Summer Review Packet
For Algebra 2 Honors

Name: ___________________________________

Current Course: ______________________________ Math Teacher: ____________________________

Algebra 2 builds on topics studied from both Algebra 1 and Geometry. Certain topics are sufficiently involved that they call for some review during the year in Algebra 2. However, some topics and basic skills are so fundamental to any Algebra 1 course that **mastery** of these topics is expected and required **prior** to beginning Algebra 2. Please review the topics and complete all practice problems.

We will be using a Ti-84 graphing calculator in our classes.

This summer packet covers the following topics:

Part I: Linear Equations

- **A. Graphing a linear equation**
- **B. Finding the slope**
- **C. Writing a linear equation**
- **D. Writing a linear equation of parallel and perpendicular lines**

Part II: Modeling with Linear Functions

- **A. Given the rate of change and the starting value**
- **B. Given two data points**

During this summer, you are to complete this review packet by following the directions in each section. Although you will have some opportunity to get some help in class when school begins, if you need a lot of help, you should consider getting it before school begins.

We recommend you do this packet close to the onset of school. It is expected that each student will fully complete the review questions. The teacher will check the packet for completion and effort for homework credit. If you have any questions, please do not hesitate to contact your child's teacher.

DO NOT LOSE THIS PACKET!!

It will also be available from the school website via the math department.

Note about the calculators:
The school will issue each student who needs/wants a Ti-84 graphing calculator, just as we issue a textbook to each student. If it is lost or broken, the student must pay the replacement value of $105 for the TI-84. A student may prefer to purchase his/her own. If so, we recommend the Ti-84 Plus (Silver Edition optional). We then highly recommend the calculator be etched with the student's name clearly on the front face, and on the back for security purposes. A sticker or a name written with a marker is not enough.

Part I Review:

I. Linear Equations

A. Graphing a linear equation

Example 1: Find the slope and the y-intercept of the line whose equation is 3y = 2x + 9 and use them to graph the equation.

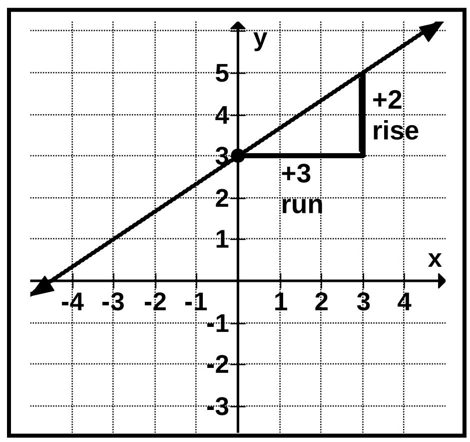
Solution:

$$3y = 2x + 9$$

$$\frac{3y}{3} = \frac{2x}{3} + \frac{9}{3}$$ Divide by 3 to solve for y.

$$y = \frac{2}{3}x + 3$$ Now the equation is in the familiar form $y = mx + b$.

The slope is the coefficient of the x-term, $\frac{2}{3}$, and the y-intercept is the constant term, 3. To graph the line, plot the y-intercept, (0 , 3). Then, since the slope is $\frac{2}{3}$, move 2 units up(rise) and 3 units right (run) to locate a second point. (See below.)



I. Linear Equations

B. Finding the slope.

C. Writing a linear equation.

Example 2: a) Find the slope of the line passing through the points (-2 , 5) and (4 , 8).
b) Given that the y-intercept is 6, write an equation for the line.

Solution: a) $\text{slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{8-5}{4+2} = \frac{3}{6} = \frac{1}{2}$

b) In a linear equation of the form $y = mx + b$, the slope is the coefficient of the x-term or linear term, namely m. The numerical term or constant term is the y-intercept, namely b.
So, starting with $y = mx + b$, substitute ½ for m and 6 for b.

