

# Interpreting Linear Relations

This Guidebook belongs to: \_\_\_\_\_

LESSON #	DATE	QUESTIONS FROM NOTES	Questions that I find difficult
1.		Pg.	
2.		Pg.	
3.		Pg.	
4.		Pg.	
5.		Pg.	
6.		Pg.	
7.		Pg.	
8.		Pg.	
9.		REVIEW	
10.		TEST	

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## Linear Relations Linear Relations

Objective	#	Daily Topic	Key Ideas
P&R1 generalize a pattern arising from a problem-solving context using linear equations and verify by substitution [C, CN, PS, R, V]	1.	Describing Patterns Algebraically (pg. 3-6) <ul style="list-style-type: none"> <li>Write an expression representing a given pictorial, oral, or written pattern.</li> <li>Write a linear equation to represent a given context.</li> </ul>	Write a linear equation to represent this pattern. 

## Key Terms

	Definition	Example
Extrapolate	To predict a value by extending a pattern beyond known values.	See page 14.
Interpolate	To estimate a value between two values.	See page 14.
Linear Relation	A relation where all the points lie on a straight line.	See page 12.
Rate of change	The amount by which a string of numbers changes.	i.e. 3,5,7,9 the rate of change is 2.
Y-intercept	The place where a linear relation crosses the y-axis.	

## Describing Patterns Algebraically

This opening exercise is designed to challenge your ability to see and explain patterns. Explain each pattern in the most efficient way possible.

1. Complete the table and explain your rational.

Figure #1	Figure #2	Figure #3	Figure #4	How many ☺ would there be in the 7 <sup>th</sup> figure?	How many ☺ would there be in the 50 <sup>th</sup> figure?
☺ ☺☺	☺ ☺☺ ☺	☺ ☺☺ ☺☺	☺ ☺☺ ☺☺ ☺		

Explain how to find the number of ☺s in **any** box.

2. Complete the table and explain your rational.

Figure #1	Figure #2	Figure #3	Figure #4	How many ☺ would there be in the 7 <sup>th</sup> figure?	How many ☺ would there be in the 50 <sup>th</sup> figure?
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Explain how to find the number of ☺s in **any** box.

3. Complete the table and explain your rational.

Figure #1	Figure #2	Figure #3	Figure #4	How many ☺ would there be in the 7 <sup>th</sup> figure?	How many ☺ would there be in the 50 <sup>th</sup> figure?
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Explain how to find the number of ☺s in **any** box.

### Challenge #1:

Study the Pattern

Figure #1.



Figure #2.



Figure #3.



Figure #4.

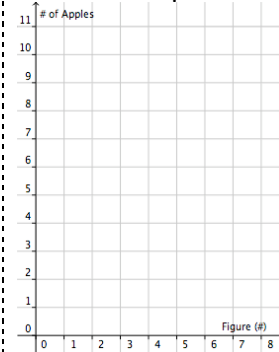


4. Fill out the table of values.

Let x= Figure # & y= # of Apples

x	y
1	
2	
3	
4	

5. Plot the points.



Answer the questions.





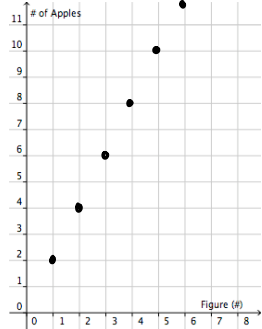
6. Rate of change: How does each figure change?

7. Write an equation to represent this pattern.





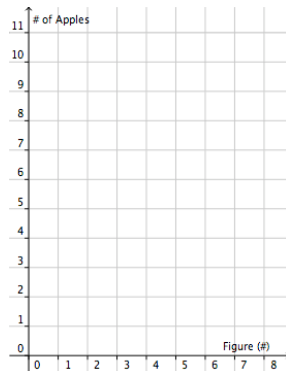
y= \_\_\_\_\_

8. Use the equation you wrote to determine how many shapes would be in the 100<sup>th</sup> figure.

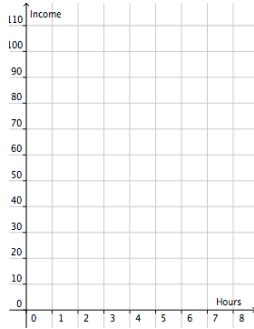
Describe a visual pattern in a table of values, a graph and an equation.

<b>Study the Pattern</b> Figure #1.  Figure #2.  Figure #3.  Figure #4. 	<b>9. Fill out the table of values.</b> Let $x = \text{Figure \#}$ & $y = \text{\# of Apples}$ <table border="1"> <thead> <tr> <th><math>x</math></th> <th><math>y</math></th> </tr> </thead> <tbody> <tr><td>1</td><td><math>1 \times 2 = 2</math></td></tr> <tr><td>2</td><td><math>2 \times 2 = 4</math></td></tr> <tr><td>3</td><td><math>3 \times 2 = 6</math></td></tr> <tr><td>4</td><td><math>4 \times 2 = 8</math></td></tr> <tr><td>5</td><td>10</td></tr> <tr><td>6</td><td>12</td></tr> </tbody> </table>	$x$	$y$	1	$1 \times 2 = 2$	2	$2 \times 2 = 4$	3	$3 \times 2 = 6$	4	$4 \times 2 = 8$	5	10	6	12	<b>10. Plot the points.</b> 	<b>Answer the questions.</b> 11. Rate of change: How does each figure change? Each figure is increasing by 2 each time. 12. Write an equation to represent this pattern. $Y = 2x$
$x$	$y$																
1	$1 \times 2 = 2$																
2	$2 \times 2 = 4$																
3	$3 \times 2 = 6$																
4	$4 \times 2 = 8$																
5	10																
6	12																
13. Use the equation you wrote to determine how many shapes would be in the 100 <sup>th</sup> figure. $Y = 2x \rightarrow \text{if } x = 100 \text{ then } y = 2(100) = 200. \text{ The } 100^{\text{th}} \text{ figure would have 200 apples.}$																	

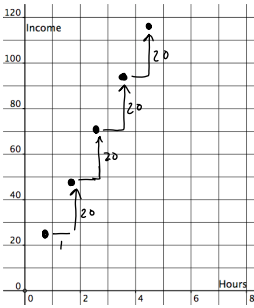
Describe a visual pattern in a table of values, a graph and an equation.

<b>Study the Pattern</b> Figure #1.  Figure #2.  Figure #3.  Figure #4. 	<b>14. Fill out the table of values.</b> Let $x = \text{Figure \#}$ & $y = \text{\# of Apples}$ <table border="1"> <thead> <tr> <th><math>x</math></th> <th><math>y</math></th> </tr> </thead> <tbody> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> </tbody> </table>	$x$	$y$													<b>15. Plot the points.</b> 	<b>Answer the questions.</b> 16. Rate of change: How does each figure change? 17. Write an equation to represent this pattern. $Y = \underline{\hspace{2cm}}$
$x$	$y$																
18. Use the equation you wrote to determine how many shapes would be in the 1000 <sup>th</sup> figure.																	

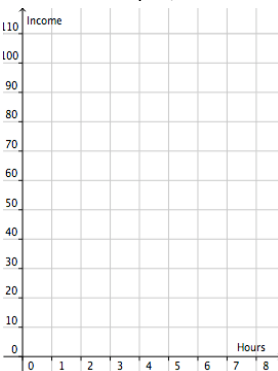
Challenge #2: Describe a written pattern in a table of values, a graph and an equation.

<b>Study the Pattern</b> Jason cuts lawns as his summer job. He charges a travelling fee of \$10 plus \$20/hour for his time.	<b>19. Fill out the table of values.</b> Let $x = \text{Hours}$ & $y = \text{Income}$ <table border="1"> <thead> <tr> <th><math>x</math></th> <th><math>y</math></th> </tr> </thead> <tbody> <tr><td>1</td><td> </td></tr> <tr><td>2</td><td> </td></tr> <tr><td>3</td><td> </td></tr> <tr><td>4</td><td> </td></tr> <tr><td>5</td><td> </td></tr> <tr><td>6</td><td> </td></tr> </tbody> </table>	$x$	$y$	1		2		3		4		5		6		<b>20. Plot as many points as will fit.</b> 	<b>Answer the questions.</b> 21. Rate of change: How is the $y$ changing? 22. Write an equation to represent this pattern. $Y = \underline{\hspace{2cm}}$
$x$	$y$																
1																	
2																	
3																	
4																	
5																	
6																	
23. How can you ensure that your equation is correct																	

Describe a written pattern in a table of values, a graph and an equation.

<p><b>Study the Pattern</b></p> <p>Jason cuts lawns as his summer job. He charges a travelling fee of \$10 plus \$20/hour for his time.</p>	<p><b>24. Fill out the table of values.</b></p> <p>Let <math>x</math> = Hours &amp; <math>y</math> = Income</p> <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="padding: 5px;"><math>x</math></th> <th style="padding: 5px;"><math>y</math></th> </tr> </thead> <tbody> <tr><td style="padding: 5px;">1</td><td style="padding: 5px;">30</td></tr> <tr><td style="padding: 5px;">2</td><td style="padding: 5px;">50</td></tr> <tr><td style="padding: 5px;">3</td><td style="padding: 5px;">70</td></tr> <tr><td style="padding: 5px;">4</td><td style="padding: 5px;">90</td></tr> <tr><td style="padding: 5px;">5</td><td style="padding: 5px;">110</td></tr> <tr><td style="padding: 5px;">6</td><td style="padding: 5px;">130</td></tr> </tbody> </table>	$x$	$y$	1	30	2	50	3	70	4	90	5	110	6	130	<p><b>25. Plot as many points as will fit.</b></p> 	<p><b>Answer the questions.</b></p> <p>26. Rate of change: How is the <math>y</math> changing? He earns \$20/h</p> <p>27. Write an equation to represent this pattern.</p> <p style="text-align: center;"><math>I = 20h + 10</math> <math>Y = 20x + 10</math></p>
$x$	$y$																
1	30																
2	50																
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5	110																
6	130																
<p>How can you ensure that your equation is correct? Substitute values from the table into the equation and make sure they work. For example <math>20(6) + 10 = 130</math>. Correct.</p>																	

Describe a written pattern in a table of values, a graph and an equation.

<p><b>Study the Pattern</b></p> <p>Rocwell was just hired at Beet's Deli. He will be paid \$10/h.</p>	<p><b>28. Fill out the table of values.</b></p> <p>Let <math>x</math> = Hours &amp; <math>y</math> = Income</p> <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="padding: 5px;"><math>x</math></th> <th style="padding: 5px;"><math>y</math></th> </tr> </thead> <tbody> <tr><td style="padding: 5px;"> </td><td style="padding: 5px;"> </td></tr> <tr><td style="padding: 5px;"> </td><td style="padding: 5px;"> </td></tr> <tr><td style="padding: 5px;"> </td><td style="padding: 5px;"> </td></tr> <tr><td style="padding: 5px;"> </td><td style="padding: 5px;"> </td></tr> <tr><td style="padding: 5px;"> </td><td style="padding: 5px;"> </td></tr> <tr><td style="padding: 5px;"> </td><td style="padding: 5px;"> </td></tr> </tbody> </table>	$x$	$y$													<p><b>29. Plot as many points as will fit.</b></p> 	<p><b>Answer the questions.</b></p> <p>30. Rate of change: How is the <math>y</math> changing?</p> <p>31. Write an equation to represent this pattern.</p> <p style="text-align: center;"><math>y = \underline{\hspace{2cm}}</math></p>
$x$	$y$																

32. How can you ensure that your equation is correct?

### Challenge #3:

33. Ranteetha is paid \$16/h working for Neater House Maids.
- A. Complete the table of values.
- B. How much more money does she make by working 8 hours rather than 6 hours?
- C. Write an equation to relate her income and the number of hours she works.

Hours	Income
5	
6	
7	
8	

**Definition:**

Rate of change: The rate of change for a set of numbers is the measure by which each number in the sequence is changing.

- Given 5,10,15,20... The rate of change is addition by 5 each time.
- Given 9,7,5,3... The rate of change is subtraction by 2 each time.

Determine the pattern, complete the table of values and state the rate of change.

34.

x	y
1	11
2	12
3	13
4	14
5	

Rate of change:

35.

x	y
1	7
2	11
3	15
4	19
5	

Rate of change:

36.

x	y
1	10
2	8
3	6
4	4
5	

Rate of change:

Write an equation and evaluate.

37. Ranteetha is paid \$16/h working for Neater House Maids. Complete the table of values.

Hours	Income
5	$5 \times 16 = 80$
6	$6 \times 16 = 96$
7	$7 \times 16 = 112$
8	$8 \times 16 = 128$

A. How much more money does she make by working 8 hours rather than 6 hours?

$$8 \times 16 - 6 \times 16 = 32$$

B. Write an equation to relate her income and the number of hours she works.

$$\text{Income} = 16 \text{ per hour} \\ I = 16h$$

38. The airport charges an activation fee of \$10 plus \$7/day for renting long-term lockers. Complete the table of values.

Day	Charge
20	
21	
22	
23	

A. Write an equation to relate the total charge to the number of days the locker is rented for.

B. What would be the total charge for a 365-day locker rental?

39. Tok Alut decided to buy the Chatzilla premium plan: \$70/ month and \$0.10 for every minute above 800 minutes.

Extra minutes	Total Charge
100	
200	
300	
400	

A. Write an equation to relate the total charge to the extra number of minutes used.

B. What would be the total charge if Tok used a total of 1140 minutes in the month of May?

## Describing Patterns in Table of Values

Determine a value for y when x=3

40.  $y = 5x + 1$

41.  $y = 3x - 1$

42.  $y = -2x + 4$

43.  $y = \frac{1}{3}x$

Explain the pattern/relationship between x and y.

44.

x	y
1	105
2	110
3	115
4	120

Explanation:

45.

x	y
1	9
2	12
3	15
4	18

Explanation:

46.

x	y
1	15
2	13
3	11
4	9

Explanation:

### Challenge #4:

47. Study the table of values.

x	y
1	6
2	7
3	8
4	9

Write down the steps to solve the challenge to the left.

A. State the rate of change: (How is y changing each time?)

B. Write an equation:  $y =$  \_\_\_\_\_ and verify your answer.

C. If  $x=42$ , determine y.

Determine the pattern, state the rate of change, write an equation and evaluate.

48.

x	y
1	6
2	7
3	8
4	9

A. Rate of change:

Ys go up by one each time.

B. Equation:  $y =$  \_\_\_\_\_

Start with

$y = \text{rate of change times } x + \text{some number.}$

$Y = I(x) + \text{some number}$

We know that when  $x=1$ ,  $y=6$  so

$(6) = I(1) + \text{some number.}$

The missing number must be 5.

