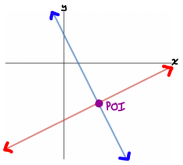
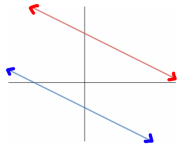
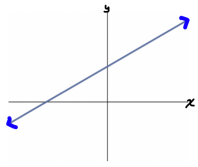
Unit 1- Linear Systems

Workbook

MPM2D

Graph	Slopes of Lines	Intercepts	Number of Solutions
Intersecting 	DIFFERENT	Usually different unless the lines intersect on an axis	1
Parallel & Distinct 	Same	Different	0
Parallel & Coincident 	Same	Same	Infinitely Many

W1 – Solving Linear Systems by GRAPHING Unit 1

MPM2D

Jensen

1) Solve each system by graphing.

a) ℓ_1: $y = 2x + 1$
ℓ_2: $y = x - 2$

Solution: $x=-3, y=-5$

Line 1

$y = 2x+1$ (m = 2, b = 1)

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

y-int $= b = 1$

Line 2

$y = 1x-2$ (m = 1, b = −2)

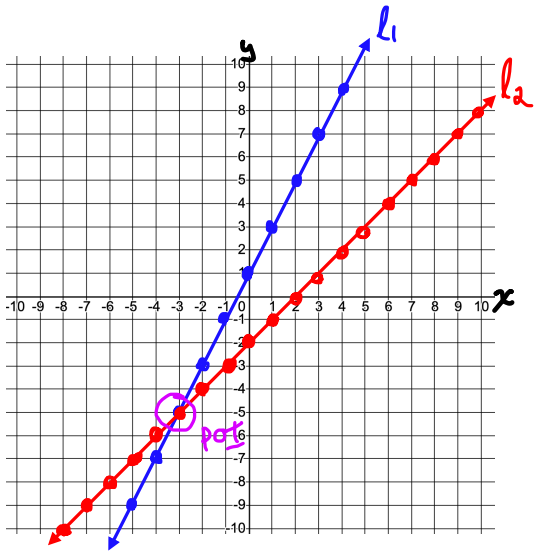
slope $= m = \frac{1}{1}$

y-int $= b = -2$

Check:

ℓ_1: LS $= y = -5$; RS $= 2x+1 = 2(-3)+1 = -5$ ✓

ℓ_2: LS $= y = -5$; RS $= x-2 = -3-2 = -5$ ✓



b) ℓ_1: $x + 2y = 2$
ℓ_2: $x + y = 3$

Solution: $x=4, y=-1$

Line 1

$x+2y=2$

$2y = -x+2$

$y = -\frac{1}{2}x + 1$ (m = −1/2, b = 1)

slope $= m = \frac{-1}{2}$

y-int $= b = 1$

Line 2

$x+y=3$

$y = -1x+3$ (m = −1, b = 3)

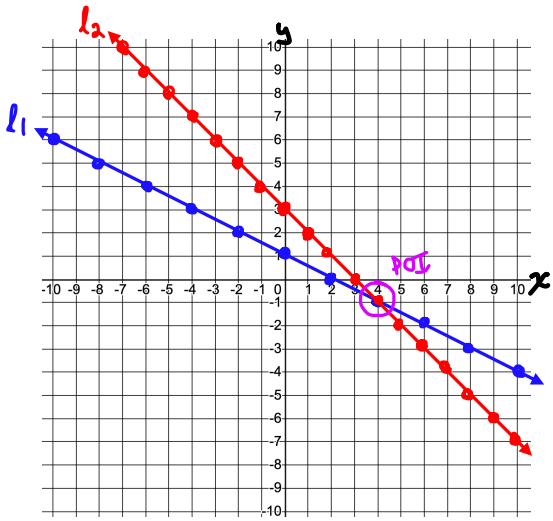
slope $= m = \frac{-1}{1}$

y-int $= b = 3$

Check:

ℓ_1: LS $= x+2y = 4+2(-1) = 2$; RS $= 2$ ✓

ℓ_2: LS $= x+y = 4+(-1) = 3$; RS $= 3$ ✓



c) ℓ_1: $y = 2x - 3$
ℓ_2: $2x - y = 5$

Line 1

$y = 2x-3$ (m = 2, b = −3)