Therefore, the equation is $y = \frac{1}{2}x + 6$

I. <u>Linear Equations</u>

D. <u>Writing a linear equation of parallel and perpendicular lines</u>.

Example 3: a) Write an equation of a line in <u>slope-intercept form</u> that is ***parallel*** to $y = \frac{2}{3}x - 3$ and passes through the point (3, –2).

b) Write an equation of a line in <u>point-slope form</u> that is ***perpendicular*** to $y = \frac{2}{3}x - 3$ and passes through the point (3, –2).

Solution: a) The slope $= \frac{2}{3}$ since parallel lines have the same slope. Use the values for slope and the given coordinate, and substitute the values for m, x, and y in the equation $y = mx + b$ to solve for b.

$$y = mx + b$$
$$-2 = \frac{2}{3}(3) + b$$
$$-2 = 2 + b$$
$$\underline{-2 \quad -2} \quad \text{subtract 2 to solve for b}$$
$$-4 = b$$

Therefore the equation parallel to $y = \frac{2}{3}x - 3$ and passes through the point (3, –2) is:

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

b) The slope $= -\frac{3}{2}$ since perpendicular lines have opposite reciprocal slopes. The point-slope form is much easier to use. It requires substituting in the values for the slope and the point.
The form is $y - y_1 = m(x - x_1)$. Substitute m with $-\frac{3}{2}$ and the x_1 with 3 and y_1 with –2 taken from the given coordinate (3, –2).

Therefore the equation in point-slope form of the line perpendicular to $y = \frac{2}{3}x - 3$ and passes through the point (3, -2) is:

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

Part I Practice:

I. Linear Equations

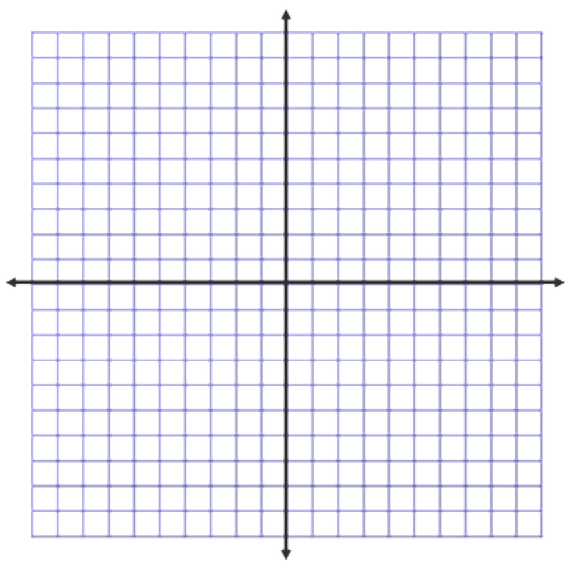
A. Graphing a linear equation.

1. For $x + 2y = 6$:

   a. Rewrite the equation into slope-intercept form.

   b. State the slope and y-intercept of $x + 2y = 6$.

   c. Graph the line.



I. Linear Equations

B. Finding the slope.

C. Writing a linear equation.

Find the slope of the line passing through each pair of points.

1. (0 , 7) and (1 , 9)	2. (8 , 1) and (-8 , 1)	3. (-2 , -6) and (-2 , 4)

Use the given information to write an equation of the line in A) slope-intercept form **and** in B) point-slope form.

4. slope = 3 , y-intercept = 7	5. slope = $\frac{2}{3}$, (3 , 4)	6. (2 , 4) , (-2 , -16)

I. <u>Linear Equations</u>

D. <u>Writing a linear equation of parallel and perpendicular lines</u>.

Write an equation of a line in <u>slope-intercept form</u> that is **parallel** to the graph of each equation and passes through the given point.

7. $4x + y = 1$; (–2 , 1)	8. $y = 3$; (2 , 6)

Write an equation of a line in <u>slope-intercept form</u> that is **perpendicular** to the graph of each equation and passes through the given point.

9. $2x - 5y = 3$; (–2 , 7)	10. $x = 6$; (4 , 2)

Part II Review:

II. Modeling with Linear Functions

A. Given the rate of change and the starting value

Given the rate of change and the starting value
1. Use $y = mx + b$
2. The rate of change is the slope, or m. The starting value is b.
3. Substitute m and b into $y = mx + b$ to write the linear model.

