UNIT 1 – Linear Systems JOURNAL

Big idea/Learning Goals
In this unit you will learn how to solve two equations with two unknowns. The unit is called linear systems since there will be more than one line involved. There are three methods you'll be shown in class: graphing method, elimination method, and substitution method.

Date	Topics	Finished the journal? Made corrections?	Did you do the HW? Checked if it was correct?	Tentative TEST date: _____ Questions to ask the teacher:
	Modelling DAY 1 HW text pg17 #1,2,3,6			
	Graphing method DAY 2 HW text pg17 #8cd,9cd,12,13,16,17			
2days	**Substitution Method** DAY 3 HW text pg26 #4,7,9,10 DAY 4 HW text pg26 5,8,11,12,16			
2days	**Elimination Method** DAY 5 HW text pg40 #7,15,16,17 DAY 6 HW text pg40 #8,9,12,14,18			
	Analyze Solutions DAY 7 HW text pg32 #1,2,3,4,5,6			
2days	**Problem Solving** DAY 8 HW text pg46 #1,2,3,4,9,10,11 DAY 9 HW text pg46 #7,8,12,14,15,16,17			

Reflect – previous TEST mark _____, Overall mark now_____.

Calculate your potential final mark to see how averages work. Show your calculations here:

potential final mark = (overall mark now)(weight so far) + (future marks)(weight to come)

= (   )(   ) + (   )(   )

=

Were you able to attain your set goal before? Looking back, what else can you improve upon? Be specific in your planning.
_____
_____
_____
_____
_____
_____
_____
_____

DAY 1 – Modelling Word Problems into Math Symbols

Mathematics is a language like any other. Below is a statement in Russian that we will translate word by word to English.

Привет! Как Дела? Хорошо.

Pronunciation:

Translation:

Same idea is applied when translating English to Math. But first we'll need a Dictionary:

+	−	×	÷	=

1. Translate each phrase into an algebraic expression.
   a) five less than one third a value

   b) a number increased by four, times another number

   c) a value decreased by the fraction one quarter

   d) three times a length

   e) fifteen percent of an area

   f) increase by eleven percent in mass

2. Translate each sentence into an algebraic equation.
   a) Three times a value, decreased by four, is two.

   b) One third a number, increased by two, is one.

   c) One number subtracted from five is two more than a second number.

   d) The price of a meal, including fourteen percent tax, is ninety-five dollars and seventy-six cents.

NOTES:
When you see commas: When you see "is" or "are":

When you see the words "less than" or "subtracted from":

When you see a phrase: and when you see a sentence:

3. Translate into TWO algebraic equation, do let statements for what variables represent.
   a) At a school concert, 355 tickets were sold. There were 51 more student tickets sold than adult tickets.

   b) A rectangle has a perimeter of 172 cm. The length of the rectangle is 23 cm longer than twice the width.

   c) The sum of two times the smaller of two consecutive numbers and three times the larger number is 113.

   d) Enrico weighs 7 kg more than Julian. The sum of their masses is 183 kg.

4. Translate each sentence into an algebraic equation. Record let statements.
   a) Buy the phone for $400 and pay $45 per month

   b) Webz charges a flat monthly fee of $5 plus $1 per hour

   c) Brian's car costs him $4000 plus $0.20 per km every year.

5. Translate into TWO algebraic equations. Record let statements.
   a) Smaller tables cost $29.95 each and bigger tables cost $39.95 each. The total price is $359.50. There are two more bigger tables than smaller tables.

   b) Charlene is looking into cell phone plans. Cell Plus gives unlimited minutes for $50 in a month. A1 Cell offers a $10 monthly fee, plus 5¢/min
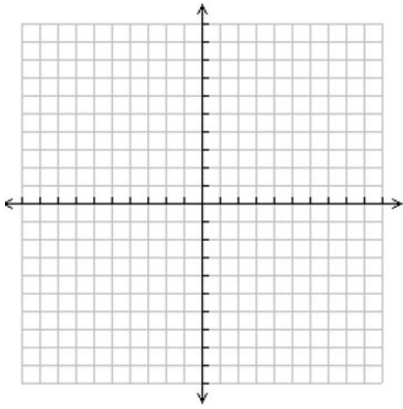
NOTES:
Rate of change number is
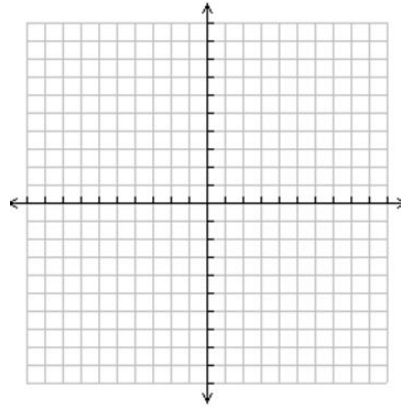
Initial value number is