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

y-int $= b = -3$

Line 2

$2x-y=5$

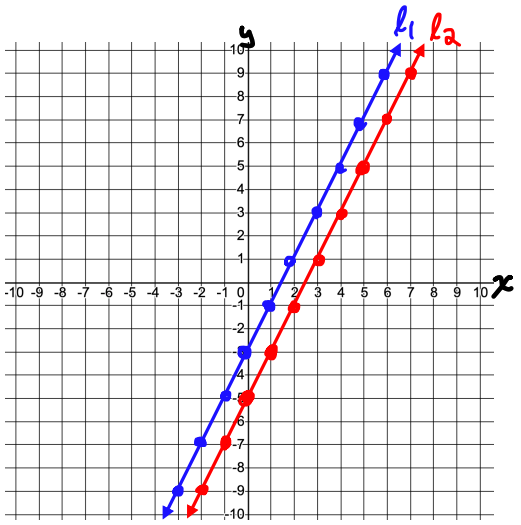
$2x-5=y$

$y = 2x-5$ (m = 2, b = −5)

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

y-int $= b = -5$

No solutions. The lines are parallel and distinct



d) ℓ_1: $3x = y + 4$
ℓ_2: $6x - 2y - 8 = 0$

Line 1

$3x = y + 4$

$3x - 4 = y$

$y = 3x - 4$ (m, b)

slope $= m = \frac{3}{1}$

y-int $= b = -4$

Line 2

$6x - 2y - 8 = 0$

$6x - 8 = 2y$

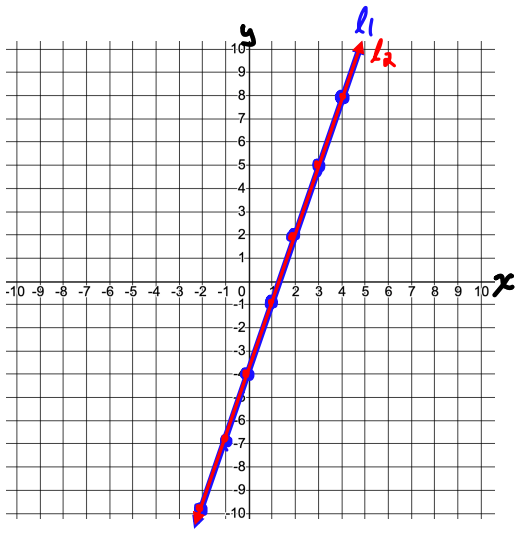
$3x - 4 = y$

$y = 3x - 4$ (m, b)

slope $= m = \frac{3}{1}$

y-int $= b = -4$

Infinitely many solutions. The lines are parallel and coincident.



e) ℓ_1: $3x + 2y = 3$
ℓ_2: $2x + 10y = -5$

Line 1

$3x + 2y = 3$

$2y = -3x + 3$

$y = -\frac{3}{2}x + \frac{3}{2}$ (m, b)

slope $= m = -\frac{3}{2}$

y-int $= b = \frac{3}{2}$

Line 2

$2x + 10y = -5$

$10y = -2x - 5$

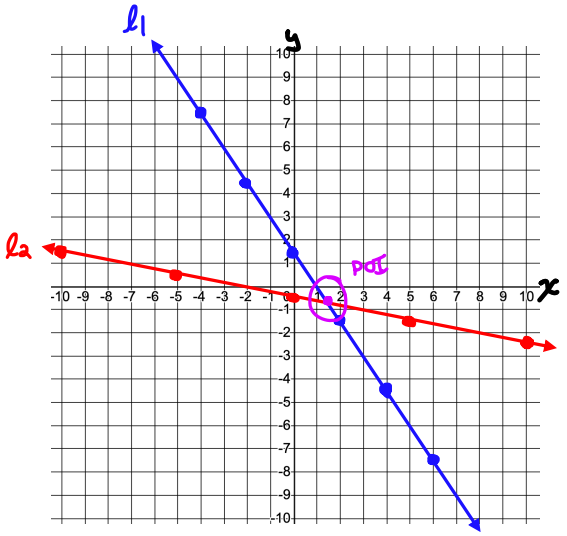
$y = -\frac{2}{10}x - \frac{5}{10}$

$y = -\frac{1}{5}x - \frac{1}{2}$ (m, b)