1. After a hurricane, a pump removes 1000 gallons of water from a basement at a constant rate of 50 gal/min.

a. Write an equation to model the amount of water in the basement, y, after x minutes.

$$\mathbf{y = -50x + 1000}$$

b. How many gallons of water are in the basement after 14 minutes?

$y = -50(14) + 1000$

$y = 300$

After 14 minutes, the basement has 300 gallons of water.

c. Graph the equation. Please label the axes!

Use the slope and the y-intercept

OR

Use the intercepts: x-intercept and y-intercept

x-intercept:

$0 = -50x + 1000$

$-1000 = -50x$

$20 = x$

The x-intercept is $(20, 0)$.

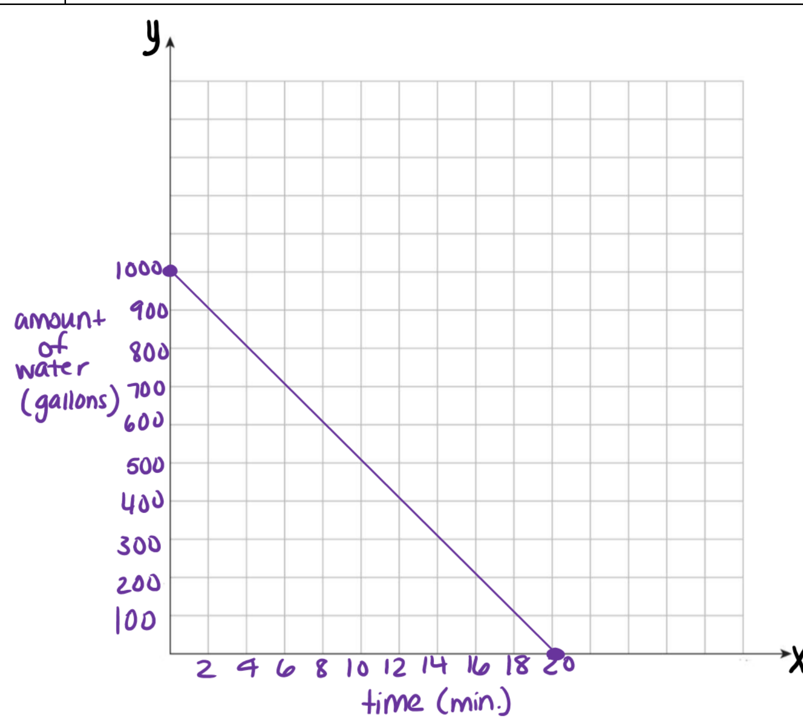
y-intercept:

$y = -50(0) + 1000$

$y = 0 + 1000$

$y = 1000$

The y-intercept is $(0, 1000)$.



d. Identify then interpret the intercepts and the slope in the context of the problem.

The x-intercept is $(\mathbf{20, 0})$. This means **after 20 minutes, there will be no water left in the basement.**

The y-intercept is $(\mathbf{0, 1000})$. This means **that originally the basement had 1000 gallons of water in it.**

The slope is $-\mathbf{50}$. This means **the water is being emptied at a rate of 50 gallons per minute.**

II. Modeling with Linear Functions

B. Given two data points

Given two data points
1. First, find the slope. 2. Substitute one of the points and the slope into $y = mx + b$, then solve for b. 3. Substitute m and b into $y = mx + b$ to write the linear model.

2. A candle is 6 inches tall after burning for 1 hour. After 3 hours, it is 5 ½ inches tall.

a. Identify the independent and dependent variables.

independent: time, x (hours)
dependent: height of candle, y (inches)

b. Identify the two points and find the slope!

$(1, 6)$ and $(3, 5.5)$

slope: $m = \frac{y_2 - y_1}{x_2 - x_1}$

$$m = \frac{5.5 - 6}{3 - 1}$$

$$\boldsymbol{m = -\frac{1}{4}}$$

c. Write a linear equation to model the height of the candle after burning for hours.