The equation is  $y = Ix + 5$

Verify  $I(2) + 5 = 7$  correct

Verify  $I(4) + 5 = 9$  correct

c. If  $x=42$ , determine  $y$ .

$Ix + 5 = y$

$I(42) + 5 = 47$

49.

x	y
1	4
2	6
3	8
4	10

A. Rate of change:

B. Equation:  $y =$  \_\_\_\_\_

c. If  $x=500$ , determine  $y$ .

50.

x	y
1	5
2	4
3	3
4	2

A. Rate of change:

B. Equation:  $y =$  \_\_\_\_\_

c. If  $x=271$ , determine  $y$ .

51.

x	y
3	16
4	21
5	26
6	31

A. Rate of change:

B. Equation:  $y =$  \_\_\_\_\_

c. If  $x=42$ , determine  $y$ .

52.

x	y
-3	-9
-2	-5
-1	-1
0	3

A. Rate of change:

B. Equation:  $y =$  \_\_\_\_\_

c. If  $x=42$ , determine  $y$ .

Choose the equation(s) that could represent each table of values.

53.

x	y
1	3
2	4
3	5
4	6

A.  $y = x + 3$

B.  $y = 2x + 1$

C.  $y = x + 2$

54.

x	y
2	10
3	15
4	20
5	25

A.  $y = 5x$

B.  $y = x + 5$

C.  $y = 2x + 3$

55.

x	y
1	-2
2	-1
3	0
4	1

A.  $y = x - 2$

B.  $y = x - 3$

C.  $y = 2x - 4$



Which of the following equations might represent the pattern?

56. When  $x=2$ ,  $y=8$ . Which of the following equations might represent the pattern?

- A.  $y = 4x$
- B.  $y = 3x + 1$
- C.  $y = 5x - 2$

57. When  $x=3$ ,  $y=5$ . Which of the following equations might represent the pattern?

- A.  $y = 2x + 1$
- B.  $y = 2x - 1$
- C.  $y = \frac{5}{3}x$

58. When  $x=10$ ,  $y=14$ . Which of the following equations might represent the pattern?

- A.  $y = 4x$
- B.  $y = 3x + 1$
- C.  $y = 5x - 2$

Complete the following table of values for the following linear relations.

59.

x	y
4	
5	16
6	19
7	

60.

x	y
1	
2	-10
3	
4	-20

61.

x	y
5	12
6	
7	
8	18

62.

x	y
-2	6
-1	
0	0
1	
2	

63.

x	y
-5	-41
-4	
-3	
-2	
-1	-1

64.

x	y
-2	8
-1	
0	
1	2
2	

### Challenge #5:

65. Jeff installs windows and charges a fixed cost of \$60 plus \$20 for every window he installs.

A. Write an equation that relates his income to the number of windows he installs.

B. If he installs 9 windows, how much will a customer be charged?

C. If he charges his customer \$580, how many windows did he install?

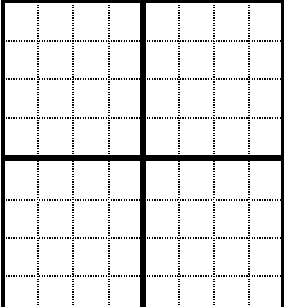
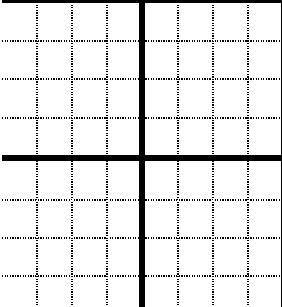
Write an equation and evaluate.

<p>66. Jeff installs windows and charges a fixed cost of \$60 plus \$20 for every window he installs.</p> <p>A. Write an equation that relates his income to the number of windows he installs.</p> <p>1 window = \$60 + \$20(1)  2 windows = \$60 + \$20(2)  3 windows = \$60 + \$20(3) ...  Equation <math>\rightarrow I = 20W + 60</math></p> <p>B. If he installs 9 windows, how much will a customer be charged?</p> <p><math>I = 20W + 60</math>  <math>I = 20(9) + 60</math>  <math>I = 240</math> ... The customer will pay \$240.</p> <p>C. If he charges his customer \$580, how many windows did he install?</p> <p><math>I = 20W + 60</math>  <math>580 = 20W + 60</math>  <math>520 = 20W</math>  <math>26 = W</math>  He installed 26 windows.</p>	<p>67. The cost to print promotional Cuiseline brochures can be calculated by adding a fixed cost of \$325, plus \$1.50 per color brochure.</p> <p>A. Write an equation that relates the total cost of the brochures to the number of brochures printed.</p> <p>B. Determine the cost of printing 3000 brochures.</p> <p>C. How many brochures can be printed for \$1435?</p>	<p>68. Jenna installs digital cable boxes in large apartment buildings. She charges a fixed cost of \$80 plus \$15 for every cable box she installs.</p> <p>A. Write an equation that relates the total charge to the number of cable boxes she installs.</p> <p>B. If she installed 16 cable boxes, how much will the apartment manager be charged?</p> <p>C. If she charged the client \$440, how many cables did she install?</p>
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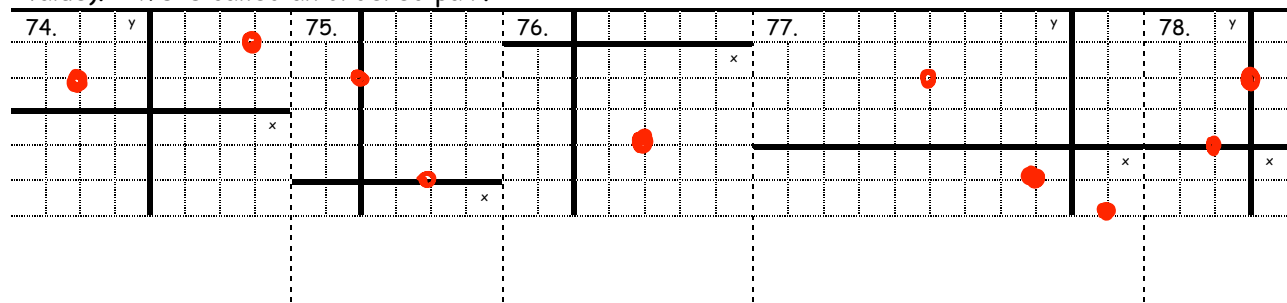
Write an equation and evaluate.

<p>69. Dathanial created the following number pattern: 9, 18, 27, ... What are the next two terms?</p> <p>Write an equation to represent this pattern.</p>	<p>70. Morland created the following number pattern: 17, 26, 35, ... What are the next two terms?</p> <p>Write an equation to represent this pattern.</p>	<p>71. Winston created the following number pattern: 7, 15, 23, ... What are the next two terms?</p> <p>Write an equation to represent this pattern.</p>
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# Interpreting Patterns in Graphs

<p>72. Label the x-axis, y-axis and the origin.</p> 	<p style="text-align: center;"><b>The Cartesian Plane</b></p> <p>The <b>ORIGIN</b> (0,0) is the place where the two axes meet.</p> <p>The <b>X-AXIS</b> is the horizontal axis.</p> <p>The x-axis is positive to the right of the origin and negative to the left.</p> <p>The <b>Y-AXIS</b> is the vertical axis.</p> <p>The y-axis is positive above the origin and negative below the origin.</p> <p>The 4 quadrants: #1 is top right, #2 is top left, #3 bottom left, #4 bottom right.</p>	<p>73. Number the x-axis and the y-axis.</p> 
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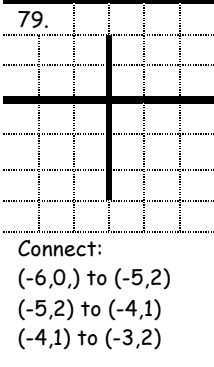
State the coordinates of each point on the graph. State the coordinate in the form (x value, y value). This is called an ordered pair.



What is an ordered pair?

Another name for **coordinate** is an **ordered pair**. To be consistent, mathematicians have agreed on an order in which they will say each coordinate. An ordered pair has an x-value and a y-value and in the order (x,y).

Graph each ordered pair and then connect the points in each column.

<p>79.</p>  <p>Connect:          (-6,0) to (-5,2)          (-5,2) to (-4,1)          (-4,1) to (-3,2)</p>	<p>Connect:          (1,-3) to (1,2)          (15,-1) to (15,-3)</p>	<p>Connect:          (-3,2) to (-2,0)          (19,-1) to (19,-3)</p>	<p>Connect:          (12,-3) to (9,0)          (6,-3) to (9,0)</p>	<p>Connect:          (1,2) to (3,0)          (3,0) to (5,2)</p>	<p>Connect:          (19,-2) to (21,-2)          (-4,-3) to (-2,0)          (-6,0) to (-4,-3)</p>
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# Linear Relations

## Definition

### Linear Relation

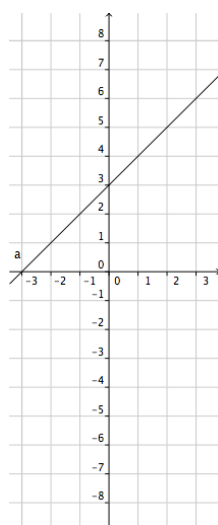
- A linear relation when graphed forms a straight line.
- Or a straight line can be drawn through every point of the graph.
- A linear relation has a constant rate of change.

Which of the following are linear relations?

80.  $y = x + 3$

x	y
-2	1
-1	2
0	3
1	3
2	4

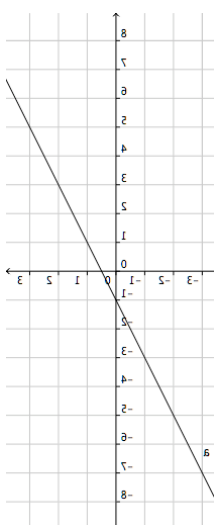
Rate of change?



81.  $y = 2x - 1$

x	y
-2	-5
-1	-3
0	-1
1	1
2	3

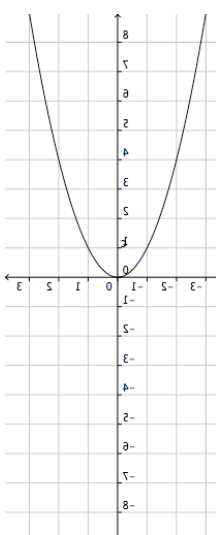
Rate of change?



82.  $y = x^2$

x	y
2	4
1	1
0	0
-1	1
-2	4

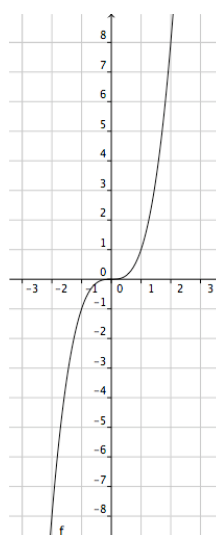
Rate of change?



83.  $y = x^3$

x	y
2	8
1	1
0	0
-1	-1
-2	8

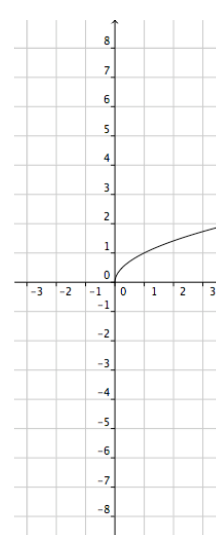
Rate of change?



84.  $y = \sqrt{x}$

x	y
4	2
1	1
0	0
-1	∅
-2	∅

Rate of change?



Which of the following are linear relations? If they are, what is the rate of change?

85.

x	y
1	2
2	4
3	6
4	8

86.

x	y
1	8
2	6
3	4
4	2

87.

x	y
1	4
2	6
3	7
4	8

Which of the following are linear relations? If they are, what is the rate of change?

88.

x	y
1	1
2	4
3	9
4	16

89.

x	y
-2	2
-1	1
1	1
2	2

90.

x	y
-200	-400
-5	-10
7	14
80	160

Fill in the table of values to determine the rate of change.

91.  $y = 4x + 6$

x	y
0	
1	
2	
3	

92.  $y = x + 7$

x	y
0	
1	
2	
3	

93.  $y = -5x$

x	y
0	
1	
2	
3	

94.  $y = 2x + 10$

x	y
0	
1	
2	
3	

95.  $y = -5x + 1$

x	y
0	
1	
2	
3	

96.  $y = 10x + 50$

x	y
0	
1	
2	
3	

97. How can you determine what the rate of change is without making a table of values?

Determine the rate of change for each of the following equations.

98.  $y = 7x + 5$

99.  $y = x - 99$

100.  $y = -5x$

101.  $y = -x - 17$

102.  $y = 9x$

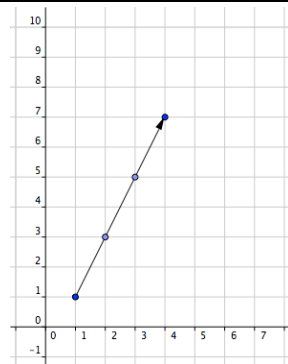
Write a real world situation that could be represented by:

103.  $P = 8.75h$

104.  $C = 60h + 75$

# Interpolation and Extrapolation

## Definition:



Interpolation: Estimate a value between two known values.

- i.e. If  $x=2.5$  then  $y$  should equal 4 since  $x=2 \rightarrow y=3$  and  $x=3 \rightarrow y=5$
- ( $x=2.5$  is between 2 and 3, as  $y=4$  is between 3 and 5)

Extrapolation: Predict a value by extending a pattern beyond known values.

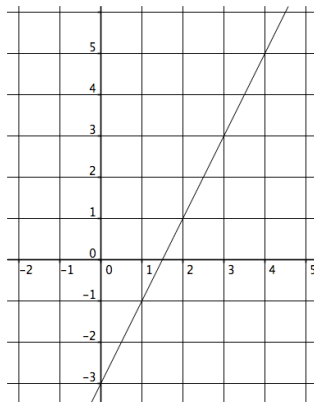
- If  $x=5$  then  $y$  should equal 9 if the pattern continues.
- (The graph goes right one and up two units.)

## Determine the values by interpolation.

105.

A. Find  $y$  if  $x=1$ .

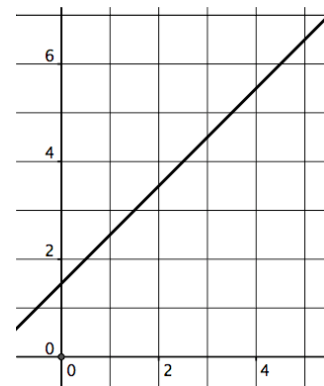
B. Find  $x$  if  $y=4$ .



