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**CHAPTER 3:** Linear Relations

DAY	SECTION / TOPIC	SEATWORK / HOMEWORK
1	3.1 – Slope as a Rate of Change	Page 106 – 109 #1 – 10, 12, *11
2	3.2 – Investigate Slope and y-	Page 115 – 117 #1, 2, 4, 6, 7
	intercept	
3	4.4 - Convert Linear Equations from	Page 187 – 189 #1, 2acef, 3acef,
	Standard Form	4aceg, 6 – 11
4	3.3 – Properties of Slopes of Lines	Page 124 – 127 #1 – 9 (#12 if
		graphing calculator is available)
5, 6	3.4 – Determine the Equation of a	Page 133 – 136
	Line	(Day 4) #1 – 3, 5
		(Day 5) #6, 7abde, 8, 9
7, 8	3.5 – Graph Linear Relations by Hand	Page 143 – 144
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9 _	Chapter 3 Review	Page 146 – 147 #1 – 13
10	CHAPTER 3 TEST	Page 152 – 153 #1 – 6

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### 3.1 – SLOPE AS A RATE OF CHANGE

#### **KEY CONCEPTS**

When the change in one variable relative to another variable is <u>constant</u>, the result is a **linear relation**.

In a linear relation, the rate of change and the slope are the same.

**EXAMPLE 1** Calculate the Slope of a Given Line

The graph shows the number of squares used in each part of this pattern. The points are joined to show the trend.

Diagram 1 2 3 4 5

	<i>y</i>		
S	8	N	
are	7		
du	6	/ Y	
f S	6		
Number of Squares	5	1	
þe	4		
트	3	M	
ž	2 /	7.1	
	1 <b>X</b>	4 4 4	- 12
	0 1 2	3 4 5 6	x
	0 1 2	3 4 5 6 Diagram	X
		Diagraili	

	RISE	RUN	SLOPE (rise / run)
M to N			
X to Y			

What do you notice about slopes of these segments?

What information about the pattern does the slope give?



## **EXAMPLE 2** Calculate Rates of Change

For the linear relation y = 2x + 5, complete the table below and determine the rate of change in the *y*-values

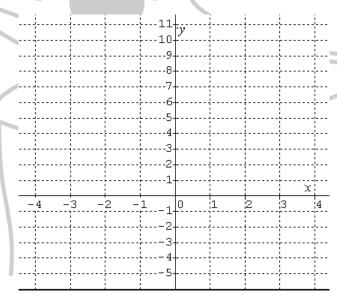
X	у	Rate of Change
0		
1		
2		
3		
4		

**EXAMPLE 3** Calculate the Slope for a Given Equation

For the line y = -3x + 2,

(a) Complete the table below and graph the line

Х	у	
-2		
-1		
0		
1		
2		



(b) Pick <u>any two (2) points</u> from the line and find the **slope**. What do you notice about this and the equation?

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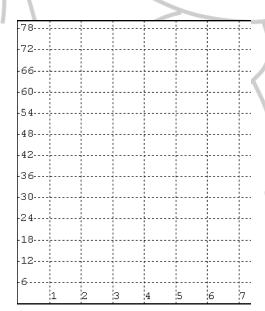
# **EXAMPLE 4** Application: Find the Rate of Change in Earnings

Abdul earns **\$12 per hour** working at a video store.

(a) Make a table of values showing Abdul's total earnings for **5 hours** of work

# of hours	Pay	Rate of Change
0	4	
1		
2		
3		
4 +	,	
5	7	7

- (b) Use the table above to determine the rate of change of Abdul's earnings
- (c) Graph Abdul's earnings. Label all axes.