$y = mx + b$

$y = -\frac{1}{4}x + b$, use $(1, 6)$

$6 = -\frac{1}{4}(1) + b$

$\frac{25}{4} = b$

$$\boldsymbol{y = -\frac{1}{4}x + \frac{25}{4}}$$

d. How tall will the candle be after burning for 11 hours?

$y = -\frac{1}{4}(11) + \frac{25}{4}$

$y = 3.5$

After burning for 11 hours, the candle will be 3.5 inches tall.

e. When will the candle be 4 inches tall?

$4 = -\frac{1}{4}x + \frac{25}{4}$

$-\frac{9}{4} = -\frac{1}{4}x$

$9 = x$

The candle will be 4 in. tall after 9 hours.

f. What was the original height of the candle?

$\left(0, \frac{25}{4}\right)$

The candle was originally 6.25 inches tall.

g. When will the candle burn out?

$0 = -\frac{1}{4}x + \frac{25}{4}$

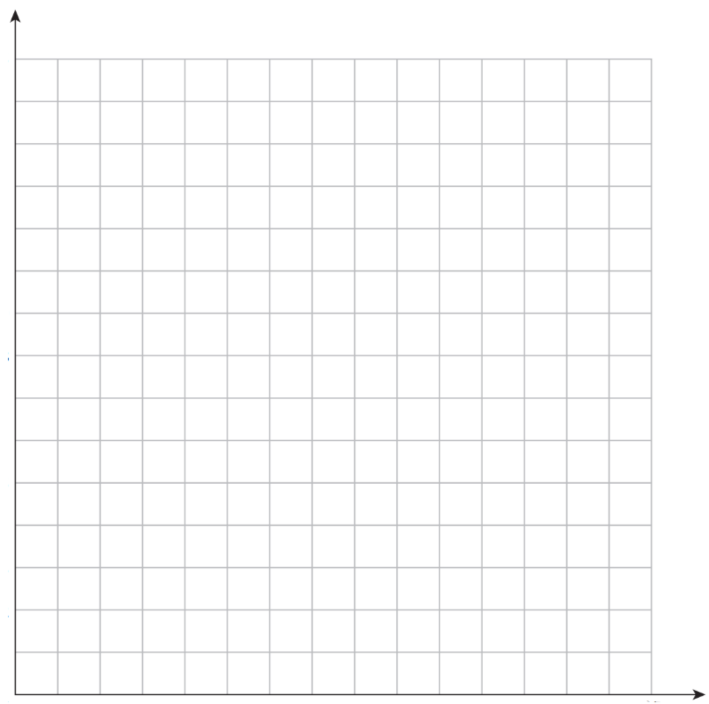
$-\frac{25}{4} = -\frac{1}{4}x$

$25 = x$ **The candle will burn out after 25 hours.**

Part II Practice:

II. Modeling with Linear Functions

A. Given the rate of change and the starting value

1. **Suppose a balloon begins descending at the rate of $20\ ft/min$ from an elevation of $1350\ ft$.**	
a. Identify the Independent and Dependent Variables.	**b.** Write an equation to model the balloon's elevation as a function of time. Be sure to define your variables!
c. How high will the balloon be after 12 minutes?	**d.** When will the balloon reach the height of the statue of liberty?
e. Graph the equation. Please label the axes!	
f. Identify then interpret the intercepts and the slope in the context of the problem. The x-intercept is ___________. This means ______________________________ The y-intercept is ___________. This means ______________________________ The slope is ___________. This means ______________________________	

II. Modeling with Linear Functions

B. Given two data points

2. A taxi driver charges a flat fee plus an additional amount per mile. He charges a total of $5.45 for a 2-mile ride. A 9-mile ride costs $7.90.	
a. Identify the independent and dependent variables	**b.** Identify the two points and find the slope!
c. Write a linear equation to model this situation.	**d.** You want take a taxi to Montclair, which is 10 miles away. You only have $8.00. Do you have enough money to make this trip?
e. Your taxi fare was $10.70. How many miles did you travel?	**f.** You earned a credit of $25 towards your next taxi ride. Use Google Maps to identify a destination that you can travel to from Livingston by only using the credit. Make sure you show mathematically that you can afford to travel to your destination.
g. The taxi company is thinking of implementing “surge pricing” during peak hours. How will your equation from **part c** change during surge pricing if the company decides to increase the charge per mile to $.51?	

