

Introduction to Linear Systems

A linear system typically refers to a scenario involving two linear equations each containing two variables. Solving a linear system involves using a mathematical technique to find the point of intersection of these two lines. In this unit, we will consider the following techniques:

- * 1. Graphing (with and without technology)
2. Substitution (algebraic method)
3. Elimination (algebraic method)

Solving Linear Systems Using the Graphing Technique

Warm – Up

Determine the coordinates of the point of intersection for each pair of lines.

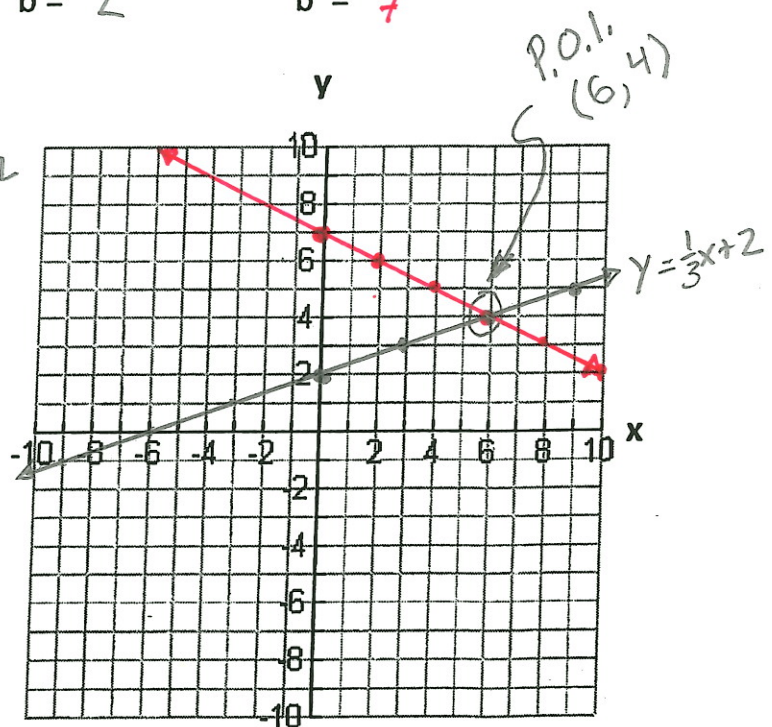
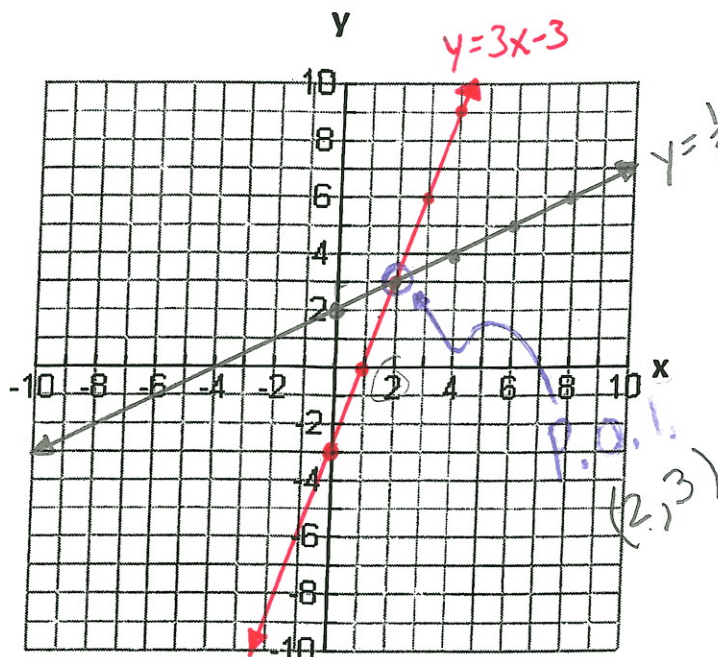
a) $y = \frac{1}{2}x + 2$ $y = 3x - 3$

$m = \frac{1}{2}$ $m = \frac{3}{1}$ ← rise
 $b = 2$ $b = -3$ ← run

b) $y = \frac{1}{3}x + 2$ $y = -\frac{1}{2}x + 7$

$m = \frac{1}{3}$ $m = -\frac{1}{2}$

$b = 2$ $b = 7$



Activity

The Tran family is looking to rent a hall to host their family reunion.

They are considering two options:

- Queen's Palace will rent their hall for \$1500 plus \$25 per person.
- The Charming Convention Center is available for \$200 plus \$50 per person.