slope $= m = -\frac{1}{5}$

y-int $= b = -\frac{1}{2}$

Estimated solution:
$x = 1.5, y = -0.8$



f) ℓ_1: $2x + 6y - 12 = 0$
ℓ_2: $6x - 3y - 15 = 0$

solution: $x = 3, y = 1$

Line 1

$2x + 6y - 12 = 0$

$6y = -2x + 12$

$y = -\frac{2}{6}x + 2$

$y = -\frac{1}{3}x + 2$ (m, b)

slope $= m = -\frac{1}{3}$

y-int $= b = 2$

Line 2

$6x - 3y - 15 = 0$

$6x - 15 = 3y$

$2x - 5 = y$

$y = 2x - 5$ (m, b)

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

y-int $= b = -5$

Check:

ℓ_1

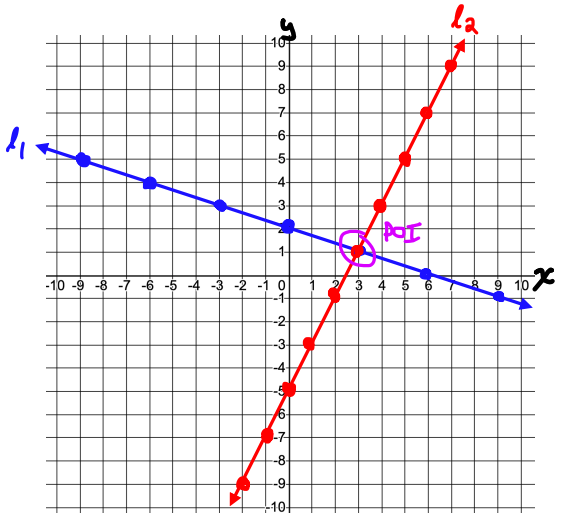
LS $= 2x + 6y - 12$
$= 2(3) + 6(1) - 12$
$= 0$

RS $= 0$

ℓ_2

LS $= 6x - 3y - 15$
$= 6(3) - 3(1) - 15$
$= 0$

RS $= 0$



2) Without graphing, determine whether each system has one solution, no solutions, or infinitely many solutions. Explain.

a) ℓ_1: $2x + y = 5$
ℓ_2: $2x + 10y = -5$

Line 1

$2x+y=5$

$y=-2x+5$

slope $= m = -2$

y-int $= b = 5$

Line 2

$2x+10y=-5$

$10y=-2x-5$

$y=-\frac{2}{10}x-\frac{5}{10}$

$y=-\frac{1}{5}x-\frac{1}{2}$

slope $= m = -\frac{1}{5}$

y-int $= b = -\frac{1}{2}$

The lines have different slopes; there is 1 solution to the system.

b) ℓ_1: $3x - y = 0$
ℓ_2: $6x - 2y = 3$

Line 1

$3x-y=0$

$3x=y$

$y=3x+0$

slope $= m = 3$

y-int $= b = 0$

Line 2

$6x-2y=3$

$6x-3=2y$

$3x-\frac{3}{2}=y$

$y=3x-\frac{3}{2}$

slope $= m = 3$

y-int $= b = -\frac{3}{2}$

Same slope but different y-intercepts; the lines are parallel and distinct and have NO solutions.

c) ℓ_1: $x + y = 2$
ℓ_2: $3x = 6 - 3y$

Line 1

$x+y=2$

$y=-x+2$

slope $= m = -1$

y-int $= b = 2$

Line 2

$3x=6-3y$

$3y=-3x+6$

$y=-1x+2$

slope $= m = -1$

y-int $= b = 2$

same slope and y-intercept. The lines are parallel and coincident. There are infinitely many solutions

Answers:

1)a) $(-3,-5)$ **b)** $(4,-1)$ **c)** no solutions; parallel and distinct **d)** infinite solutions; parallel and coincident

e) $(1.5,-0.8)$ this is an approximate answer **f)** $(3,1)$

2)a) one solution **b)** no solutions **c)** infinitely many solutions

W2 – Solving Linear Systems by SUBSTITUTION Unit 1

MPM2D

Jensen

1) Solve each linear system using the method of substitution. Check your answers.