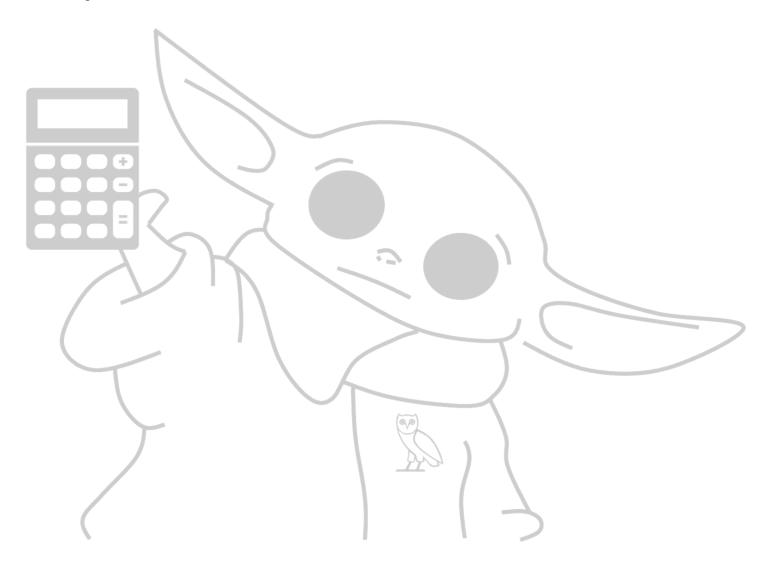




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(d) Pick <u>any two (2) points</u> and calculate the **slope**. What do you notice about this slope and your answer from (b)?

Homework: Page 106 – 109 #1 – 10, 12, \*11





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### 3.2 - INVESTIGATE SLOPE and y-INTERCEPT

#### **KEY CONCEPTS**

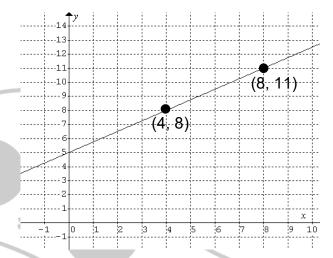
Any linear relation can be modelled by an equation of the form y = mx + b, where m represents the slope of the line and b represents the point where the line crosses the y-axis, the y-intercept.

Conversely, if *m* and *b* can be determined, a **linear equation** can be generated.

**EXAMPLE** 

Equations of Lines

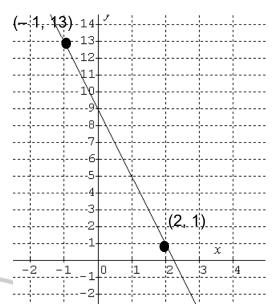
(a) Using the information on the graph on the *right*, determine the equation of the line in the form  $\mathbf{y} = \mathbf{m}\mathbf{x} + \mathbf{b}$ , where m represents the slope and b represent the y-intercept.





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(b) Using the information on the graph on the right, determine the equation of the line in the form y = mx + b, where m represents the slope and b represent the y-intercept.





Homework: Page 115 – 117 #1, 2, 4, 6, 7



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### 4.4 - CONVERT LINEAR EQUATIONS FROM STANDARD FORM

#### **KEY CONCEPTS**

A linear equation can be represented in different ways.

An equation in standard form is written in the form Ax + By + C = 0

**A** is a whole number

**B** and **C** are *integers* 

A and B cannot both equal zero

An equation in *standard form* can be re-written into **slope** y-intercept form, y = mx + b, by re-arranging the equation to **isolate** y.

#### INVESTIGATE

Finding the Initial Value and Rate of Change

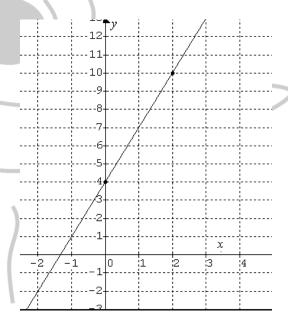
The equation 6x - 2y + 8 = 0 is written in **standard** form. In this equation,

y represents the total cost of a school field trip

x represents the total number of students going on the trip.

1. Use the graph.

(a) Find the **slope** of the line. What does the slope represent in this situation?



(b) What is the **y-intercept**? What does this value represent?

(c) Write the equation of the line in the form y = mx + b.



2.

(a) Rearrange the equation 6x - 2y + 8 = 0 to isolate y.

(b) How does the result compare to your answer to #1(c)?

#### **EXAMPLE 1**

Re-Write a Linear Equation in Slope y-Intercept Form

Re-arrange the following equations into slope y-intercept form, y = mx + b and identify the slope and y-intercept.

(a) 
$$-4x + y + 7 = 0$$

(b) 
$$5x - y - 9 = 0$$

m = \_\_\_\_

m =



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# **EXAMPLE 2** Re-arrange a Linear Equation Involving Fractions

Re-arrange the following equations into slope y-intercept form, y = mx + b and identify the slope and y-intercept.