Deciding on the variables
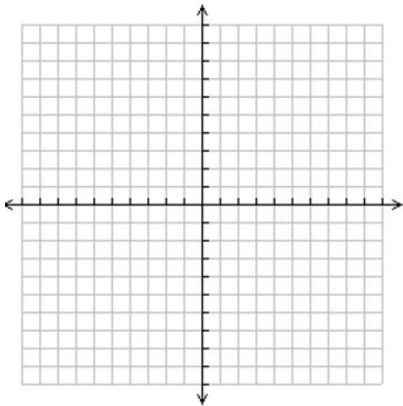
DAY 2 – Graphing Method to Find POI
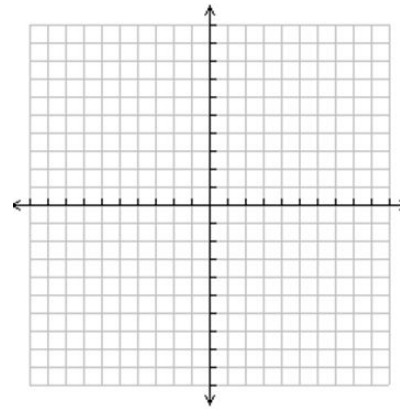
1.

$y = -x - 7$
$y = 3x + 5$

2.

$x + 2y = -5$
$3x - y = -1$

3. Use table of values

$-2x - y = -8$
$x + y = 9$

4. Use intercepts

$2x + 5y = -20$
$5x - 3y = -15$

NOTES:

Using m and b   **Using intercepts**   **Using tables**

Solve by graphing. Ensure you use appropriate scale, label axes, label lines and give the graph a title. Once POI is found, explain what it means.

5. For Megan's sixteenth birthday, her parents are planning a party. Tony's Pizzeria charges $150 for the party room and $12 per guest for the cost of food. Hamburger Joey charges $180 for the party room and $10 per guest.

a) Write a system of linear equations to represent the situation.
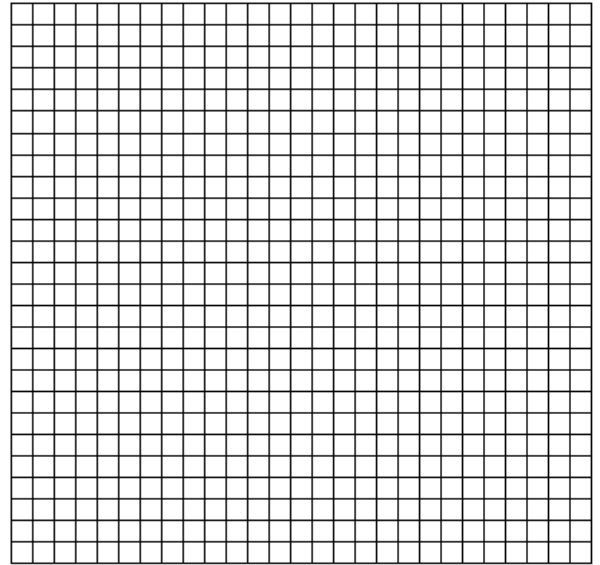
b) Fill in the tables to help you graph the lines

Tony's:

guests	total cost

Joey's:

guests	total cost

c) Find and check the point of intersection.

d) What does this point of intersection represent?

6. The student council is deciding which banquet hall to book for this year's graduation dinner and dance. Thompson Hall charges a fixed cost of $1200 plus $35 per student. Adeline's Country Club charges $1000 plus $40 per student.

a) Write a system of linear equations to represent the situation.