a) $\ell_1: y = 3x - 4$
$\ell_2: x + y = 8$

① $y = 3x - 4$

$y = 3(3) - 4$

$y = 5$

② $x + y = 8$

$x + (3x - 4) = 8$

$4x - 4 = 8$

$4x = 12$

$x = 3$

Solution: $x = 3, y = 5$

b) $\ell_1: x = -4y + 5$
$\ell_2: x + 2y = 7$

① $x = -4y + 5$

$x = -4(-1) + 5$

$x = 9$

② $x + 2y = 7$

$(-4y + 5) + 2y = 7$

$-2y + 5 = 7$

$-2y = 2$

$y = -1$

Solution: $x = 9, y = -1$

c) $\ell_1: y = -2x + 3$
$\ell_2: 4x - 3y = 1$

① $y = -2x + 3$

$y = -2(1) + 3$

$y = 1$

② $4x - 3y = 1$

$4x - 3(-2x + 3) = 1$

$4x + 6x - 9 = 1$

$10x = 10$

$x = 1$

Solution: $x = 1, y = 1$

d) $\ell_1: 2x + 4y = 2$
$\ell_2: x = 1 - 2y$

① $2x + 4y = 2$

$2(1 - 2y) + 4y = 2$

$2 - 4y + 4y = 2$

$0y = 0$

② $x = 1 - 2y$

infinitely many solutions.
The lines are parallel and coincident.

e) $\ell_1: x + 2y = 3$
$\ell_2: 5x + 4y = 8$

① $x + 2y = 3$

$x = 3 - 2y$

$x = 3 - 2\left(\frac{7}{6}\right)$

$x = 3 - \frac{7}{3}$

$x = \frac{9}{3} - \frac{7}{3}$

$x = \frac{2}{3}$

② $5x + 4y = 8$

$5(3 - 2y) + 4y = 8$

$15 - 10y + 4y = 8$

$-6y = -7$

$y = \frac{7}{6}$

Solution: $x = \frac{2}{3}, y = \frac{7}{6}$

f) $\ell_1: 6x + 5y = 7$
$\ell_2: x - y = 3$

① $6x + 5y = 7$

$6(3 + y) + 5y = 7$

$18 + 6y + 5y = 7$

$11y = -11$

$y = -1$

② $x - y = 3$

$x = 3 + y$

$x = 3 + (-1)$

$x = 2$

Solution: $x = 2, y = -1$

g) $\ell_1: 2m + n = 2$
$\ell_2: 3m - 2n = 3$

① $2m+n=2$
$n = 2-2m$
$n = 2-2(1)$
$n = 0$

② $3m-2n=3$
$3m-2(2-2m)=3$
$3m-4+4m=3$
$7m=7$
$m=1$

Solution: $m=1$, $n=0$

h) $\ell_1: 3a + 2b = 4$
$\ell_2: 2a + b = 6$

① $3a+2b=4$
$3a+2(6-2a)=4$
$3a+12-4a=4$
$-a=-8$
$a=8$

② $2a+b=6$
$b=6-2a$
$b=6-2(8)$
$b=-10$

Solution: $a=8$, $b=-10$

i) $\ell_1: 2x + y = 4$
$\ell_2: 4x - y = 2$

① $2x+y=4$
$y=4-2x$
$y=4-2(1)$
$y=2$

②$4x-y=2$
$4x-(4-2x)=2$
$4x-4+2x=2$
$6x=6$
$x=1$

solution: $x=1$, $y=2$

2) Find the point of intersection of each pair of lines.

a) $\ell_1: 2x = y + 5$
$\ell_2: 3x + y = -9$

① $2x=y+5$
$2x-5=y$
$2\left(-\frac{4}{5}\right)-5=y$
$-\frac{8}{5}-\frac{25}{5}=y$
$-\frac{33}{5}=y$

② $3x+y=-9$
$3x+(2x-5)=-9$
$5x-5=-9$
$5x=-4$
$x=-\frac{4}{5}$

solution: $x=-\frac{4}{5}$, $y=-\frac{33}{5}$

b) $\ell_1: 4x + 2y = 7$
$\ell_2: -x - 7y = 6$

① $4x+2y=7$
$4(-7y-6)+2y=7$
$-28y-24+2y=7$
$-26y=31$
$y=-\frac{31}{26}$

② $-x-7y=6$
$-7y-6=x$
$-7\left(\frac{-31}{26}\right)-6=x$
$\frac{217}{26}-\frac{156}{26}=x$
$x=\frac{61}{26}$

solution: $x=\frac{61}{26}$, $y=-\frac{31}{26}$

c) $\ell_1: p + 4q = 3$
$\ell_2: 5p = -2q + 3$

① $p + 4q = 3$
$p = 3 - 4q$
$p = 3 - 4\left(\frac{2}{3}\right)$
$p = \frac{9}{3} - \frac{8}{3}$
$p = \frac{1}{3}$