Both halls offer similar amenities. Which hall is cheaper? It depends.

a) Create equations to relate the cost to rent each hall, C , in terms of the number of guests (n) that plan to attend. *dep. var. = r.o.c. x ind. var. + initial v.*

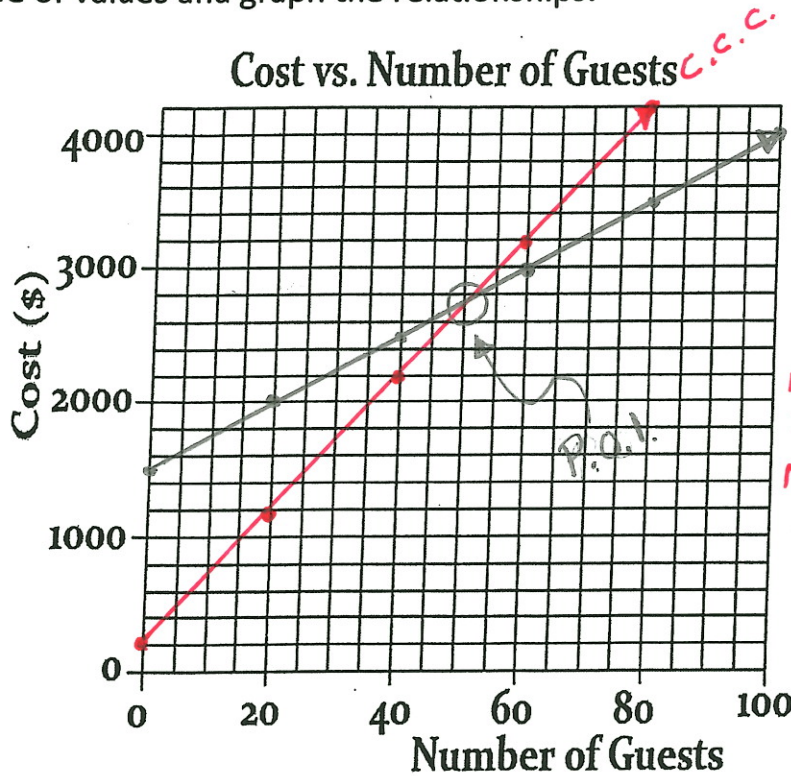
Queen's Palace : $C = 25n + 1500$

Charming C. C. : $C = 50n + 200$

b) Complete the table of values and graph the relationships.

$C = 25(20) + 1500$
 $= 500 + 1500$
 $= 2000$

Queen's Palace	
Guests	Cost (\$)
0	1500
20	2000
40	2500
60	3000
80	3500
100	4000



$C = 50(20) + 200$
 $= 1000 + 200$
 $= 1200$

Charming C. C.	
Guests	Cost (\$)
0	200
20	1200
40	2200
60	3200
80	4200
100	5200

c) What are the coordinates of the point of intersection? $(52, 2800)$

d) Use your graph and the point of intersection to determine which hall is cheaper.

- * 3 parts
- if there are less than 52 guests, C.C.C. is cheaper,
 - if there are more than 52 guests, Q.P. is cheaper,
 - if there are exactly 52 guests, both cost the same,



Practice – Task 1

Lourdes is planning to purchase sweatshirts to celebrate its 50th anniversary.

The school is considering two sweatshirt companies:

- Walter Wears will charge \$300 for the design and then \$15 to produce each sweatshirt.
- Avalon's Shop will charge \$700 for the design and then \$10 to produce each sweatshirt.

Both manufacturers can produce similar quality sweatshirts. Which offer is cheaper?

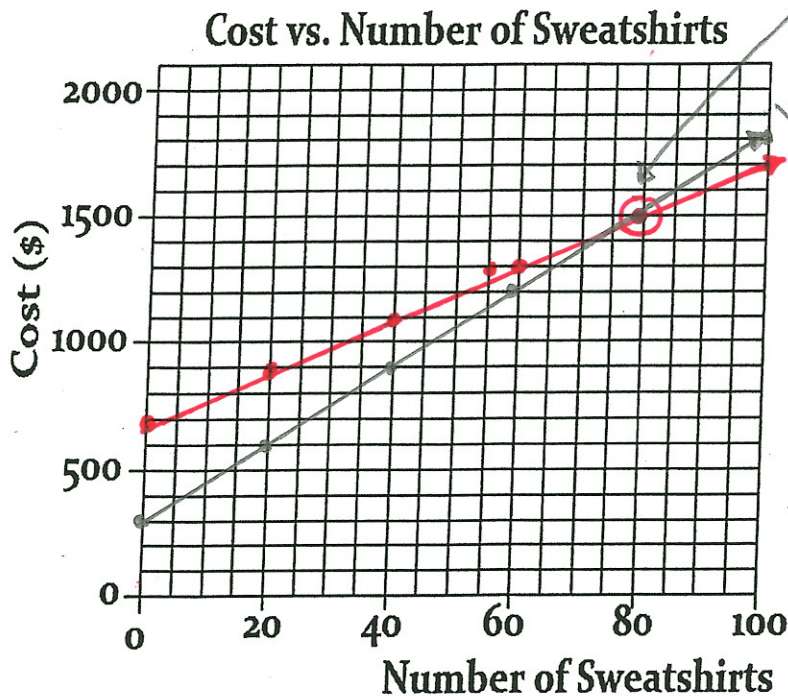
a) Create equations to represent the cost to purchase sweatshirts, C , as it relates to the number of sweatshirts (n) being produced.

