Variables

Sol. 1)

a)$5x - y = 7, x - y + 1 = 0.$

$$\frac{5}{1} \neq \frac{-1}{-1} \neq \frac{-7}{1}$$

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

Hence, the given system of equation has unique solution.

b) $2x + 3y = 4, 4x + 6y = 12.$

$$\frac{2}{4} = \frac{3}{6} \neq \frac{-4}{-12}$$

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

Hence, the given system of equation has no solution.

c) $2x + 3y = 6, 4x + 6y = 12.$

$$\frac{2}{4} = \frac{3}{6} = \frac{-6}{-12}$$

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

Hence, the given system of equation has infinitely many solutions.

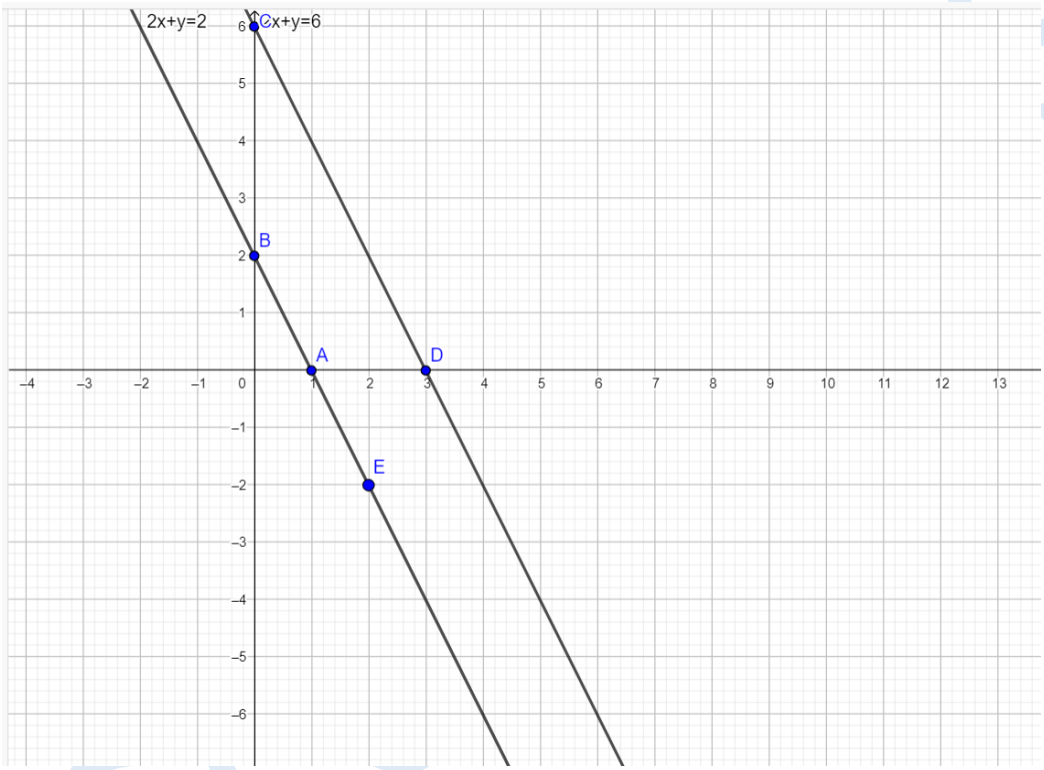
Q2) Solve the following system of equation graphically and find the vertices and area of the polynomial so formed by these lines and the axis.

$2x + y = 2, 2x + y = 6.$

$Eq1 \ : \ 2x + y = 2 \rightarrow y = 2 - 2x$

x	1	0	2
y	0	2	-2

x	3	2	1
y	0	2	-2



ar(ABCD) =arΔ(OCD) - arΔ(OAB)

arΔ(OCD) = $\frac{1}{2} OD \times OC - \frac{1}{2} OA \times OB \implies \frac{1}{2} \times 3 \times 6 - \frac{1}{2} \times 1 \times 2 = 8 \ sq \ units$

Q3)Solve for $x \ and \ y$. $\frac{2}{3x+2y} + \frac{3}{3x-2y} = \frac{17}{5}, \frac{5}{3x+2y} + \frac{1}{3x-2y} = 2.$

Sol.3) $\frac{2}{3x+2y} + \frac{3}{3x-2y} = \frac{17}{5}$

Let $\frac{1}{3x+2y} = a \ and \ \frac{1}{3x-2y} = b$

$$\frac{2}{3x+2y}+\frac{3}{3x-2y}=\frac{17}{5}\Rightarrow 2a+3b=\frac{17}{5}\ or\ 10a+15b=17\mapsto \quad ①$$

$$\frac{5}{3x+2y}+\frac{1}{3x-2y}=2\Rightarrow 5a+b=2\mapsto ②$$

$Solve\ ① - 2\times ②$

$$10a+15b=17\text{- }(10a+2b=4)\Rightarrow 13b=13\ \Rightarrow b=1\ and\ a=\frac{1}{5}$$