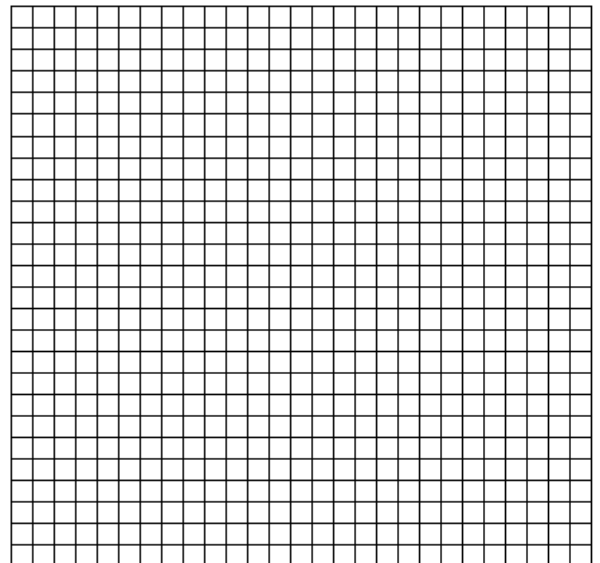**b)** Fill in the tables to help you graph the lines

Thomson:

students	total cost

Adeline:

students	total cost

c) Find and check the point of intersection.

d) What does this point of intersection represent?

DAY 3 & 4 – Substitution Method

1. Is (2, –3) the solution for the following linear system? Explain how you can tell.

   $3x + 6y = -12$

   $2y - 8x = -22$

NOTES:

2. Solve by substitution. Check your solution.

   a) $4x + y = 0$

            $x + 2y + 1 = 0$

   b) $2c - d + 2 = 0$

            $3c + 2d + 10 = 0$

3. Phoenix Health Club charges a $200 initiation fee, plus $15 per month. Champion Health Club charges a $100 initiation fee, plus $20 per month.
    a) Write a linear equation to represent the charges for each club.
    b) Solve the linear system.
    c) After how many months are the costs the same?
    d) If you joined a club for only 1 year, which club would be less expensive?

NOTES:

4. Simplify each equation, and then solve the linear system by substitution.
$$3(x + 1) - 2(y - 2) = -6$$
$$x + 4(y + 3) = 29$$

5. The number of tickets sold for a school event is 330. Let a represent the number of adult tickets sold and s represent the number of student tickets sold. The cost of a student ticket is $6 and the cost of an adult ticket is $10. In total, $2380 was taken in from ticket sales.
    a) Write a linear system to represent the information.
    b) Solve the linear system to find the number of each type of ticket sold.

DAY 5 & 6 – Elimination Method

1. Solve the system using elimination.
    $0.6a - 0.2b = 1.8$
    $0.5b - 0.4a - 0.7 = 0$

NOTES:

2. Some provinces have names with First Nations origins. For example, "Ontario" comes from an Iroquois word meaning "beautiful water." If the number of provincial names with First Nations origins is a, and the number with other origins is b, the numbers are related by the following equations.

   $a + b = 10$

   $3a - 2b = 0$

   a) Interpret each equation in words.

   b) Find the number of provinces that have names with First Nations origins.

3. At Lisa's Sub Shop, two veggie subs and four roast beef subs cost $34. Five veggie subs and six roast beef subs cost $61. Write and solve a system of equations to find the cost of each type of sub.

4. Solve by elimination. Check the solution.

$2(a-4)+5(b+1)=8$

$3(a-1)-2(b-2)=-11$

5. Solve by elimination.

$$\frac{x-6}{4}+\frac{y+2}{3}=0$$

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

6. A weekend at Skyview Lodge costs $360 and includes two nights' accommodation and four meals. A week costs $1200 and includes seven nights' accommodation and ten meals. Write and solve a system of equations to find the cost of one night and the cost of one meal.

7. The Mackenzie, the longest river in Canada, is 1056 km longer than the Yukon, the second-longest river. The total length of the two rivers is 7426 km. Find the length of each river.

DAY 7 – Equivalent Linear Relations & Number of Solutions

Solve using which ever method you like. What do you notice about number of solutions? Explain with graphs and make notes

1.

$y = 2x - 3$
$2x - y = 5$

2.

$3x + 2y - 10 = 0$
$2x - 3y - 3 = 0$

3.