② $5p = -2q + 3$
$5(3 - 4q) = -2q + 3$
$15 - 20q = -2q + 3$
$12 = 18q$
$\frac{12}{18} = q$
$q = \frac{2}{3}$

solution: $p = \frac{1}{3}, \frac{2}{3}$

d) $\ell_1: a + b + 6 = 0$
$\ell_2: 2a - b - 3 = 0$

① $a + b + 6 = 0$
$a + (2a - 3) + 6 = 0$
$3a + 3 = 0$
$3a = -3$
$a = -1$

② $2a - b - 3 = 0$
$2a - 3 = b$
$2(-1) - 3 = b$
$b = -5$

solution: $a = -1, b = -5$

e) $\ell_1: x - 2y - 2 = 0$
$\ell_2: 3x + 4y - 16 = 0$

① $x - 2y - 2 = 0$
$x = 2y + 2$
$x = 2(1) + 2$
$x = 4$

② $3x + 4y - 16 = 0$
$3(2y + 2) + 4y - 16 = 0$
$6y + 6 + 4y - 16 = 0$
$10y - 10 = 0$
$10y = 10$
$y = 1$

solution: $x = 4, y = 1$

3) Samantha works twice as many hours per week as Adriana. Together they work a total of 39 hours in one week.

a) Write an equation to represent the information in the first sentence.

$S = 2A$

b) Write an equation to represent the information in the second sentence.

$S + A = 39$

c) Use the method of substitution to find the number of hours worked by each person.

$S = 2A$

$S = 2(13)$

$S = 26$

$S + A = 39$

$2A + A = 39$

$3A = 39$

$A = 13$

Solution: Samantha worked 26 hours
Adriana worked 13 hours

4) Ugo plays hockey and is awarded 2 points for each goal and 1 point for each assist. Last season he had a total of 86 points. He scored 17 fewer goals than assists.

a) Write a linear system to represent the information

① $2g + a = 86$

② $a - g = 17$

b) Solve the system

$2g + a = 86$

$2g + (17 + g) = 86$

$3g = 69$

$g = 23$

$a - g = 17$

$a = 17 + g$

$a = 17 + 23$

$a = 40$

c) What does the solution represent in the context of this question?

Ugo scored 23 goals and had 40 assists.

5) Joanne's family decides to rent a hall for her retirement party. Pin Hall charges $500 for the hall and $15 per meal. Bloom Place charges $350 for the hall and $18 per meal.

a) Write two equations to represent the information.

① $C = 500 + 15g$

② $C = 350 + 18g$

b) Solve the linear system to find the number of guests for which the charges are the same at both halls.

$C = 500 + 15g$

$350 + 18g = 500 + 15g$

$3g = 150$

$g = 50$

$C = 350 + 18g$

$C = 350 + 18(50)$

$C = 1250$

Solution: Both halls would charge $1250 if 50 guests attended.

Answers:

1) a) $x = 3, y = 5$ **b)** $x = 9, y = -1$ **c)** $x = 1, y = 1$ **d)** infinite solutions
e) $x = \frac{2}{3}, y = \frac{7}{6}$ **f)** $x = 2, y = -1$ **g)** $m = 1, n = 0$ **h)** $a = 8, b = -10$ **i)** $x = 1, y = 2$
2)a) $x = -\frac{4}{5}, y = -\frac{33}{5}$ **b)** $x = \frac{61}{26}, y = -\frac{31}{26}$ **c)** $p = \frac{1}{3}, q = \frac{2}{3}$ **d)** $a = -1, b = -5$ **e)** $x = 4, y = 1$
3)a) $S = 2a$ **b)** $S + A = 39$ **c)** Samantha worked 26 hours and Adriana worked 13 hours
4)a) $2g + a = 86; g = a - 17$ **b)** $g = 23, a = 40$ **c)** 23 goals; 40 assists
5)a) $C = 500 + 15n; C = 350 + 18n$ **b)** 50 guests