Walter Wears : $C = 15n + 300$

Avalon's Shop : $C = 10n + 700$

b) Complete the table of values and graph the relationships.

Walter Wears	
Shirts	Cost (\$)
0	300
20	600
40	900
60	1200
80	1500
100	1800



Avalon's Shop	
Shirts	Cost (\$)
0	700
20	900
40	1100
60	1300
80	1500
100	1700

c) What are the coordinates of the point of intersection? $(80, 1500)$

d) Use your graph and the point of intersection to determine which manufacturer is cheaper.

- if you are purchasing less than 80 shirts, W.W. is cheaper.
- if you are purchasing more than 80 shirts, A.S. is cheaper.
- if you are purchasing exactly 80 shirts, both stores charge the same.



Practice – Task 2

Darius has left Guelph and is driving in his car to see his mom Gilda who lives in Quebec city. Gilda is so excited to see her son that she gets into her car and starts driving towards Guelph to meet her son part way.

The location and travel speed for each person is as follows:

- Darius is currently 100 km from Guelph and traveling at 50km/hr away from Guelph.
- Gilda is currently 1000 km from Guelph and is traveling at 100 km/hr towards Guelph.

Assuming that they are driving along the same highway and moving towards each other, how long will it take until they meet? How far will they be from Guelph at that time?

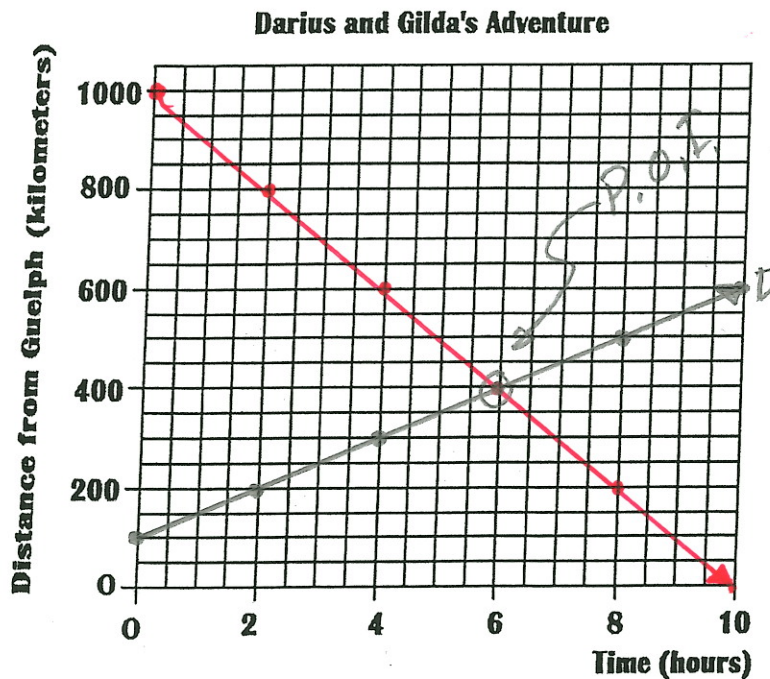
a) Create equations to represent the distance from Guelph, d in kilometers, as time, t measured in hours, elapses.

Darius : $d = 50t + 100$

Gilda : $d = -100t + 1000$

b) Complete the table of values and graph the relationships.

Darius	
Time (Hours)	Distance (km)
0	100
2	200
4	300
6	400
8	500
10	600



Gilda	
Time (Hours)	Distance (km)
0	1000
2	800
4	600
6	400
8	200
10	0

c) What are the coordinates of the point of intersection? $(6, 400)$

d) What does the point of intersection mean in terms of the Darius and Gilda's travels?
Darius and Gilda met 400km from Guelph after 6 hrs.