(a) 
$$2x + 5y - 15 = 0$$

(b) 
$$-3x - 7y + 14 = 0$$

m = \_\_\_

m =

b =

b =

**EXAMPLE 3** Find the Number of Tickets Sold

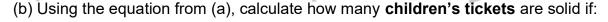
Tickets for a local theatre production are \$20 per adult and \$10 per child. The total revenue, the amount of money the theatre made, R, is

20x + 10y = R

where *x* represents the number of *adult* tickets sold *y* represents the number of *children's* tickets sold.

The theatre company wants to bring in revenue of **\$7500** for each of the two shows. The number of *adult* tickets sold for these shows is **200** and **350** respectively.

(a) Write the revenue equation in slope y-intercept form



(i) 200 adult tickets are sold?



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(ii) 350 adult tickets are sold?

(c) Why might it be advantageous to re-arrange the equation first?



**EXAMPLE 4** 

Problems Involving the Standard Form

The line 6x + 8y + C = 0 passes through the point (3, -4). Determine the value of C.

Homework:
Page 187 – 189 #1, 2acef, 3acef, 4aceg, 6 – 11



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### 3.3 - PROPERTIES OF SLOPES and LINES

#### **KEY CONCEPTS**

A line with a <u>positive</u> slope goes **up** from left to right A line with a <u>negative</u> slope goes **down** from left to right.

A horizontal line has a slope of zero.

Parallel lines have the same slope.

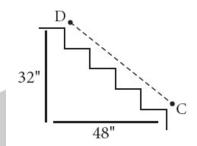
Ignoring the sign on the coefficient of x, the <u>greater</u> the coefficient of x, the **steeper** the line.

(b)

**EXAMPLE 1** Positive and Negative Slopes

Determine the slope of each object.

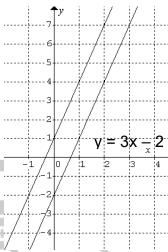
(a) 50 cm



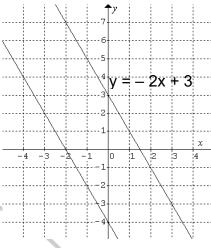


Write the equation of the line that is parallel to each line (recall that parallel lines have the **same** slope!)

(a)



(b)



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**EXAMPLE 3** Determining Which Equation is Steeper

For each pair of equations, determine which equation represents a **steeper** slope and provide an explanation

EQUATIONS	EXPLANATION
y = 2x + 7	
y = 5x - 3	
y = -3x + 2	
y = x - 1	
y = -8x + 2	
y = 8x + 3	

Homework:

Page 124 – 127 #1 – 9 (#12 if graphing calculator i available)



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### 3.4 - DETERMINE THE EQUATION OF A LINE

#### **KEY CONCEPTS**

The equation of a line can be determined from a graph by **finding the slope** and **identifying the** *y***-intercept**.

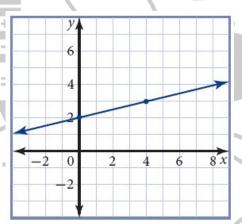
The equation of a line can be determined if you know **one point on the line** and **the slope** (rate of change).

If the slope and the coordinates of one point on the line are known, the *y*-intercept can be found either by **patterning** or by **substituting known values** into y = mx + b and then solving for b.

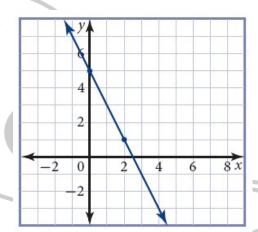
**EXAMPLE 1** 

Determine the Equation of a Line from a Given Graph

(a)



(b)





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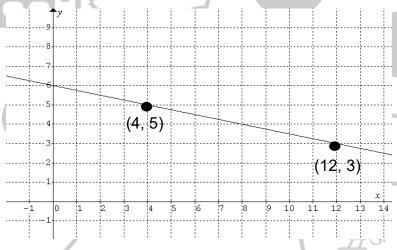
# **EXAMPLE 2** Determine the Equation of a Line Given the Slope and a Point on the Line

A line of slope of 3 passes through the point (5, 13).

Determine the equation of the line in the form y = mx + b.

# **EXAMPLE 3** Determine the Equation of a Line Given Two Points on a Line, Graph Given

Using the graph given, determine the equation of the line in the form y = mx + b.





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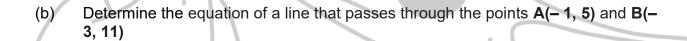
# **EXAMPLE 4** Determine the Equation of a Line Given Two Points on a Line, Graph <u>NOT</u> Given

You can find an equation for a line if you know two points on the line.