W3 – Solving Linear Systems by ELMINATION Unit 1

MPM2D

Jensen

1) Solve using the method of elimination

a) $\ell_1: x + y = 2$
$\ell_2: 3x - y = 2$

$\ell_1 \rightarrow \quad x+y=2$
$\ell_2 \rightarrow \quad 3x-y=2 \quad +$
$4x \quad =4$
$x=1$

sub $x=1$ into ℓ_1
$x+y=2$
$1+y=2$
$y=1$

solution: $x=1, y=1$

b) $\ell_1: x - y = -1$
$\ell_2: 3x + y = -7$

$\ell_1 \rightarrow \quad x-y=-1$
$\ell_2 \rightarrow \quad 3x+y=-7 \quad +$
$4x \quad =-8$
$x=-2$

sub $x=-2$ into ℓ_1:
$x-y=-1$
$-2-y=-1$
$-1=y$

solution: $x=-2, y=-1$

c) $\ell_1: 3x + 3y = 7$
$\ell_2: x + y = 3$

$\ell_1 \rightarrow \quad 3x+3y=7$
$3 \times \ell_2 \rightarrow \quad 3x+3y=9 \quad -$
$0x+0y=-2$

No solutions. The lines are parallel and distinct.

d) $\ell_1: 5x + 2y = -11$
$\ell_2: 3x + 2y = -9$

$\ell_1 \rightarrow \quad 5x+2y=-11$
$\ell_2 \rightarrow \quad 3x+2y=-9 \quad -$
$2x \quad =-2$
$x=-1$

sub $x=-1$ into ℓ_2
$3x+2y=-9$
$3(-1)+2y=-9$
$-3+2y=-9$
$2y=-6$
$y=-3$

solution: $x=-1, y=-3$

2) Find the point of intersection of each pair of lines

a) $\ell_1: x + 2y = 2$
$\ell_2: 3x + 5y = 4$

$3 \times \ell_1 \rightarrow \quad 3x+6y=6$
$\ell_2 \rightarrow \quad 3x+5y=4 \quad -$
$y=2$

sub $y=2$ into ℓ_1
$x+2y=2$
$x+2(2)=2$
$x+4=2$
$x=-2$

solution: $x=-2, y=2$

b) $\ell_1: 3x + 5y = 12$
$\ell_2: 2x - y = -5$

$\ell_1 \rightarrow \quad 3x+5y=12$
$5 \times \ell_2 \rightarrow \quad 10x-5y=-25 \quad +$
$13x \quad =-13$
$x=-1$

sub $x=-1$ into ℓ_2
$2x-y=-5$
$2(-1)-y=-5$
$-2+5=y$
$y=3$

solution: $x=-1, y=3$

c) $\ell_1: 3x + y = 13$
$\ell_2: 2x + 3y = 18$

$3 \times \ell_1 \rightarrow \quad 9x + 3y = 39$
$\ell_2 \rightarrow \quad 2x + 3y = 18 \; -$
$7x = 21$
$x = 3$

sub $x=3$ into ℓ_1
$3x+y=13$
$3(3)+y=13$
$9+y=13$
$y=4$

solution: $x=3, y=4$

d) $\ell_1: 6x + 5y = 12$
$\ell_2: 3x - 4y = 6$

$\ell_1 \rightarrow \quad 6x + 5y = 12$
$2 \times \ell_2 \rightarrow \quad 6x - 8y = 12 \; -$
$13y = 0$
$y = 0$

sub $y=0$ into ℓ_1
$6x+5y=12$
$6x+5(0)=12$
$6x=12$
$x=2$

solution: $x=2, y=0$

3) Solve by elimination

a) $\ell_1: 3x - 2y = 5$
$\ell_2: 2x + 3y = 12$

$2 \times \ell_1 \rightarrow \quad 6x - 4y = 10$
$3 \times \ell_2 \rightarrow \quad 6x + 9y = 36 \; -$
$-13y = -26$
$y = 2$

sub $y=2$ into ℓ_2
$2x+3y=12$
$2x+3(2)=12$
$2x+6=12$
$2x=6$
$x=3$

solution: $x=3, y=2$

b) $\ell_1: 5m + 2n = 5$
$\ell_2: 2m + 3n = 13$

$2 \times \ell_1 \rightarrow \quad 10m + 4n = 10$
$5 \times \ell_2 \rightarrow \quad 10m + 15n = 65 \; -$
$-11n = -55$
$n = 5$