Answers to Practice

I. <u>Linear Equations</u>

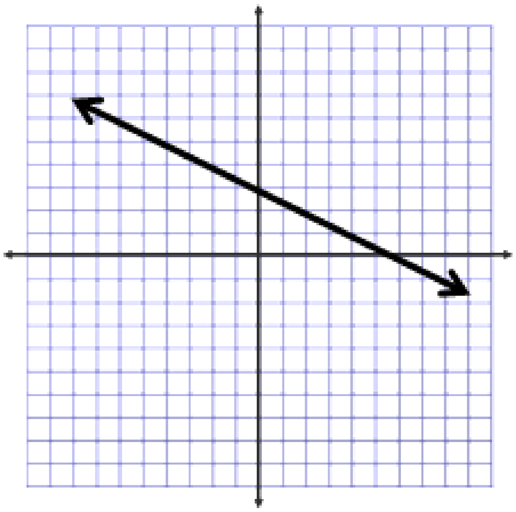
A. <u>Graphing a linear equation.</u>

1. For $x + 2y = 6$:

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

b. $m = -\frac{1}{2}$ $\quad b = 3$

c.



I. <u>Linear Equations</u>

B. <u>Finding the slope</u>.

C. <u>Writing a linear equation</u>.

1. $m = 2$

2. $m = 0$

3. undefined slope

4. A) $y = 3x + 7$

B) $y - 7 = 3(x - 0)$

5. A) $y = \frac{2}{3}x + 2$

B) $y - 4 = \frac{2}{3}(x - 3)$

6. A) $y = 5x - 6$

B) $y - 4 = 5(x - 2)$

or

$y + 12 = 5(x + 2)$

I. <u>Linear Equations</u>

D. <u>Writing a linear equation of parallel and perpendicular lines</u>.

7. $y = -4x - 7$

8. $y = 6$

9. $y = -\frac{5}{2}x + 2$

10. $y = 2$

II. Modeling with Linear Functions

1. a. Independent Variable: x = time (minutes)
   Dependent Variable: y = height (feet)

   b. Let x= time (minutes)
   Let y = height (feet)
   $y = -20x + 1350$

   c. $y = -20(12) + 1350$
   $y = 1110\ feet$

   d. $305 = -20x + 1350$
   $-1350 \qquad - 1350$
   $-1045 = -20x$
   $x = 52.25\ minutes$

   e. *If you graphed by using the slope and y-intercept, the slope is -20 and the y-intercept is $(0, 1350)$.
   *If you graphed by using the intercepts, the x-intercept is $(67.5, 0)$ and the y-intercept is $(0, 1350)$.

   f. The x-intercept is $(67.5, 0)$. This means that after 67.5 minutes the balloon is on the ground.
   The y-intercept is $(0, 1350)$. This means that balloon is initially 1350 feet off the ground.
   The slope is -20. This means the balloons descends at a rate of 20 feet per minute.

2. a. Independent Variable: x = distance traveled (miles)
   Dependent Variable: y = total cost of ride ($)

   b. $(2, 5.45)$ and $(9, 7.90)$
   $m = \frac{y_2 - y_1}{x_2 - x_1}$
   $m = 0.35$

   c. $y = 0.35x + b$, use $(2, 5.45)$
   $5.45 = 0.35(2) + b$
   $4.75 = b$
   $y = 0.35x + 4.75$

   d. *Answer will vary.*

   e. $y = 0.51x + 4.75$