Now, $\frac{1}{3x+2y}=a\ and\ \frac{1}{3x-2y}=b$

$$\Rightarrow \frac{1}{3x+2y}=\frac{1}{5}\quad and\ \frac{1}{3x-2y}=1$$

$$\Rightarrow 3x+2y=5\ \mapsto ③ and\ 3x-2y=1\mapsto ④$$

$solve\ ③+④$

$$3x+2y=5\ +(3x-2y=1)\Rightarrow 6x=6$$

$$\Rightarrow x=1\ and\ y=1$$

Q4) For what value of k does the system of equation $x+2y=3$,

$5x+ky+7=0$ have i) a unique solution, ii) no solution?

Sol.4)

Eq1 : $x+2y=3$

Eq2: $5x+ky+7$

$$\frac{a_1}{a_2}=\frac{1}{5},\qquad \frac{b_1}{b_2}=\frac{2}{k},\qquad \frac{c_1}{c_2}=\frac{-3}{7}$$

i) For unique solution

$\frac{a_1}{a_2}\neq\frac{b_1}{b_2}$ i.e. $\frac{1}{5}\neq\frac{2}{k}$, hence, for $k\neq 10$ it has unique solution.

ii)For no solution $\frac{a_1}{a_2}=\frac{b_1}{b_2}\neq\frac{c_1}{c_2}$

$$\frac{1}{5}=\frac{2}{k}, k=10$$

Q5) For what value of k does the system of equation $2x + 3y = 7$,

$(k-1)x + (k+2)y = 3k$ have infinitely many solutions?

$Sol. 5)$

$2x + 3y = 7$

$(k-1)x + (k+2)y = 3k$

$\frac{a_1}{a_2} = \frac{2}{k-1}, \frac{b_1}{b_2} = \frac{3}{k+2}, \frac{c_1}{c_2} = \frac{-7}{-3k}$

For infinitely many solutions:

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

$\frac{2}{k-1} = \frac{3}{k+2} \Longrightarrow 2(k+2) = 3(k-1) \Longrightarrow k = 7$

Q6) 8 men and 12 boys can finish a piece of work in 5 days, while 6 men and 8 boys can finish it in 7 days. Find the time taken by one man alone to finish the work and that taken by one boy alone to finish the work.

Sol) Suppose one men alone can finish the work in $x\ days$ and one boy alone can finish it in y days.

One man's one day work = $\frac{1}{x}$

One boy's one day work = $\frac{1}{y}$

8 men and 12 boys can finish work in 5 days.

$\Longrightarrow$(8 men's 1 day work) + (12 boys one day work) = $\frac{1}{5}$

$\Longrightarrow \frac{8}{x} + \frac{12}{y} = \frac{1}{5}$

$\Longrightarrow 8u + 12v = \frac{1}{5} \ \ldots.(1)$

6 men and 8 boys can finish work in 7 days.

$\Longrightarrow$(6 men's 1 day work) + (8 boys one day work) = $\frac{1}{7}$

$$\Longrightarrow \frac{6}{x}+\frac{8}{y}=\frac{1}{7}$$

$$\Longrightarrow 6u+8v=\frac{1}{7} \quad \ldots.(2)$$

Solve 3x(1) – 4x(2)

$$\left(24u+36v=\frac{3}{5}\right)-\left(24u+32v=\frac{4}{7}\right) \Longrightarrow 4v=\left(\frac{3}{5}-\frac{4}{7}\right)$$

$$v=\frac{1}{140} \Rightarrow y=140 \; and \; u=\frac{1}{70} \Rightarrow x=70$$

Hence one man alone can finish work in 70 days.

And one boy alone can finish work in 140 days.

Q7) A boat goes 10km in 5 hours upstream and 30km in 3 hours downstream. Find its speed in still water and speed of the current.

Sol.7)

Let the speed of boat in still water be x

Let the speed of current = y

Speed of boat in Upstream $(x-y)$= $\frac{10}{5}=\frac{2km}{hr}$

$x-y=2 \longmapsto ①$

Speed of boat in Downstream $(x+y)$ = $\frac{30}{3}=10km/hr$

$x+y=10 \longmapsto ②$

$Solve \; ① + ②$

$2x=12 \Longrightarrow x=6, y=4$

speed of boat in still water = 6km/hr.

speed of current = 4km/hr.