sub $n=5$ into ℓ_1
$5m+2n=5$
$5m+2(5)=5$
$5m+10=5$
$5m=-5$
$m=-1$

solution: $m=-1, n=5$

c) $\ell_1: 3a - 4b = 10$
$\ell_2: 5a - 12b = 6$

$3 \times \ell_1 \rightarrow \quad 9a - 12b = 30$
$\ell_2 \rightarrow \quad 5a - 12b = 6 \; -$
$4a = 24$
$a = 6$

sub $a=6$ into ℓ_1
$3a-4b=10$
$3(6)-4b=10$
$18-10=4b$
$8=4b$
$b=2$

solution: $a=6, b=2$

d) $\ell_1: 3h - 4k = 5$
$\ell_2: 5h + 3k = -11$

$3 \times \ell_1 \rightarrow \quad 9h - 12k = 15$
$4 \times \ell_2 \rightarrow \quad 20h + 12k = -44 \; +$
$29h = -29$
$h = -1$

sub $h=-1$ into ℓ_2
$5h+3k=-11$
$5(-1)+3k=-11$
$-5+3k=-11$
$3k=-6$
$k=-2$

solution: $h=-1, k=-2$

4) Mehrad works in a department store selling sports equipment. Baseball gloves cost $29 each and bats cost $14 each. One shift, he sells 28 items. His receipts total $647.

a) How many bats did Mehrab sell?

x = # of gloves
y = # of bats

① $x + y = 28$
② $29x + 14y = 647$

$14 \times$ ① → $14x + 14y = 392$
② → $29x + 14y = 647$ −

$-15x = -255$
$x = 17$

sub $x = 17$ into ①

$x + y = 28$
$17 + y = 28$
$y = 11$

Mehrab sold 11 bats

b) How many gloves did he sell?

17 gloves

5) Maria rented the same car twice in one month. She paid $180 the first time for 3 days and she drove a total of 150 km. The next time, she also paid $180 and had the vehicle for only 2 days, but travelled 400 km.

a) What was the cost per day?

x = cost per day
y = cost per km

① $3x + 150y = 180$
② $2x + 400y = 180$

$2 \times$ ① $6x + 300y = 360$
$3 \times$ ② $6x + 1200y = 540$ −

$-900y = -180$
$y = 0.2$

sub $y = 0.2$ into ①

$3x + 150y = 180$
$3x + 150(0.2) = 180$
$3x + 30 = 180$
$3x = 150$
$x = 50$

$50 per day

b) What was the cost per km?

$0.20 per km

Answers:

1)a) $x = 1, y = 1$ **b)** $x = -2, y = -1$ **c)** no solutions **d)** $x = -1, y = -3$
2)a) $(-2,2)$ **b)** $(-1,3)$ **c)** $(3,4)$ **d)** $(2,0)$
3)a) $x = 3, y = 2$ **b)** $m = -1, n = 5$ **c)** $a = 6, b = 2$ **d)** $h = -1, k = -2$
4)a) 11 **b)** 17
5)a) $50/day **b)** $0.20/km

W4 – Solving Problems Involving Linear Systems Unit 1

MPM2D

Jensen

1) Leanne works at a greenhouse. She needs to plant a total of 32 bulbs. Two types of bulbs are available. She is asked to plant three times as many crocus bulbs as tulip bulbs. How many of each should she plant?

x = # of crocus

y = # of tulip

① $x + y = 32$

$3y + y = 32$

$4y = 32$

$y = 8$

② $x = 3y$

$x = 3(8)$

$x = 24$

she should plant 24 crocus and 8 tulips.

2) James looks in his TV cabinet and finds some old Beta and VHS tapes. He has 17 tapes in all. He finds that he has three more Beta tapes than VHS tapes. How many of each type does he have?

x = # of Beta

y = # of VHS

① $x + y = 17$

$y + 3 + y = 17$

$2y = 14$

$y = 7$

② $x = y + 3$

$x = 7 + 3$

$x = 10$

James has 10 Beta and 7 VHS tapes

3) The girls' soccer team held a fundraising car wash. They charged $5 for each car and $8 for each van. They washed 44 cars and vans and collected $262. How many of each type of vehicle did they wash?

x = # of cars

y = # of vans

① $x + y = 44$

② $5x + 8y = 262$

$5 \times$ ① → $5x + 5y = 220$

② → $5x + 8y = 262$ −

$-3y = -42$

$y = 14$

sub $y = 14$ into ①

$x + y = 44$

$x + 14 = 44$

$x = 30$

They washed 30 cars and 14 vans.