106.

A. Find  $y$  if  $x=3$ .

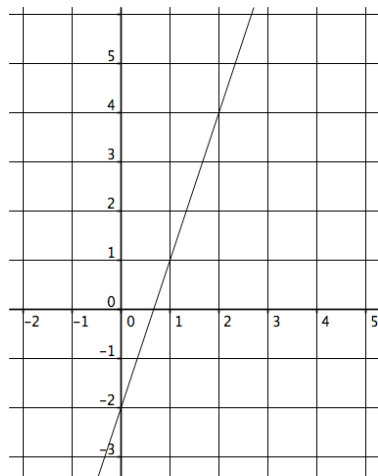
B. Find  $x$  if  $y=0$ .



107. Interpolate.

A. Find  $y$  if  $x=2$ .

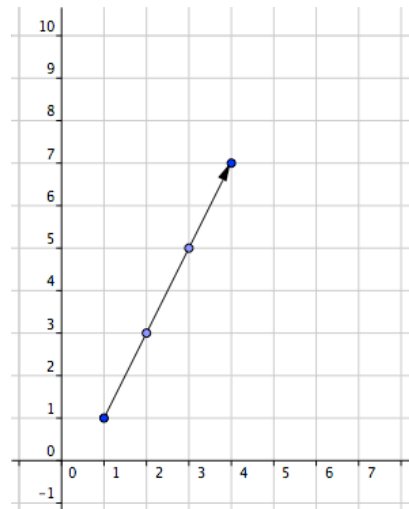
B. Find  $x$  if  $y=-1$ .



108. Extrapolate

A. Find  $y$  if  $x=6$ .

B. Find  $x$  if  $y=-1$ .

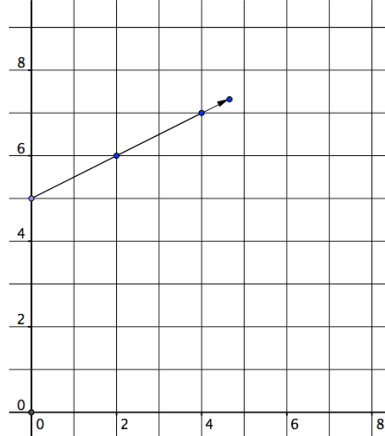


Determine the values by extrapolation.

109.

A. Find  $y$  if  $x=8$ .

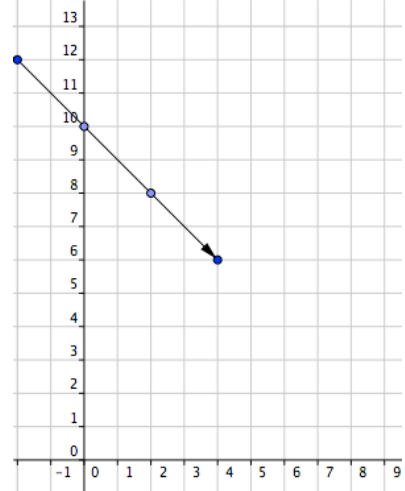
B. Find  $x$  if  $y=3$ .



110.

A. Find  $y$  if  $x=5.5$ .

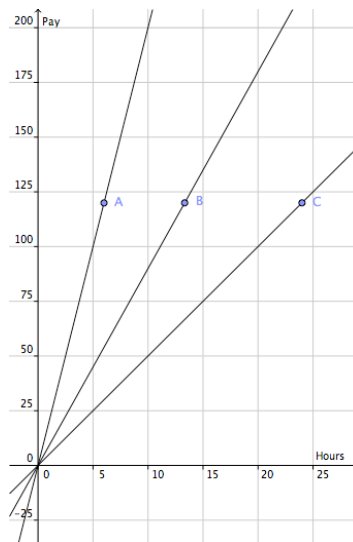
B. Find  $x$  if  $y=1.5$ .



### Challenge #6:

111. Business people are now hiring virtual assistants on the internet to do office tasks for them. Silvia needs a report turned into a power point presentation. She goes on line and receives three offers from 3 different virtual assistants.

The graph below represents three virtual assistants hourly rate.



A. Which letter represents the most expensive rate?

B. She thinks the job will take about ten hours. How much will she save by choosing company B over company A?

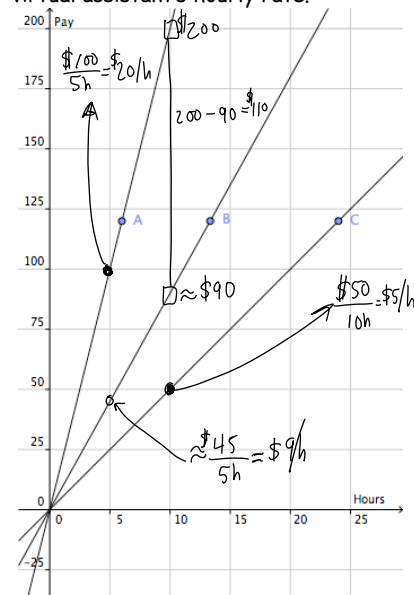
C. Write an equation to represent the approximate hourly rate for each company

112. Did this challenge require interpolation or extrapolation?

Analyze each graph.

113. Business people are now hiring virtual assistants to do tasks for them. Silvia needs a report turned into a power point presentation. She goes on line and receives three offers from 3 different virtual assistants.

The graph below represents each virtual assistant's hourly rate.



- A. Which letter represents the most expensive price?

At 5 hours, "A" charges over 100\$, "B" Charges less than \$50 and "C" charges \$25. "A" charges the most.

- B. She thinks the job will take about ten hours. Approximately how much will she save by choosing company B over company A?

"A" charges about \$200 and B charges about \$90. It looks like a savings of around \$110.

- C. Write an equation to represent the approximate hourly rate for each company

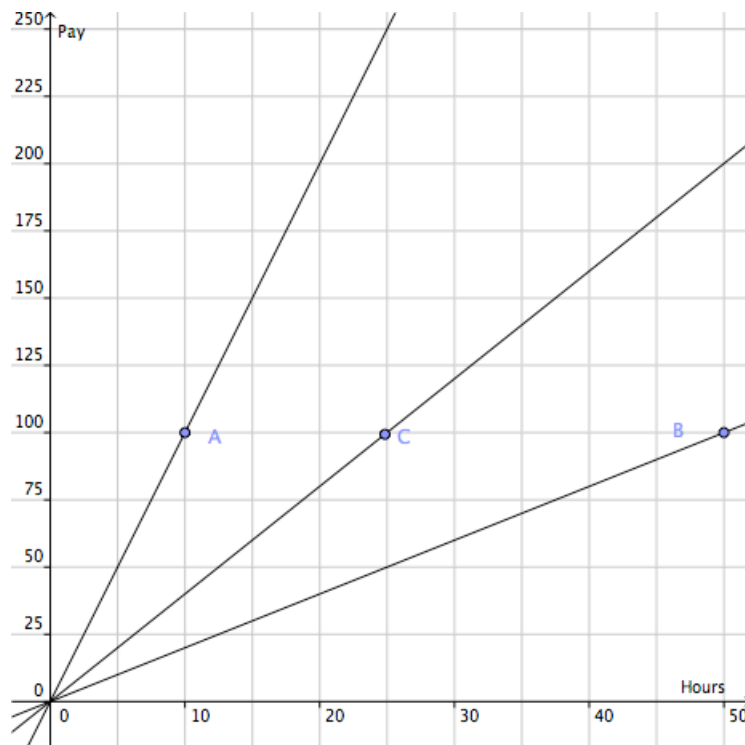
"A"  $\rightarrow \$100/5h = \$25/h \rightarrow I = 25h$

"B"  $\rightarrow \text{About } \$45/5h = \$9/h \rightarrow I = 9h$

"C"  $\rightarrow \$25/5h = \$5/h \rightarrow I = 5h$

114. Sarai is learning web design from her dad who is a web designer in Canada and charges \$40/hour. She has become really good and has decided to become a virtual assistant to earn a little extra money. She decides to charge \$10/hour for now and see how it goes. To her surprise she does not get any business.

- A. Analyze the graph below. Which line represents Sarai's hourly rate.



- B. How much does each person or company charge for 20 hours of work?

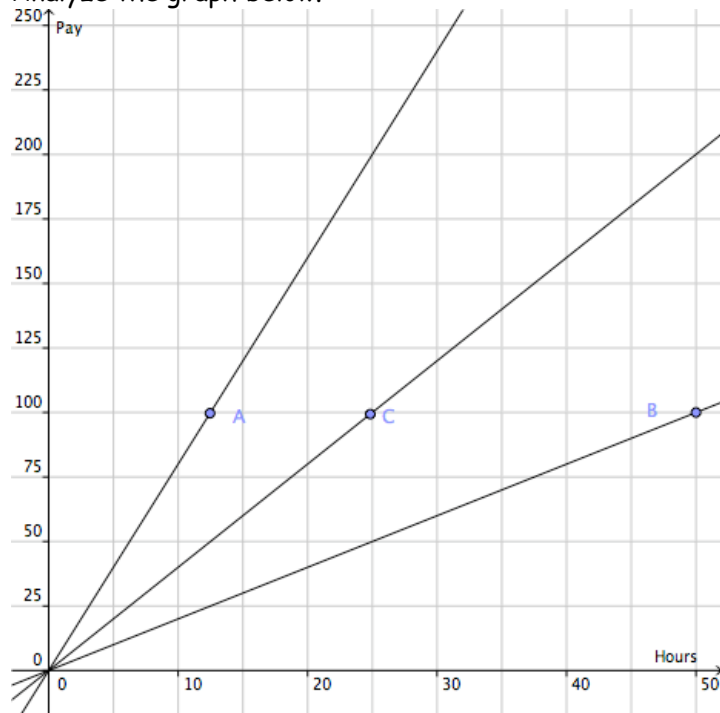
- C. How many more hours of work is company b willing to do than Sarai for \$100?

- D. Explain how the other companies can charge so little.



115. Sarai is really surprised by what some companies in the world are able to pay people to work for them. To be more competitive she lowers her hourly rate.

Analyze the graph below.

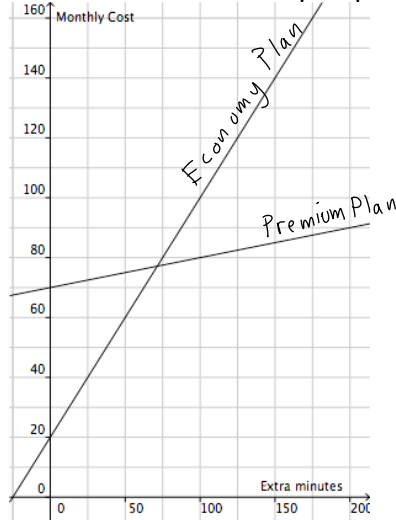


- A. Line A: Determine Sarai's hourly rate.
- B. Line B: Determine the hourly rate for the Virtual assistant from India
- C. Line C: Determine the hourly rate for the virtual assistant from Pakistan
- D. Approximately how many hours of work will each person do for \$50?
- E. Is this fair?

## Analyzing graphs to solve problems

116. Tok Alut, is trying to decide between two phone plans. His options include:
- Chatzilla Economy Plan: \$20/ month and \$0.80 for every minute above 300 minutes.
  - Chatzilla Premium Plan: \$70/ month and \$0.10 for every minute above 300 minutes.\*

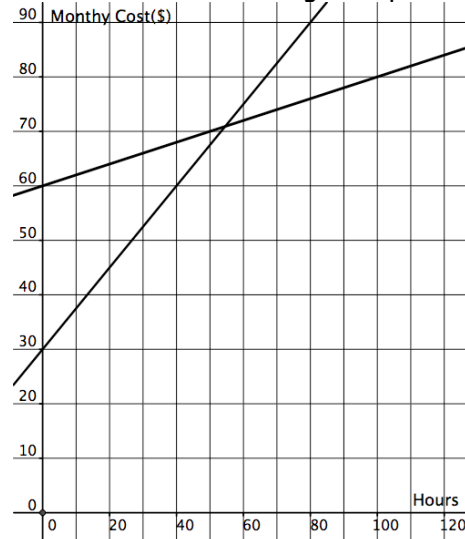
Label each linear relation economy or premium.



- Write an equation to represent the Economy Plan.
- Write an equation to represent the Premium Plan.
- If Tok thinks he will only use about 40 extra minutes per month, which phone plan should he choose and approximately how much will he save?
- If he thinks he will use a total of 400 minutes per month. Which phone plan should he choose and exactly how much will he save?
- Tok has budgeted \$90 per month for his phone. Which option should he choose and why?

117. Bes Deel, is trying to decide between two phone plans. Her options include:
- Vertical Budget Plan: \$30/month and \$0.75 for every minute above 400 minutes.
  - Vertical Premium Plan: \$60/ month and \$0.20 for every minute above 400 minutes.

Label each linear relation budget or premium.



- Write an equation to represent the Budget Plan.
- Write an equation to represent the Premium Plan.
- If Bes thinks she will use a total of 500 minutes per month, which phone plan should she choose and approximately how much will she save?
- If Bes thinks she will use a total of 200 extra minutes per month, which phone plan should she choose and approximately how much will she save?
- Bes has budgeted \$80 per month for her phone. Which option should she choose and why?

\*There is a detailed solution on the next page if you get stuck.

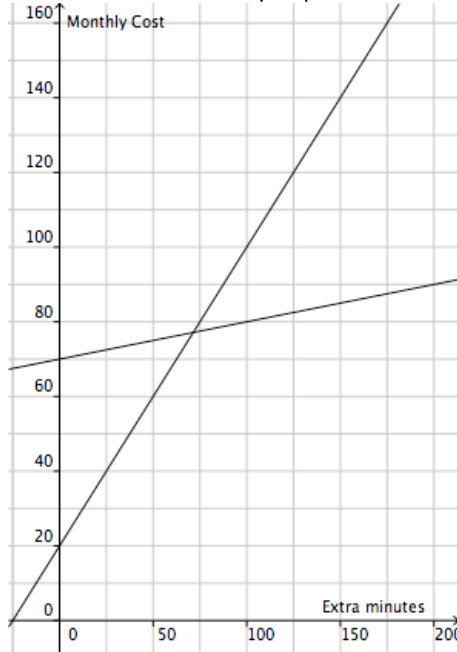
**Do not read this solution until you have tried the question on the previous page.**

118. Tok Alut, is trying to decide between two phone plans.

His options include:

- Chatzilla Economy Plan: \$20/ month and \$0.80 for every minute above 300 minutes.
- Chatzilla Premium Plan: \$70/ month and \$0.10 for every minute above 300 minutes.