$x + 3y = -1$
$2x + 6y + 2 = 0$

NOTES:

4. How many solutions does each system have? Explain

a) $x + y = 7$ $x - y = 10$	b) $2x - 4y = 8$ $4 - x + 2y = 0$	c) $4x - y = 9$ $12x - 6 = 3y$

5. Find A so that the system has the specified number of solutions

a) $Ax - 3y = 4$ $5x - 6y - 8 = 0$ Create A so that you have infinitely many solutions	b) $x(A + 3) - y = 10$ $4x + y = 3$ Create A so that you have no solutions	c) $2Ax + 3y = 12$ $(A - 2)x - y = 10$ Create A so that you have no solutions

DAY 8 & 9 – Problem Solving with Linear Systems

Money Problems

1. The cost of printing a magazine is based on a fixed set-up cost and the number of pages to be printed. One printing company charges a $250 set-up fee and $5/page, while a second company charges a $400 set-up fee plus $4/page.
    a) Write an equation to represent the cost for each company. Define your variables.
    b) Solve the linear system.
    c) What does the point of intersection represent?
    d) Which company should Richard choose to print 175 pages?

2. Joe invests a total of $4000 in two plans. Part of the money is invested at 8% per year and the rest at 11% per year. The interest paid after 1 year on the 11% investment is $212 more than the interest paid on the 8% investment. Set up equations with variables on how much did Joe invest in each.

Geometry Problems

3. The perimeter of a rectangular pool is 38m. The length is 3m more than the width. Set up equations with variables being the dimensions of the pool.

4. A 10m pipe is to be cut into two pieces of different length. One piece is 3m longer than the other. Set up equations with variables being the lengths of the two pieces of pipe.

5. Linda has a garden. The width of her garden is 8 feet longer than the length of it. Around the garden she has a 2 foot wide sidewalk. The area of the sidewalk is 320 feet squared. Set up equations with variables being the dimensions of the garden.

Mixture Problems

6. What volume, in millilitres, of a 60% hydrochloric acid solution must be added to 100 mL of a 30% hydrochloric acid solution to make a 36% hydrochloric acid solution? Set up equations only.

7. One type of granola is 30% fruit, and another type is 15% fruit. What mass of each type of granola should be mixed to make 600 g of granola that is 21% fruit? Solve.

Age Problems

8. Bill is 11 years younger than Sue. Nine years ago, Sue was twice as old as Bill. How old is each person now? Set up equations only.

9. Heidi's mother is twice as old as Heidi. The sum of their ages in 6 years will be 72. What are their present ages? Solve.

Motion Problems

10. Erika drove from Ottawa at 80 km/h. Julie left Ottawa 1 h later and drove along the same road at 100 km/h. How far from Ottawa did Julie overtake Erika? Set up equations only.

Wind/Current Problems

12. Suppose it takes a small airplame flying with a head wind 16 hours to travel 1800 miles. When flying with a tail wind, the airplane can travel the same distance in only 9 hours. Set up equations with variables being the speed of the wind and the speed of the plane without the wind.

11. Debbie is driving from Moose Bay to Peggy's Cove, Larry is going in the opposite direction. Debbie drove her car for 3h and Larry drove his motorcycle for 5h when they passed each other. The distance between Moose Bay and Peggy's Cove is 420km. If Larry drove 16km/h slower than Debby, how fast did each of them go?

13. A boat goes 32 miles downstream in three hours. The return trip against the current takes sixteen hours. Find the rate of the boat in calm water and the rate of the current. Set up equations only.

Rate Problems

14. Playing tennis burns energy at a rate of about 25 kJ/min. Cycling burns energy at about 35 kJ/min. Hans exercised by playing tennis and then cycling. He exercised for 50 min altogether and used a total of 1450 kJ of energy. For how long did he play tennis? Set up equations only.

16. A street has a row of 15 new houses for sale. The middle house is on the most desirable piece of property and is the most expensive. The second house from one end costs $3000 more than the first house, the third house costs $3000 more than the second house, and so on, up to and including the middle house. The second house from the other end costs $5000 more than the first house, the third house costs $5000 more than the second house, and so on, up to and including the middle house. All the houses on the street cost a total of $3 091 000. Set up equations with variables being the selling price of the house at each end of the street?

Other Problems

15. The sum of two numbers is 56. One number exceeds the other number by 2. Find the two numbers. Set up equations only.