4) Rehman invests his summer earnings of $3050. He invests part of the money at 8% per year, and the rest at 7.5% per year. After 1 year, these investments earn $242 in simple interest. How much did he invest at each rate?

x = amount at 8%
y = amount at 7.5%

① $x + y = 3050$
$y = 3050 - x$
$y = 3050 - 2650$
$y = 400$

② $0.08x + 0.075y = 242$
$0.08x + 0.075(3050 - x) = 242$
$0.08x + 228.75 - 0.075x = 242$
$0.005x = 13.25$
$x = 2650$

Rehman invested $2650 at 8% and $400 at 7.5%.

5) To join Karate Klub, David must pay a monthly fee of $25 and an initial fee of $200. If he chooses Kool Karate, he must pay an initial fee of only $100 but $35 per month.

a) After how many months is the cost the same at either karate club?

C = cost
m = # of months

① $C = 25m + 200$
$35m + 100 = 25m + 200$
$10m = 100$
$m = 10$

② $C = 35m + 100$
$C = 35(10) + 100$
$C = 350 + 100$
$C = 450$

After 10 months both clubs cost $450.

b) If David plans to try karate for 6 months, which club should he join?

Kool Karate.

c) If David decides to do karate for a year, which club should he join?

Karate Klub.

6) White vinegar is a solution of acetic acid in water. There are two strengths of white vinegar, a 5% solution and a 10% solution. How many ml of each solution must be mixed to make 50 ml of a 9% vinegar solution?

x = amount of 5% solution
y = amount of 10% solution

① $x + y = 50$
② $0.05x + 0.1y = 0.09(50)$

① $x + y = 50$
$10 \times$ ② $0.5x + y = 45$ −
$0.5x = 5$
$x = 10$

sub $x = 10$ into ①
$x + y = 50$
$10 + y = 50$
$y = 40$

10ml of 5% and 40ml of 10%

7) It took a patrol boat 5 hours to travel 60 km up a river against the current, and 3 hours for the return trip with the current. Find the speed of the boat in still water and the speed of the current.

x = speed in still water
y = speed of current

① $60 = 5(x - y)$
① $60 = 5x - 5y$
$60 + 5y = 5x$
$12 + y = x$
$12 + 4 = x$
$x = 16$

② $60 = 3(x + y)$
② $60 = 3x + 3y$
$60 = 3(12 + y) + 3y$
$60 = 36 + 3y + 3y$
$24 = 6y$
$y = 4$

Remember:
distance = velocity x time

Speed of boat in still water is 16 km/h
speed of current is 4 km/h.

8) Kareem took 5 hours to drive 470 km from Sudbury to Brantford. For part of the trip, he drove at 100 km/h. For the rest of the trip, he drove at 90 km/h. How far did he drive at each speed?

x = time driven at 90km/h
y = time driven at 100km/h

① $90x + 100y = 470$
② $x + y = 5$

① $90x + 100y = 470$
$100 \times$ ② $100x + 100y = 500$ −
$-10x = -30$
$x = 3$

sub $x = 3$ into ②
$x + y = 5$
$3 + y = 5$
$y = 2$

Remember:
distance = velocity x time

Distance calculations:
distance at 100 km/h
$= 100 \times 2$
$= 200$ km

distance at 90 km/h
$= 90 \times 3$
$= 270$ km

Kareem drove 200km at 100km/h and 270 km at 90km/h

Answers

1) 24 crocus bulbs and 8 tulip bulbs
2) 10 beta tapes and 7 vhs tapes
3) 30 cars and 14 vans
4) $2650 at 8%/year and $400 at 7.5%/year
5) a) 10 months b) Kool Karate c) Karate Klub
6) 10 ml of the 5% solution, 40 ml of the 10% solution
7) boat in still water 16 km/h; current 4km/h
8) 200km at 100km/h; 270 km at 90km/h