Label each linear relation economy or premium.



A. Write an equation to represent the Economy Plan.

1 minute  $\rightarrow 0.8(1) + 20$   
 2 minutes  $\rightarrow 0.8(2) + 20$   
 Equation  $\rightarrow EP = 0.8m + 20$

B. Write an equation to represent the Premium Plan.

1 minute  $\rightarrow 0.1(1) + 70$   
 2 minutes  $\rightarrow 0.1(2) + 70$   
 Equation  $\rightarrow PP = 0.1m + 70$

C. If Tok thinks he will only use about 40 extra minutes per month, which phone plan should he choose and approximately how much will he save?

At 40 minutes the Economy Plan (EP) is less than \$60 and the Premium Plan (PP) is more than \$70. Therefore the Economy Plan is the better plan.

D. If thinks he will use a total of 400 minutes per month. Which phone plan should he choose and exactly how much will he save?

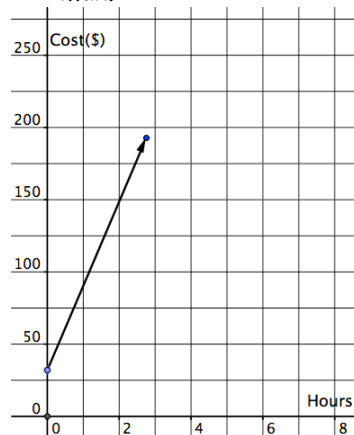
EP  $\rightarrow$  100 extra minutes will lead to \$100 monthly bill  
 PP  $\rightarrow$  100 extra minutes will lead to \$80 monthly bill

E. Tok has budgeted \$90 per month for his phone. Which option should he choose and why?

\$90 buys about 80 extra minutes with EP and 200 minutes with PP.  
 The better value for \$90 is the Premium plan.

**Challenge #7:**

119. The graph represents how much it costs to hire Jordy the handy man.



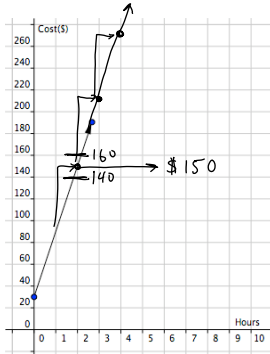
A. Interpolate: How much will it cost to hire Jordy for 2 hours.

Write down the steps to solve the challenge to the left.

B. Extrapolate: How much will it cost to hire Jordy for 4 hours?

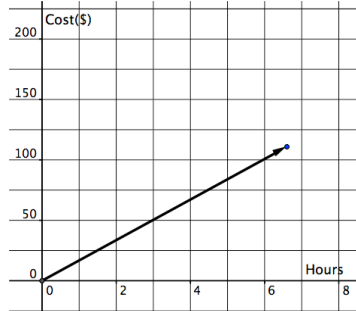
# Interpreting a linear relation by interpolation or extrapolation.

120. The graph represents how much it costs to hire Jordy the handy man.



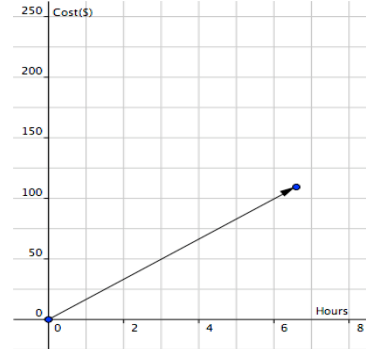
- A. Interpolate: Estimate how much it will cost to hire Jordy for 2 hours. 2 hours puts the price between \$140 and \$160. The cost is about \$150.
- B. Extrapolate: Estimate how much it will cost to hire Jordy for 4 hours?  $1h=90, 2h=150, 3h=\text{about } 210$ , the price seems to be increasing by \$60 each time. The prediction for 4 hours work is \$270.

121. The graph represents how much it costs to hire Marty to cut your grass.



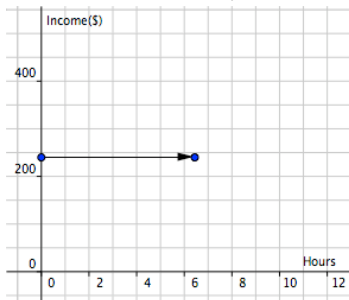
- A. Interpolate: Estimate how much does it cost to hire Marty for 3.5 hours?
- B. Extrapolate: Estimate how much it will cost to hire Marty for 8 hours.

122. The graph represents how much it costs to hire Marty to do your gardening.



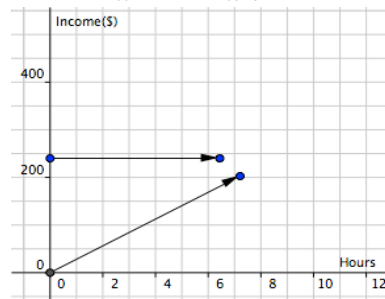
- A. Mrs. Layseebuckets says she will pay him \$200/week to do her gardening. Estimate how many hours of work is this for Marty?

123. Consider the following linear relation.



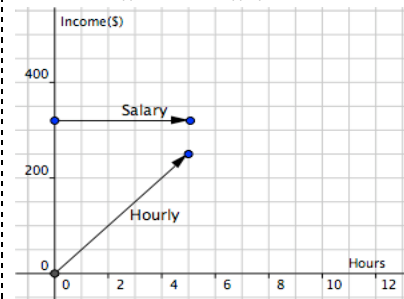
- A. Interpolate: What will the income be after 4.25 hours?
- B. Extrapolate: What will the income be after 9.123 hours?
- C. What kind of job might have an income line that looks like this? Why?

124. Jerry is trying to decide between a salary job and a hourly job. The graph below represents the two income streams.



- A. If the job only requires 4 hours of work per day, which job should he choose?
- B. At what point in time is the salary job not a good financial idea.

125. Mel is trying to decide between a salary job and a hourly job. The graph below represents the two income streams.



- A. Mel chose the salary position. In the first month she average 9 hours a day. Did she make a good decision? Explain.

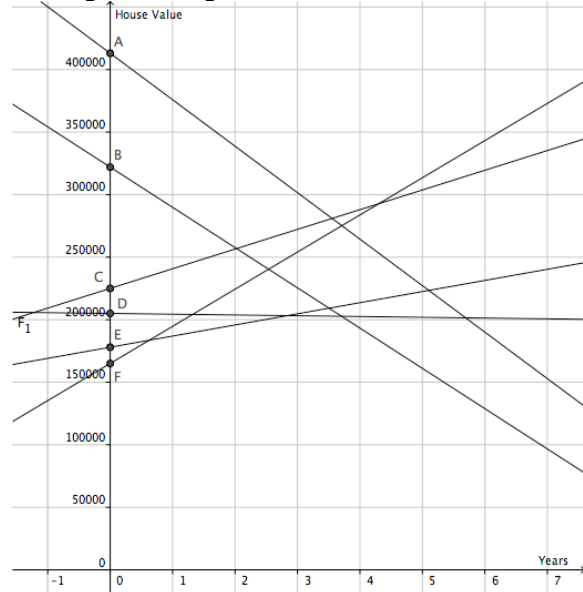
Analyze the table of values and the graph.

The table below gives the average housing prices and the average increase or decrease in housing prices for each province in 2009.

If the rate of change remains constant for the next 5 years, match the province to the corresponding linear relation to the right.

Province & Average House Price	Change in Price in 2009
126. _____ Alb, 322000	-32000
127. _____ BC, 413000	-37000
128. _____ Man, 178000	+9000
129. _____ PEI, 165000	+30000
130. _____ Que, 205000	-1000
131. _____ Sask, 225000	+16000

Average Housing Prices in Canada in 2009



132. In 3 years which province will have the highest average house price?

133. In 4 years which province will have the lowest average house price?

134. Which province has a rate of change closest to zero?

135. Where is the best province to buy in 2010 if you want to make a great investment?

136. How long will it take for BC house prices to fall below PEI house prices?

137. The housing prices were taken from [The Canadian Real Estate Association](#) for 2009. The linear relations assume that the rate of changes will remain constant. The graphs you see are extrapolations of what could happen. How valid do you think the extrapolation is?

# Introduction to Graphing Linear Relations

(It may be helpful to try challenge #8 prior to this page.)

## Learning to graph without a table of values.

138. Complete the following table of values:  $y = x - 2$

x	y
-2	
0	
2	

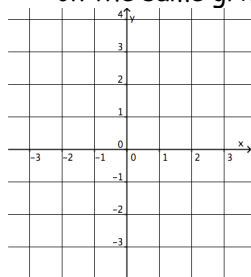
- A. What is the rate of change?

$$y = x + 3$$

x	y
-2	
0	
2	

- B. What is the rate of change?

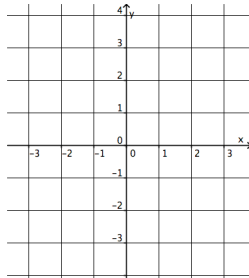
139. Graph  $y = x - 2$ ,  $y = x + 3$  on the same grid.



- A. Where does  $y = x - 2$  cross the y-axis?

- B. Where does  $y = x + 3$  cross the y-axis?

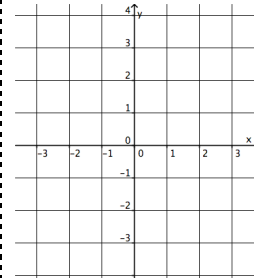
140. Graph  $y = x + 1$  without a table of values.



Confirm the accuracy of your graph with a table of values.

x	y
-2	
0	
2	

141. Graph  $y = -x + 1$  without a table of values.



Confirm the accuracy of your graph with a table of values.

x	y
-2	
0	
2	

142. How can you tell where a linear relation will cross the y-axis by only looking at its equation?

## Learning to graph without a table of values.

143. Complete the following table of values:  $y = 2x + 5$

x	y
-1	
0	
1	

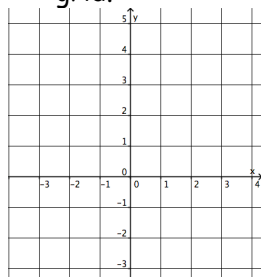
- A. What is the rate of change?

$$y = 2x + 1$$

x	y
-1	
0	
1	

- B. What is the rate of change?

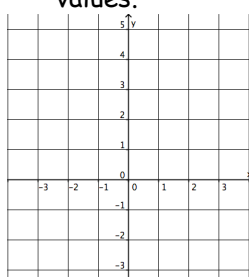
144. Graph  $y = 2x + 5$ ,  $y = 2x + 1$  on the same grid.



- A. Where does  $y = 2x + 5$  cross the y-axis?

- B. Where does  $y = 2x + 1$  cross the y-axis?

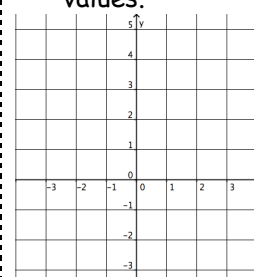
145. Graph  $y = 2x + 3$  without a table of values.



Confirm the accuracy of your graph with a table of values.

x	y
-1	
0	
1	

146. Graph  $y = 2x - 1$  without a table of values.



Confirm the accuracy of your graph with a table of values.

x	y
-1	
0	
1	

147. How can you tell what the rate of change is for a linear relation just by looking at its equation?

Definition:

Y-intercept: The y-intercept is where a linear relation crosses the y-axis.

Learning to graph without a table of values.

148. Complete the following table of

values:  $y = \frac{1}{2}x$

x	y
-2	
0	
2	

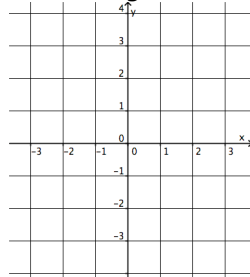
A. What is the rate of change?

$y = \frac{1}{2}x + 2$

x	y
-2	
0	
2	

B. What is the rate of change?

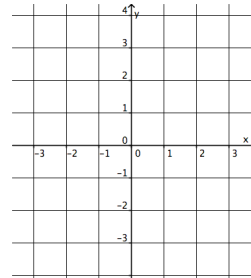
149. Graph  $y = 0.5x$ ,  $y = 0.5x + 2$  on the same grid.



A. Where does  $y = 0.5x$  cross the y-axis?

B. Where does  $y = 0.5x + 2$  cross the y-axis?

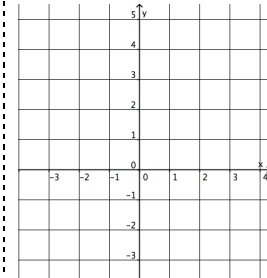
150. Graph  $y = \frac{1}{2}x - 1$  without a table of values.



Confirm the accuracy of your graph with a table of values.

x	y
-2	
0	
2	

151. Graph  $y = \frac{1}{2}x + 4$  without a table of values.



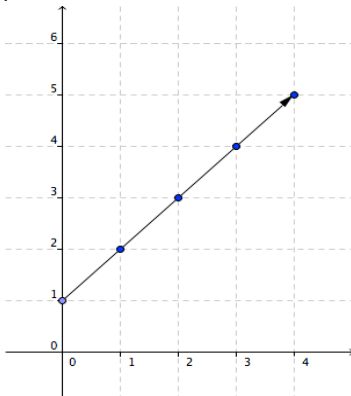
Confirm the accuracy of your graph with a table of values.

X	y
-2	
0	
2	

152. How can you tell where a linear relation will cross the y-axis by looking only at its equation?

Challenge #8: Complete the table of values from the given linear relation.

153.



A. Complete the table of values.

x	y
0	
1	
2	
3	

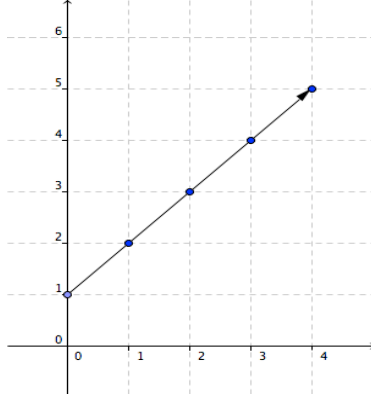
B. Write an equation to represent the table of values?

C. How can the equation be used to determine where the line crosses the y-axis?

D. How can the equation be used to determine the rate of change?

Complete the table of values from the given linear relation.

154.