To find the equation,

- $\rightarrow$  Find the **slope** by substituting the two points into the slope formula:  $m = \frac{y_2 y_1}{x_2 x_1}$
- $\rightarrow$  Find the y-intercept by substituting the slope and one of the points into y = mx + b
- →Solve for *b*
- $\rightarrow$ Write the equation by substituting m and b into y = mx + b
- (a) Determine the equation of a line that passes through the points **A(3, 7)** and **B(5, 11)**





## **Homework:**

Page 133 – 136 (Day 4) #1 – 3, 5 (Day 5) #6, 7abde, 8, 9



### 3.5 - GRAPH LINEAR RELATIONS BY HAND

#### **KEY CONCEPTS**

A linear relation can be graphed by **plotting a series of points**, or by **plotting the** *y***-intercept** and then **applying the slope** to locate other points.

Some situations can be represented by linear relations.

If there is a  $\underline{\text{constant rate of changes}}$  between two variables, this is the  $\underline{\text{slope}}$ . The  $\underline{\textit{initial}}$  value is the  $\underline{\text{y-intercept}}$ .

#### **EXAMPLE 1**

Graph a Line using the y-Intercept and Slope

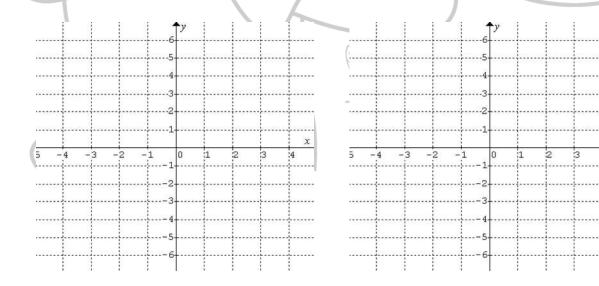
For each line, identify the **slope** and **y-intercept**. Use these to graph the line.

(a) 
$$y = 2x - 4$$

(b) 
$$y = -3x + 5$$

#### GRAPHING USING Y-INTERCEPT and SLOPE

- 1. Plot the **y-intercept**
- 2. From the y-intercept:
- (i) Perform rise
- (ii) Perform run
- (iii) Plot
- 3. Draw a line through the points



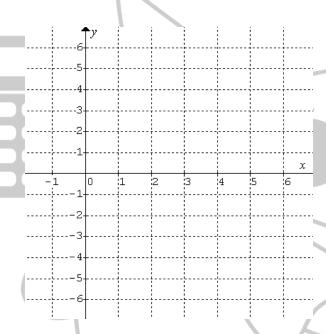


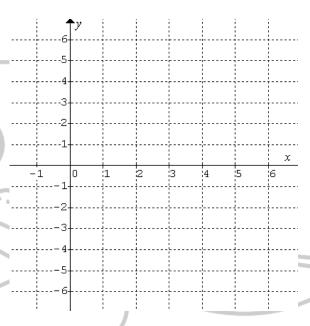
# **EXAMPLE 2** Graph a Line When the Slope is a Fraction

For each line, identify the **slope** and **y-intercept**. Use these to graph the line.

(a) 
$$y = \frac{3}{4}x - 1$$

(b) 
$$y = \frac{-1}{2}x + 4$$





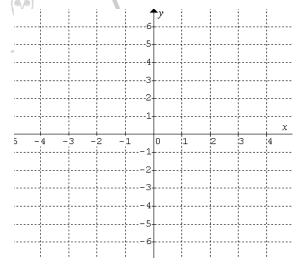
# **EXAMPLE 3** Graphing Horizontal Lines

Any equation in the for y = b (where b is the y-intercept) will <u>always</u> be a **horizontal line** 

Graph the equations below on the same grid:



(b) 
$$y = -3$$





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#### **EXAMPLE 4** Model the Cost of Pizza

Giovanni's pizza parlour charges \$8 for a pizza plus \$2 for each topping.

Graph the linear relation that models the cost.

Write an equation relating C, the cost in dollars, to t, the number of toppings.

	•		J	,			,	,			• •	0					
Method	<u>1</u> : Us	e a ta	ble of	f value	es				Method	<u>2</u> : Us	ing th	e y-in	terce	ot and	slope	9	
Comple	te the	table	giver	n for u	p to 4	topp	ings										
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#### **Homework:**

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(Day 6) #1 - 4

(Day 7) #5 – 9