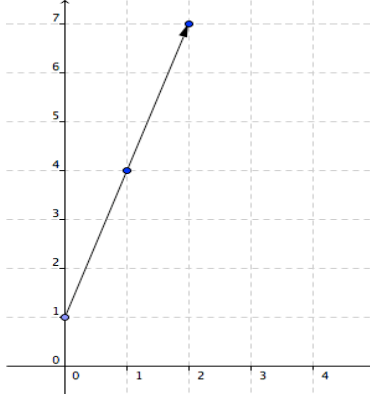
A. Complete the table of values.

x	y
0	1
1	2
2	3
3	4

B. Write an equation to represent the table of values?  
Y is one more than x. Therefore  $y = x + 1$

C. How can the equation be used to determine where the line crosses the y-axis(y-intercept)?  
The 1 from  $y = x + 1$  is where it the graph crosses the y-axis.

155.



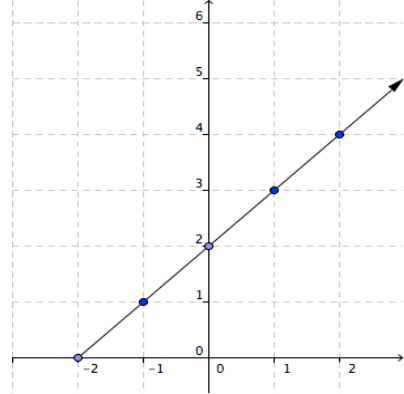
A. Complete the table of values.

x	y
0	
1	
2	
3	

B. Write an equation to represent the table of values?

C. How can the equation be used to determine the y-intercept?

156.



A. Complete the table of values.

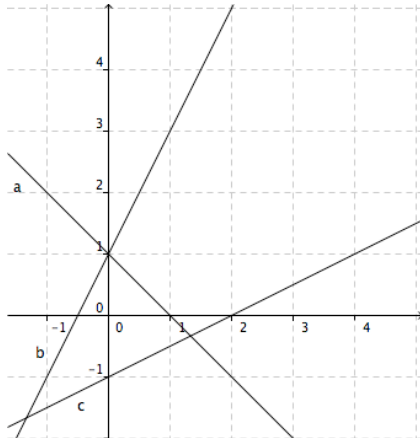
x	y
0	
1	
2	
3	

B. Write an equation to represent the table of values?

C. How can the equation be used to determine the rate of change?

Match the letter from each linear relation to the appropriate equation.

157.

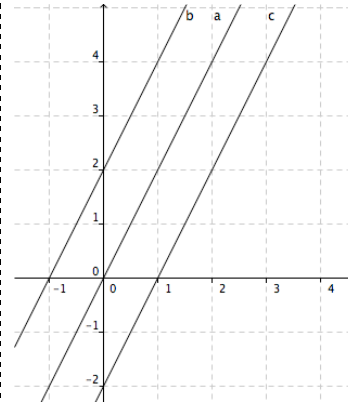


i.  $y = \frac{1}{2}x - 1$

ii.  $y = 2x + 1$

iii.  $y = -x + 1$

158.



i.  $y = 2x$

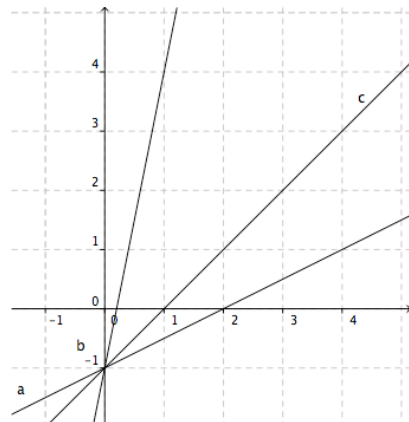
ii.  $y = 2x + 2$

iii.  $y = 2x - 2$



Match the letter from each linear relation to the appropriate equation.

159.

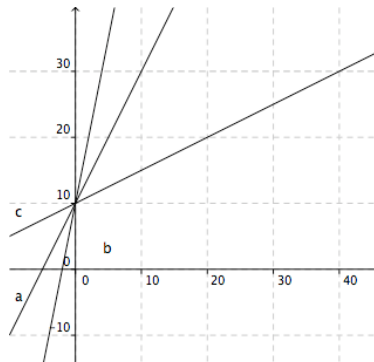


i.  $y = \frac{1}{2}x - 1$

ii.  $y = 5x - 1$

iii.  $y = x - 1$

160.



i.  $y = \frac{1}{2}x + 10$

ii.  $y = 5x + 10$

iii.  $y = 2x + 10$

What is the rate of change for each linear relation?

161.  $Y = 7x + 10$

162.  $Y = 20 - 2x$

163.  $Y = 17.6 + x$

164.  $Y = -x + 19$

165.  $Y = mx + b$

What is the value where the line crosses the y-axis for each linear relation?

166.  $Y = 2x + 9$

167.  $Y = 18 - 5x$

168.  $Y = 1.6 + x$

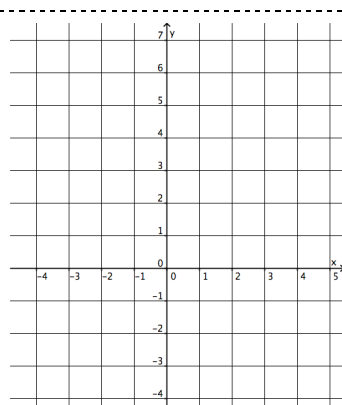
169.  $Y = -x + 11$

170.  $Y = mx + b$

Sketch the following equations. Use the table of values as needed.

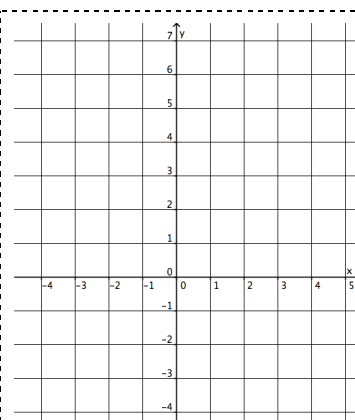
171. Graph  $y = 3x + 1$

x	y
2	
1	
0	
-1	
-2	



172. Graph  $y = 3x - 1$

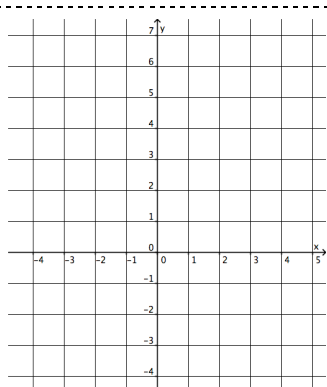
x	y
2	
1	
0	
-1	
-2	



Sketch the following equations. Use the table of values as needed.

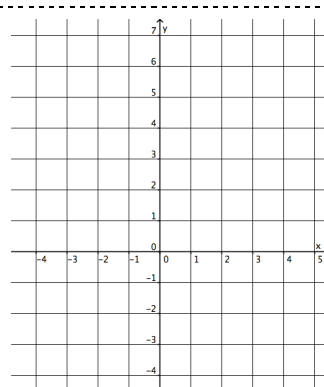
173. Graph  $y = 3x - 3$

x	y
2	
1	
0	
-1	
-2	



174. Graph  $y = 3x$

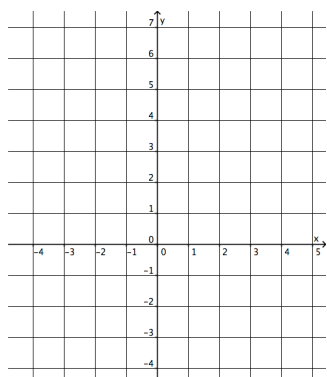
x	y
2	
1	
0	
-1	
-2	



Sketch the following equations. Use the table of values as needed.

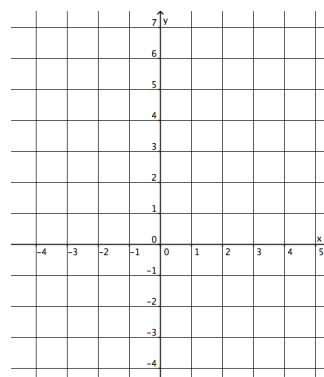
175. Graph  $y = \frac{1}{2}x + 3$

x	y
2	
0	
-2	



176. Graph  $y = -\frac{1}{2}x + 3$

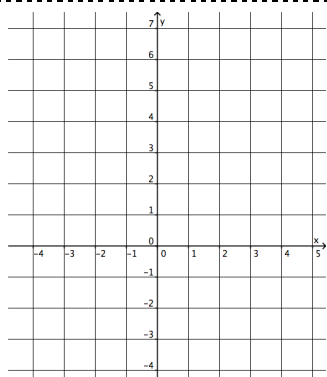
x	y
2	
0	
-2	



Sketch the following equations. Use the table of values as needed.

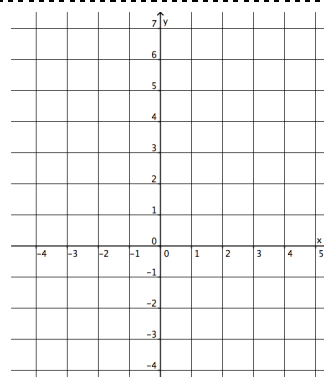
177. Graph  $y = \frac{3}{2}x$

x	y
2	
0	
-2	



178. Graph  $y = \frac{3}{2}x + 2$

x	y
2	
0	
-2	

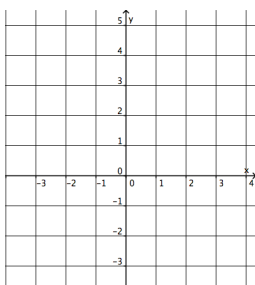


179. Explain how to graph a linear equation without make a table of values.

Sketch the following equations. Use the table of values as needed.

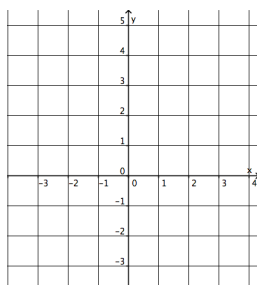
180. Graph  $y = 0x + 4$

x	y
-2	
-1	
0	
1	
2	



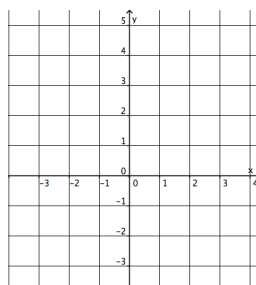
181. Graph  $y = -2$

x	y
-2	
-1	
0	
1	
2	



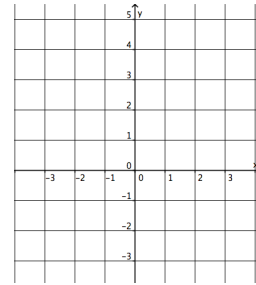
182. Graph  $x = 0y + 2$

x	y
	-2
	-1
	0
	1
	2



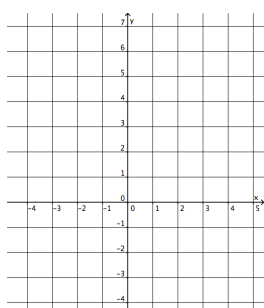
183. Graph  $x = -3$

x	y
	-2
	-1
	0
	1
	2

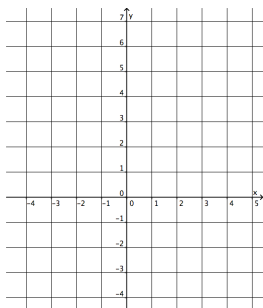


Sketch the following graph. Create a table of values as needed.

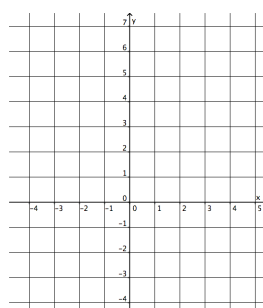
184. Graph  $y = 3$



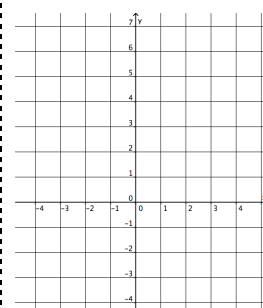
185. Graph  $x = -2$



186. Graph  $y = -4$

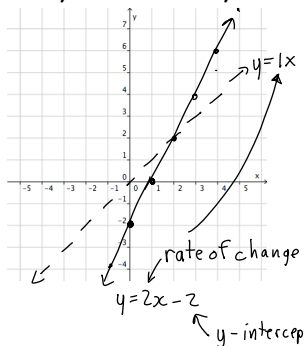


187. Graph  $y = 7$

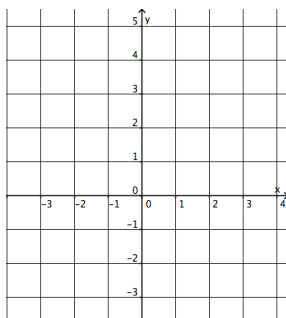


Graph each of the following state the point of intersection. Use a table of values as needed.

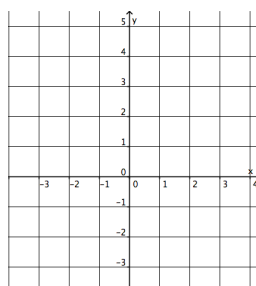
188.  $y = 2x - 2$  &  $y = x$



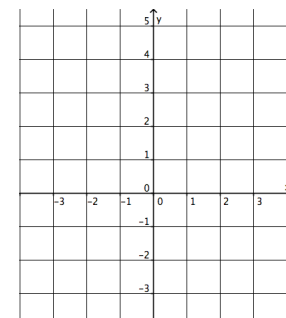
189.  $y = 3x + 1$  &  $y = 4$



190.  $y = \frac{1}{2}x + 2$  &  $x = -2$



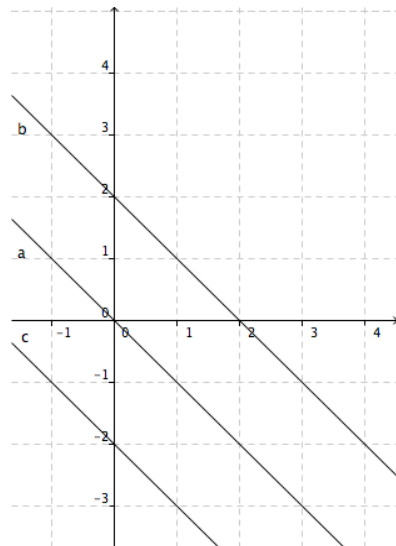
191.  $y = 4$  &  $x = -3$



"Rate of Change" and "the Slope of a line" mean the same thing.

Match the letter from each linear relation to the appropriate equation.

192.



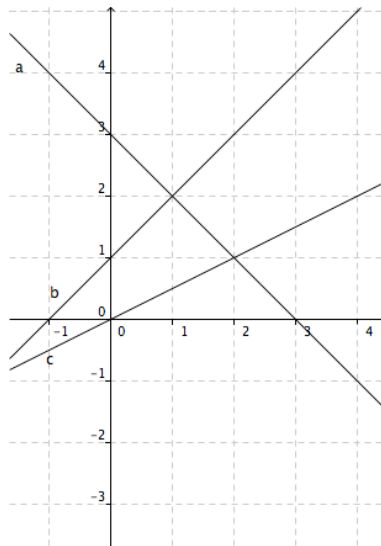
i.  $y = -x + 2$

ii.  $y = -x$

iii.  $y = -x - 2$

iv. Why do the lines slope down to the right?

193.



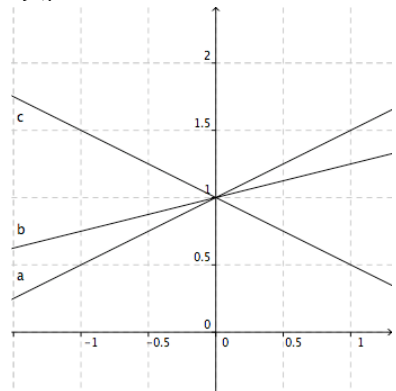
i.  $y = \frac{1}{2}x$

ii.  $y = -x + 3$

iii.  $y = x + 1$

iv. What is the y-intercept in equation ii?

194.



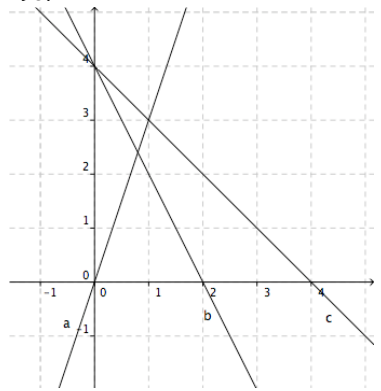
i.  $y = \frac{1}{2}x + 1$

ii.  $y = -\frac{1}{2}x + 1$

iii.  $y = \frac{1}{4}x + 1$

iv. Which slope is the more steep  $\frac{1}{2}$  or  $\frac{1}{4}$ ?

195.



i.  $y = 3x$

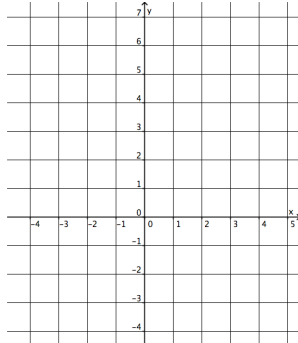
ii.  $y = -x + 4$

iii.  $y = -2x + 4$

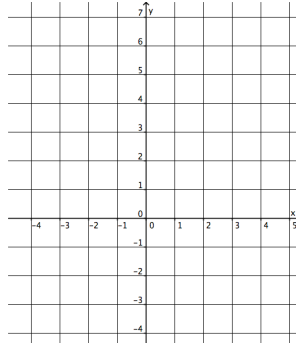
v. Which slope is the more steep 3 or -2?

Graph each linear relation on the same graph and state the intersection point.

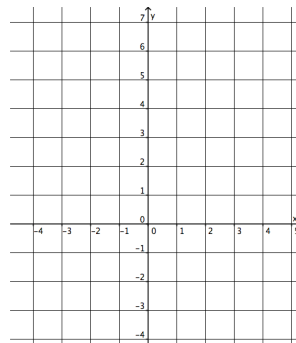
196.  $y = 2x + 3$  &  
 $y = -x$



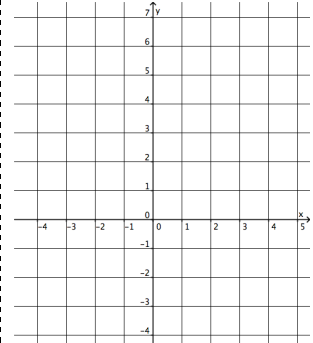
197.  $y = x + 1$  &  $y = -3$



198.  $y = \frac{1}{2}x$  &  $x = -4$



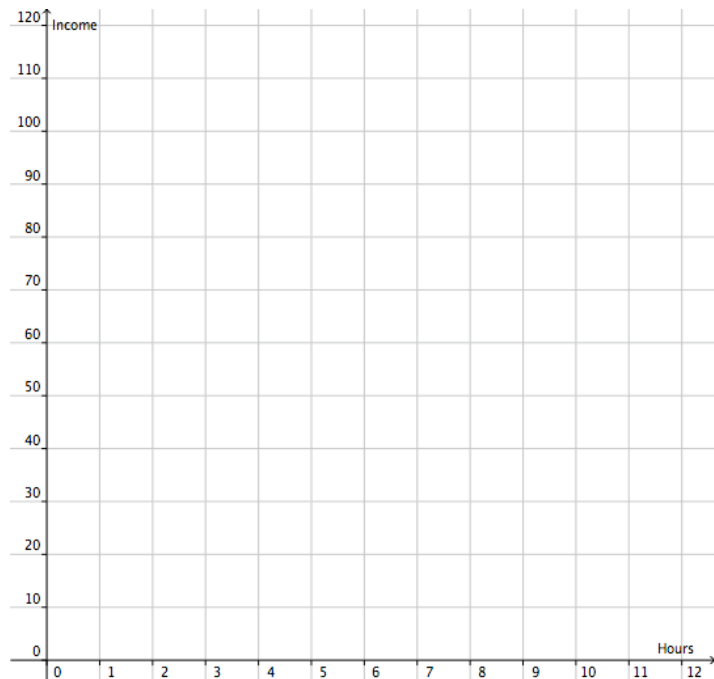
199.  $y = x$  &  $x = 2$



**Challenge #9:** Write an equation, graph a linear relation and solve a problem.

200. Daniel works at a restaurant and currently makes \$10/h. The general manager has just asked him if he would like to take a salary job for \$110 per day.

- Write an equation to represent income in terms of hourly pay.
- Write an equation to represent income in terms of salary.
- Graph a linear relation that compares the two income options.
- He decides against the salary position. Was this wise? Explain.



# Graph linear relations to solve problems.

201. Daniel works at a restaurant and currently makes \$10/h. The general manager has just asked him if he would like to take a salary job for \$110 per day.

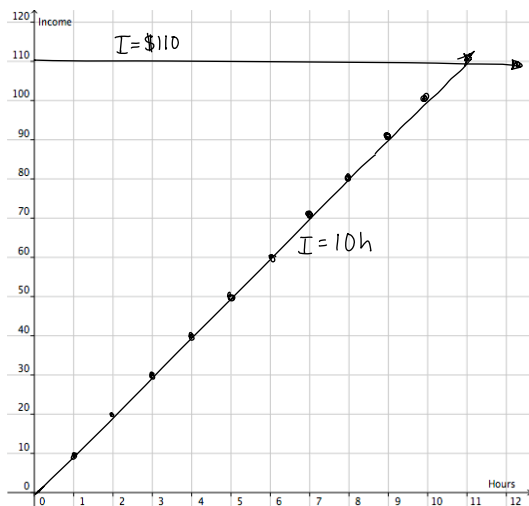
A. Write an equation to represent income in terms of hourly pay.

1hour=10(1), 2 hours=10(2), Equation:  $I=10h$

B. Write an equation to represent income in terms of salary.

Income = \$110 regardless of hours worked.  $I=110$

C. Graph a linear relation that compares the two income options.



D. He decides against the salary position. Was this wise? Explain.

The salary pay is a better paying until 11 hours. I would recommend taking the salary job since the pay is probably better, plus there may be other benefits as well.

202. Carrie is training for an ultra marathon. The table below represents her distance as a function of time.

Time, t (h)	Distance, d (km)
1	11
2	22
3	33
4	44

A. Graph a linear relation that relates distance to time.



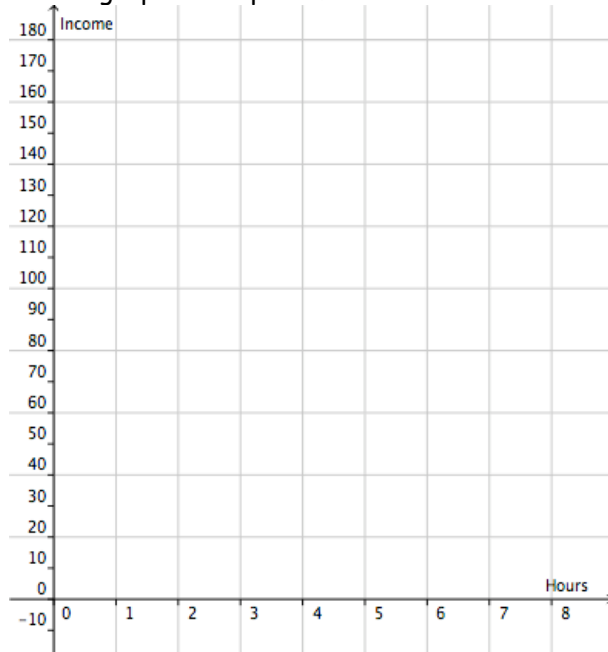
B. How far will she run in 5.5 hours?

C. Approximately how long will it take her to run 70km?

### Graph linear relations to solve problems.

203. Konfuzd currently charges his customers a fixed rate of \$150 per job. His friend Juda thinks he will make more money if he charges a travel fee of \$30 plus \$40/hour.

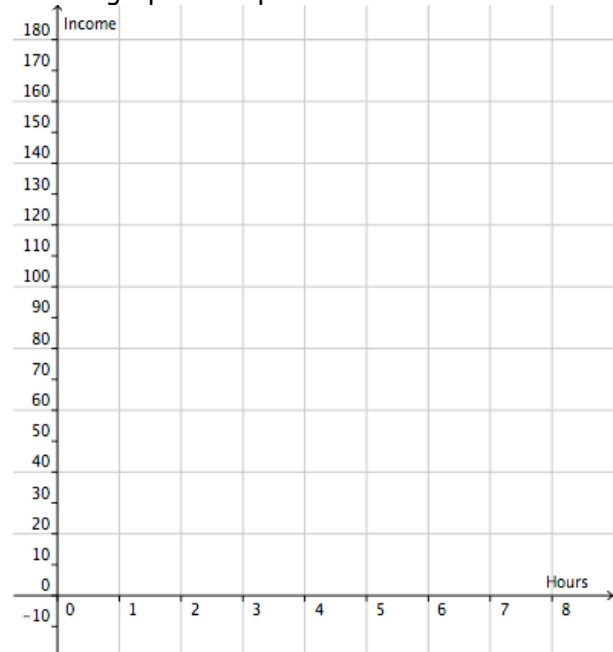
Draw a graph to help Konfuzd make his decision.



Describe the length of jobs that would make Juda's idea better idea than the fixed rate.

E. Konfuzd decided to charge a travel fee of \$30 plus \$40/hour as Juda suggested. Jen thinks he made a mistake. She thinks he should charge a travel fee of \$50 plus \$20/hour.

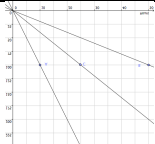
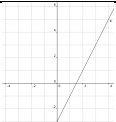
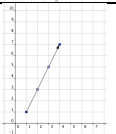
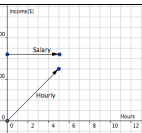
Draw a graph to help Konfuzd make his decision.



Describe the length of jobs that would make Jen's idea better idea than Juda's idea?

## Review Check List

Definitions:		Pg #	Face it ☺☹*
Go to page 2 and write down any definitions that you are unsure of.	Define each word and be able to show your understanding with examples.	2	

Learning Target	Example	Pg #	Face it ☺☹								
Write an expression representing a given pictorial, oral, or written pattern	Write a linear equation to represent this pattern. ▲▲, ▲▲▲, ▲▲▲▲, ▲▲▲▲▲, ▲▲▲▲▲▲,.....	3									
Write a linear equation to represent a given context	Jason cuts lawns as his summer job. He charges a travelling fee of \$10 plus \$20/hour for his time. Write an equation to represent this pattern.	4,10									
Describe a context for a given linear equation	Write a real world situation that could be represented by: $P = 8.75h$	13									
Solve, using a linear equation, a given problem that involves pictorial, oral, and written linear patterns.	Jeff installs windows and charges a fixed cost of \$60 plus \$20 for every window he installs. If he charges his customer \$580, how many windows did he install?	9									
Write a linear equation representing the pattern in a given table of values and verify the equation by substituting values from the table	Write an equation to represent the table of values. <table><tr><th>x</th><th>y</th></tr><tr><td>1</td><td>6</td></tr><tr><td>2</td><td>7</td></tr><tr><td>3</td><td>8</td></tr></table>	x	y	1	6	2	7	3	8	8	
x	y										
1	6										
2	7										
3	8										
Describe the pattern found in a given graph.	 E. How much does each person or company charge for 20 hours of work?	15									
Graph a given linear relation, including horizontal and vertical lines	Graph $y = 3x + 1$ & $y = 4$	24									
Match given equations of linear relations with their corresponding graphs	Match the equation to the given graphs. See page 26.	25									
Extend a given graph (extrapolate) to determine the value of an unknown element	Find y if x=1. Find x if y=4. 	14									
Interpolate the approximate value of one variable on a given graph given the value of the other variable	Find y if x=6. Find x if y=-1. 	14									
Extrapolate the approximate value of one variable from a given graph given the value of the other variable	 At what point in time is the salary job not a good financial idea.	18									
Solve a given problem by graphing a linear relation and analyzing the graph	Konfuzd currently charges his customers a fixed rate of \$150 per job. His friend Juda thinks he will make more money if he charges a travel fee of \$30 plus \$40/hour. Draw a graph to help Konfuzd make his decision.	26,27									

\*Face it. When you have mastered the content draw a ☺ OR if you are unsure, draw a ☹ and ask for help.



Score: \_\_\_\_\_ 34

### Practice Test

- Write this test and do not look at the answers until you have completed the entire test.
- Mark the test and decide whether or not you are happy with the result. FACE IT!
- Successful students will go back in the guidebook and review any questions they got wrong on this test.

Complete the table.

Figure #1	Figure #2	Figure #3	Figure #4	1. How many ☺ would there be in the 60 <sup>th</sup> figure?
☺ ☺☺ ☺	☺ ☺☺ ☺☺☺ ☺	☺ ☺☺ ☺☺☺ ☺☺☺ ☺	☺ ☺☺ ☺☺☺ ☺☺☺ ☺☺☺ ☺	
2. Explain how to find the number of ☺s in <b>any</b> box.				

Represent a written pattern in a table of values, a graph and an equation.

<p>Study the Pattern</p> <p>Jason cuts lawns as his summer job. He charges a travelling fee of \$20 plus \$10/hour for his time.</p>	<p>3. Fill out the table of values.</p> <p>Let <math>x</math>= Hours &amp; <math>y</math>= Income</p> <table><tr><th><math>x</math></th><th><math>y</math></th></tr><tr><td>1</td><td></td></tr><tr><td>2</td><td></td></tr><tr><td>3</td><td></td></tr><tr><td>4</td><td></td></tr><tr><td>5</td><td></td></tr><tr><td>6</td><td></td></tr></table>	$x$	$y$	1		2		3		4		5		6		<p>4. Plot as many points as will fit.</p> <p>The graph shows a coordinate plane with the y-axis labeled 'Income' ranging from 0 to 110 in increments of 10, and the x-axis labeled 'Hours' ranging from 0 to 8 in increments of 1. A grid is present for plotting points.</p>	<p>Answer the questions</p> <p>5. Rate of change: How are the <math>y</math> values changing?</p> <p>6. Write an equation to represent this pattern.</p> <p><math>y</math>= _____</p>
$x$	$y$																
1																	
2																	
3																	
4																	
5																	
6																	

7. Complete the following table of values for following linear relations.

X	y
-2	6
-1	
0	0
1	
2	

8. Which expression(s) represent(s) each the given table of values

x	y
1	3
2	4
3	5
4	6

A.  $y = x + 3$   
B.  $y = 2x + 1$   
C.  $y = x + 2$

9. When  $x=2$ ,  $y=8$ . Which of the following equations might represent the pattern?

A.  $y = 4x$   
B.  $y = 3x + 1$   
C.  $y = 5x - 2$

Answer the following questions.

Determine the pattern, state the rate of change, write an equation and evaluate.

X	y
1	5
2	8
3	11
4	14

10. Rate of change:

11. Equation:  $y =$  \_\_\_\_\_

12. If  $x=500$ , determine  $y$ .

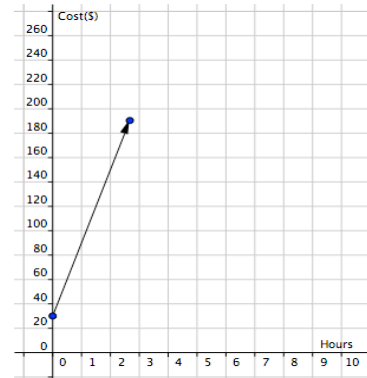
Jeff installs windows and charges a fixed cost of \$50 plus \$30 for every window he installs.

13. Write an equation that relates his income to the number of windows he installs.

14. If he installs 9 windows, how much will a customer be charged?

15. If he charges his customer \$590, how many windows did he install?

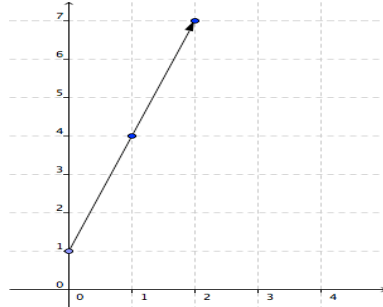
The graph represents how much it costs to hire Jordy the handy man.



16. Interpolate: Estimate how much it will cost to hire Jordy for 1 hour.

17. Extrapolate: Estimate how much it will cost to hire Jordy for 3 hours?

Use the graph to fill out the table of values.



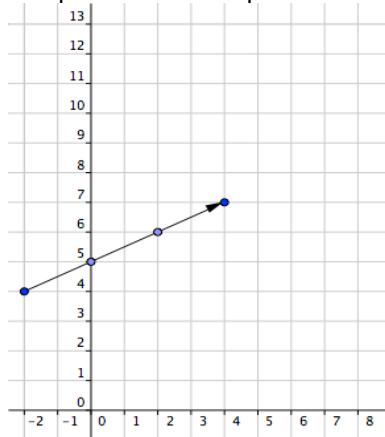
18. Complete the table of values.

x	y
0	
1	
2	
3	

19. Write an equation to represent the table of values?

20. How can the equation be used to determine the y-intercept?

Interpolation or extrapolation?



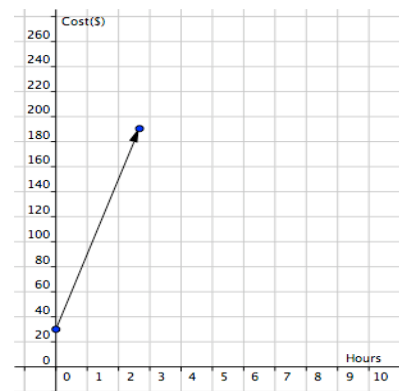
Answer each question and state whether you are interpolating or extrapolating.

21. Estimate  $y$  if  $x=1$

22. Predict  $y$  if  $x=8$ .

23. Predict  $x$  if  $y=3$ .

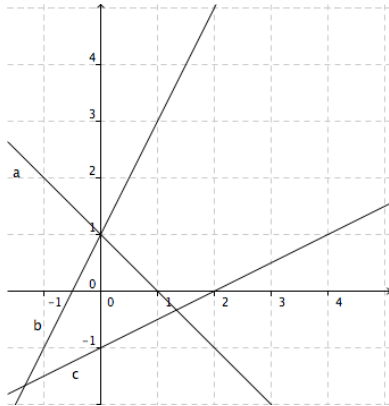
The graph represents how much it costs to hire Jordy the handy man.



24. Interpolate: Estimate how much it will cost to hire Jordy for 1.5 hours.

25. Extrapolate: Estimate how much it will cost to hire Jordy for 4 hours?

26. Match the letter from each linear relation to the appropriate equation.



- i.  $y = \frac{1}{2}x - 1$   
 ii.  $y = 2x + 1$   
 iii.  $y = -x + 1$

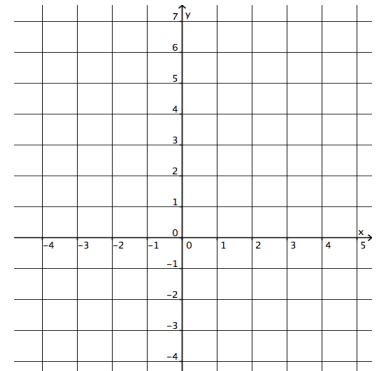
27. Fill out the table of values and determine the rate of change.

$$y = 4x + 6$$

x	y
0	
1	
2	
3	

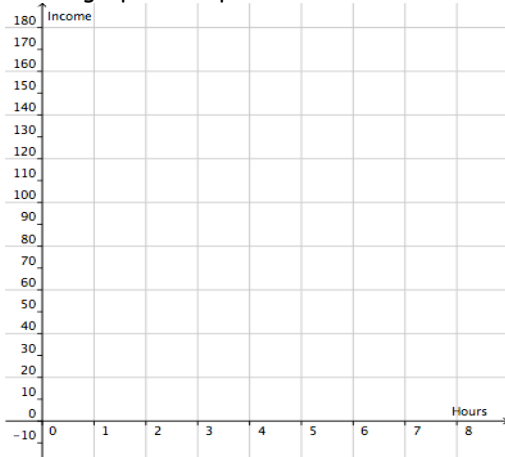
28. Graph  $y = 3x - 1$

x	y
2	
1	
0	
-1	
-2	



Volan currently charges his customers a fixed rate of \$140 per job. His friend Juda thinks he will make more money if he charges a travel fee of \$20 plus \$40/hour.

29. Draw a graph to help Volan make his decision.

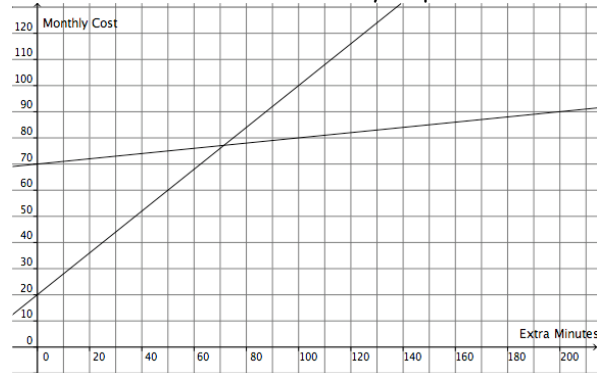


30. Describe the length of jobs that would make Juda's idea better idea than the fixed rate.

Tok Alut, is trying to decide between two phone plans. His options include:

- Chatzilla Economy Plan: \$20/ month and \$0.80 for every minute above 300 minutes.
- Chatzilla Premium Plan: \$70/ month and \$0.10 for every minute above 300 minutes.\*

Label each linear relation economy or premium.



31. If he thinks he will use 110 extra minutes per month, which phone plan should he choose and approximately how much will he save?

32. Tok has budgeted \$90 per month for his phone. Which option should he choose and why?

## Answers to Linear Relations

Legend: AOP=Answered On Page

1. 9, 52, box#+2
2. 21, 150, 3(box #)
3. 16, 102, 2(box#)+2
4. See page 4 or the web.
5. See page 4 or the web.
6. 2 up each time
7.  $y=2x$
8. 200
9. AOP
10. AOP
11. AOP
12. AOP
13. AOP
- 14.
- 15.
16. +1 each time
17.  $y=x+1$
18. 1001
19. See page 5.
20. See page 5.
21. +20 each time
22.  $y=20x+10$
23. Substitute x,y from the table of values into the equation and see if they work out.
24. AOP
25. AOP
26. AOP
27. AOP
28. AOP
- 29.
30. Add 10 each time
31.  $Y=10x$
32. Test a point in the equation. For example,  $(6,60) \rightarrow 60=10(6)$  correct.
33. A. 80,96,112,128 B. \$32 more,  $I=16h$  or  $y=16x$ . Variables may vary.
34. +1
35. +4
36. -2
37. AOP
38. 150, 157, 164, 171, A.  $y=7x+10$ . B. \$2565
39. 80,90,100,110, A.  $y=0.1x+70$ , B. 340 additional minutes will cost \$104.
40. 16
41. 8
42. -2
43. 1
44. 5 times x plus 100
45. 3 times x plus 6
46. -2 times x +17
47. +1,  $y=x+5$ , 47
48. AOP
49. 2,  $y=2x+2$ , 1002
50. -1,  $y=-x+6$ , -265
51. 5,  $y=5x+1$ , 211
52. 4,  $y=4x+3$ , 171
53. C.  $y = x + 2$
54. A.  $y=5x$
55. B.  $y=x-3$
56. A,C
57. B,C
58. None
59. 13,22
60. -5,-15
61. 14,16
62. 3,-3,-6
63. -31,-21,-11
64. 6,4,0
65.  $y=20x+60$ , \$240, 26 windows
66. AOP
67.  $Y=1.5x+325$ , \$4825, 740 brochures
68.  $Y=15x+80$ , \$320, 24 cable boxes
69. 36, 45,  $Y=9x$
70. 44, 53,  $Y=9x+8$
71. 31, 39,  $Y=8x-1$
72. Y is vertical , x is horizontal
73. Y is positive above the x-axis and negative below. X values are positive to the right of the y axis and negative to the left.
74. (-2,1) & (3,2)
75. (0,3), & (2,0)
76. (2,-3)
77. (-4,2), (-1,-1),(1,-2)
78. (-1,0) & (0,2)
79. Check with a friend. It is a surprise ☺
80. Yes, +1
81. Yes, +2
82. No, not a straight line. No additive rate of change.
83. No, not a straight line. No additive rate of change.
84. No, not a straight line. No additive rate of change.
85. +2
86. -2
87. No. The rate of change changes.
88. No. The rate of change changes.
89. No. The rate of change changes.
90. Yes. Careful. Notice the x values are not in sequential order. The equation is  $y=2x$ .
91. 4
92. 1
93. -5

94. 2  
 95. -5  
 96. 10  
 97. The rate of change is the number before the  $x$  in  $y=mx+b$ . The rate of change would be  $m$ .  
 98. 7  
 99. 1  
 100. -5  
 101. -1  
 102. 9  
 103. Answers will vary. Paul gets paid \$8.75 working at a video store.  
 104. Cole installs hot water tanks. He charges \$75 for a service call and \$60/h once he is there.  
 105. -1, 3.5  
 106. 4.5, -1.5  
 107. 4, Between 0.25 & 0.5  
 108. 11, 0  
 109. 9, -4  
 110. 4.5, 8.5  
 111. A is the most expensive., Approximately \$110.,  $A=20h$ ,  $B=9h$ ,  $C=5h$   
 112. This was an example of interpolation. All values were estimated based on known values that enclosed the estimated value.  
 113. AOP  
 114. A)  $A=\$200$ ,  $B=\$40$ ,  $C=\$80$ , B) About 40 more hours, C) It is possible that they work in different countries where pay and the cost of living are different.  
 115. About \$8/h, About \$2/h, about

\$4/h,  $6\frac{1}{4}h$ , 25h, 12.5h.

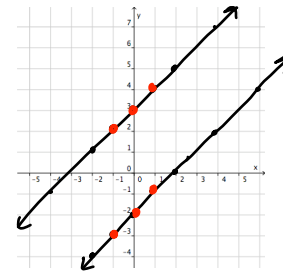
Answers will vary. Class discussion.

116.  $Y=0.8x+20$ ,  $y=0.1x+70$ , Economy is about \$22 cheaper, Premium is about \$25 cheaper, The Premium plan gets more minutes for \$90.  
 117.  $Y=0.75x+30$ ,  $y=0.2x+60$ , Premium is \$25 cheaper, Premium is \$80 cheaper, Premium gets about 33 more minutes.  
 118. AOP  
 119. \$150, about \$270  
 120. AOP  
 121. About \$60, about \$130  
 122. About 12 h  
 123. \$240, \$240, A salary job.  
 124. The salary job looks like about twice the hourly pay job., After about 9 hours.  
 125. It is not a wise financial decision. She gets paid about \$140 less at the salary job.  
 126. B  
 127. A  
 128. E  
 129. F  
 130. D  
 131. C  
 132. BC  
 133. Alberta  
 134. Quebec  
 135. PEI  
 136. Just under 4 years.  
 137. Answers will vary. The extrapolation is not that valid. There is no guarantee at all that

what happened in 2009 will continue in 2010.

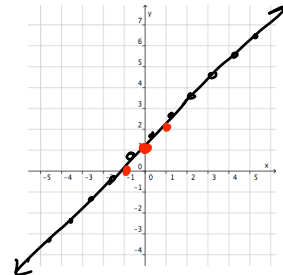
138. +1, +1

139.

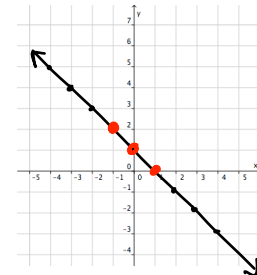


-2 & +3

140.



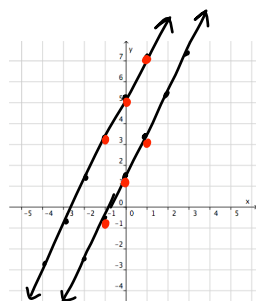
141.



142. The constant in  $y=x-2$  is the y-intercept.

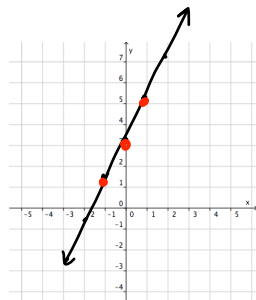
143. +2, +2

144.

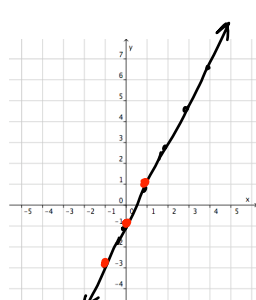


+5, +1

145.



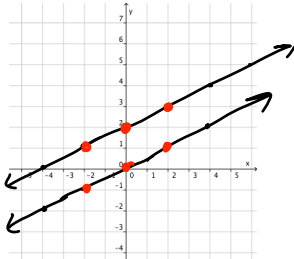
146.



147. It is the coefficient

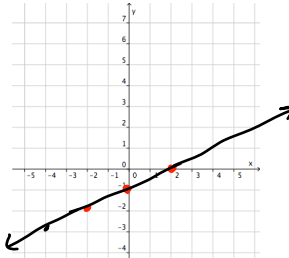
148.  $\frac{1}{2}$ ,  $\frac{1}{2}$

149.

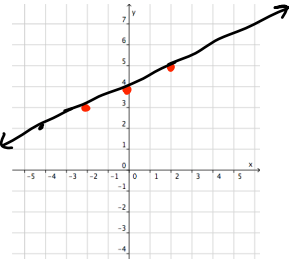


0, 2

150.



151.



152. The constant term is the y-intercept in  $y=0.5x+1$

153. Y value=1,2,3,4.,  $y=x+1$ , The constant is the y-intercept., the number in front of the x is the rate of change.

154. AOP

155. y value=1,4,7,10.,  $y=3x+1$ , The 1 is the y-intercept.

156. Y value=2,3,4,5.,  $y=1x+2$ , the 1 in front of the x is the rate of change.

157. C,B,A

158. A,B,C

159. A,B,C

160. C,B,A

161. 7

162. -2

163. 1

164. -1

165. m

166. 9

167. 18

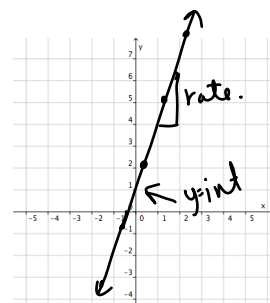
168. 1.6

169. 11

170. b

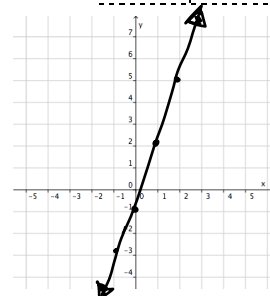
171.  $y = 3x + 1$

x	y
2	7
1	4
0	1
-1	-2
-2	-5



172.  $y = 3x - 1$

x	y
2	5
1	2
0	-1
-1	-4
-2	-7



173. The rate is 3 and the y-intercept is -3. See web for detailed graph.

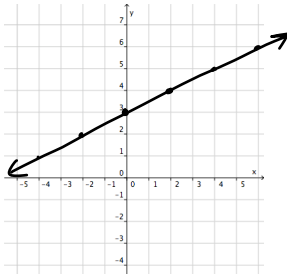
174.

The rate of change is 3 and the y-intercept is 0. See web for detailed graphs.

Sketch the following equations. Use the table of values as needed.

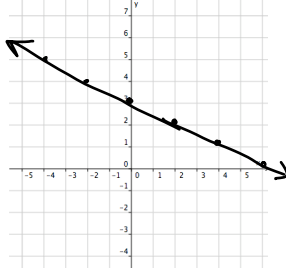
175. Graph  $y = \frac{1}{2}x + 3$

x	y
2	4
0	3
-2	2



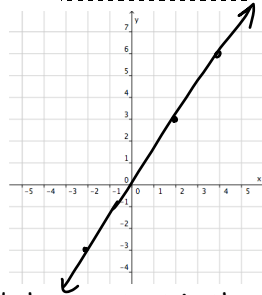
176. Graph  $y = -\frac{1}{2}x + 3$

x	y
2	2
0	3
-2	4



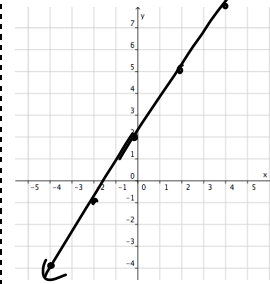
177. Graph  $y = \frac{3}{2}x$

x	y
2	3
0	0
-2	-3



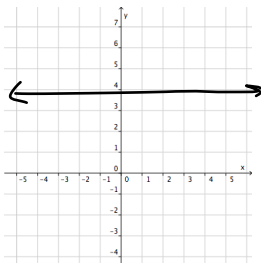
178. Graph  $y = \frac{3}{2}x + 2$

x	y
2	5
0	2
-2	-1

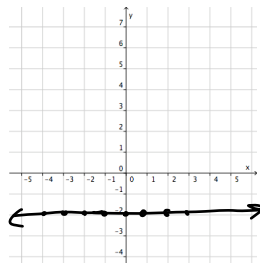


179. The number before x is the rate of change and the constant is the y-intercept.

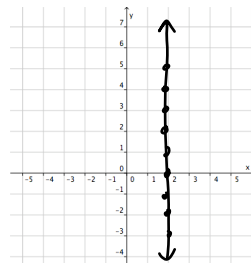
180. Graph  $y = 0x + 4$



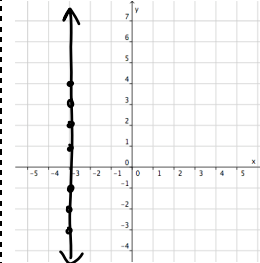
181. Graph  $y = -2$



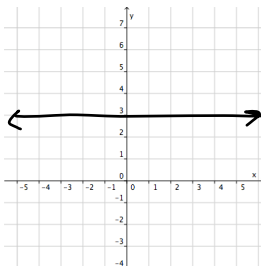
182. Graph  $x = 0y + 2$



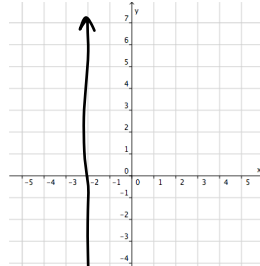
183. Graph  $x = -3$



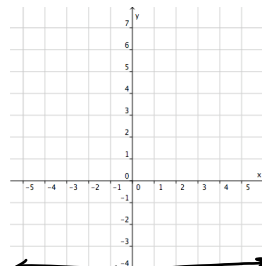
184. Graph  $y = 3$



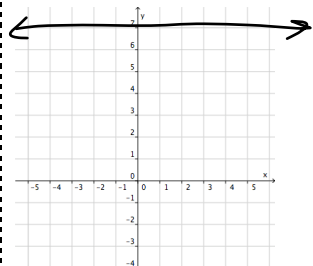
185. Graph  $x = -2$



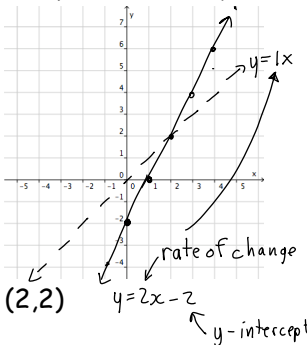
186. Graph  $y = -4$



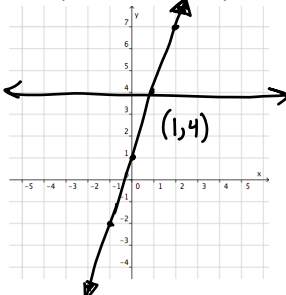
187. Graph  $y = 7$



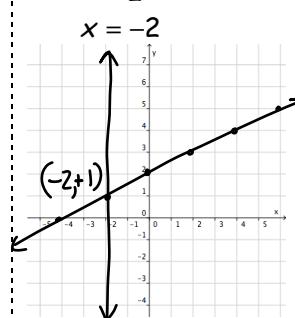
188.  $y = 2x - 2$  &  $y = x$



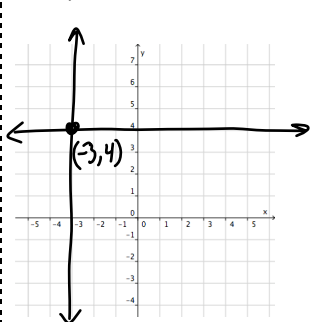
189.  $y = 3x + 1$  &  $y = 4$



190.  $y = \frac{1}{2}x + 2$  &  $x = -2$

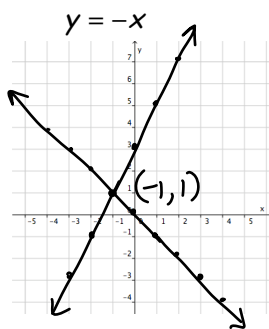


191.  $y = 4$  &  $x = -3$



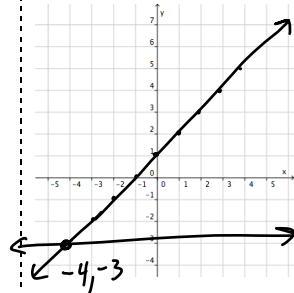
192. B, A, C, all have a negative slope (-1)

196.  $y = 2x + 3$  &



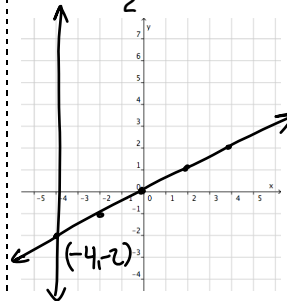
193. C, A, B, 3

197.  $y = x + 1$  &  $y = -3$



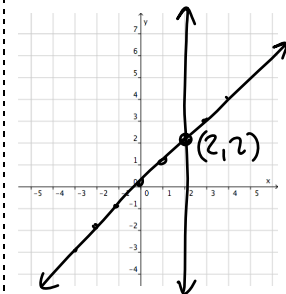
194. A, C, B,  $1/2$

198.  $y = \frac{1}{2}x$  &  $x = -4$



195. A, B, C, 3

199.  $y = x$  &  $x = 2$

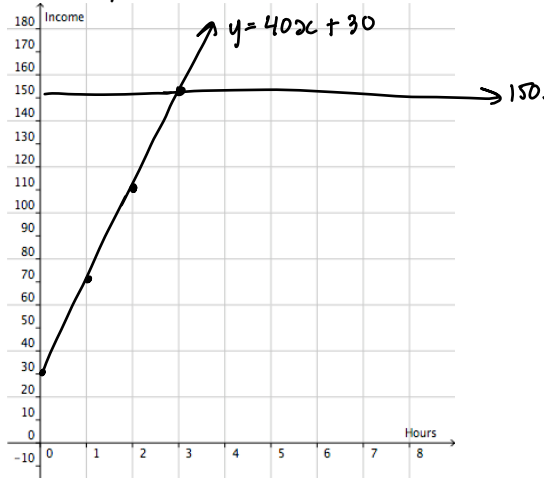


200. See number 201.

201. AOP

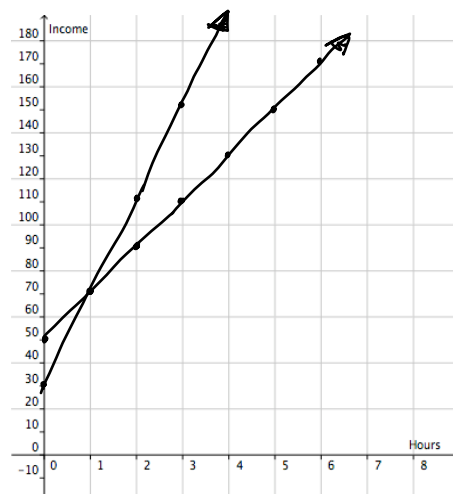
202. See website, About 60km, about 6.4 hours.

203.  $y = \$150$  vs  $y = 40h + 30$



Juda's idea is best for jobs that last longer than 3 hours.

204.  $y = 20x + 50$  vs  $y = 40x + 30$



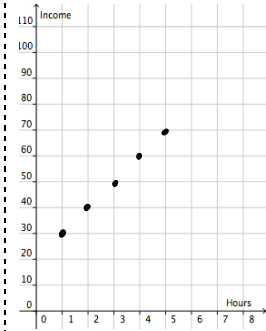
Jenna's idea is better than Konfuzd after 5 hours and better than Juda's for jobs less than 1 hour.



Practice test.

1. 181
2. 3 times the box number plus 1.
3. (1,30), (2,40), (3,50), (4,60), (5,70), (6,80)

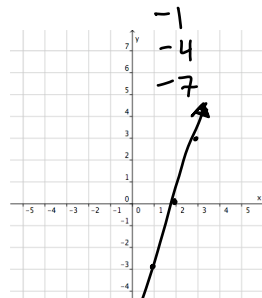
4. Plot as many points as will fit.



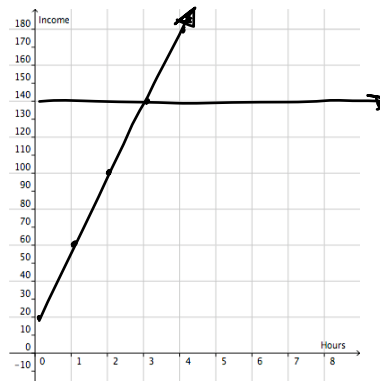
5. +10
6.  $y=10x+20$
7. y values  $\rightarrow 6, 3, 0, -3, -6$
8. C
9. A, C
10. 3
11.  $y=3x+2$
12. 1502
13.  $y=30x+50$
14. \$320
15. 18 windows
16. About \$90.
17. About \$210.
18. Y-values  $\rightarrow 1, 4, 7, 10$
19.  $Y=3x+1$
20. The constant is the y-intercept
21. 5.5 Interpolation
22. 9 Extrapolation.
23. About -4, extrapolation
24. About \$120.
25. About \$270.
26. C, B, A
27. 6, 10, 14, 18+4

28. Graph  $y = 3x - 1$

x	y
2	
1	
0	
-1	5
-2	2



29.  $Y = \$140$  vs.  $Y = 40X + 20$



30. Jobs that take more than 3 hours.
31. The premium is about \$27 cheaper.
32. The premium plan gets about 110 more minutes.