Name: _____     Class #: _____

## Math 48A, Lesson 7: Linear Functions

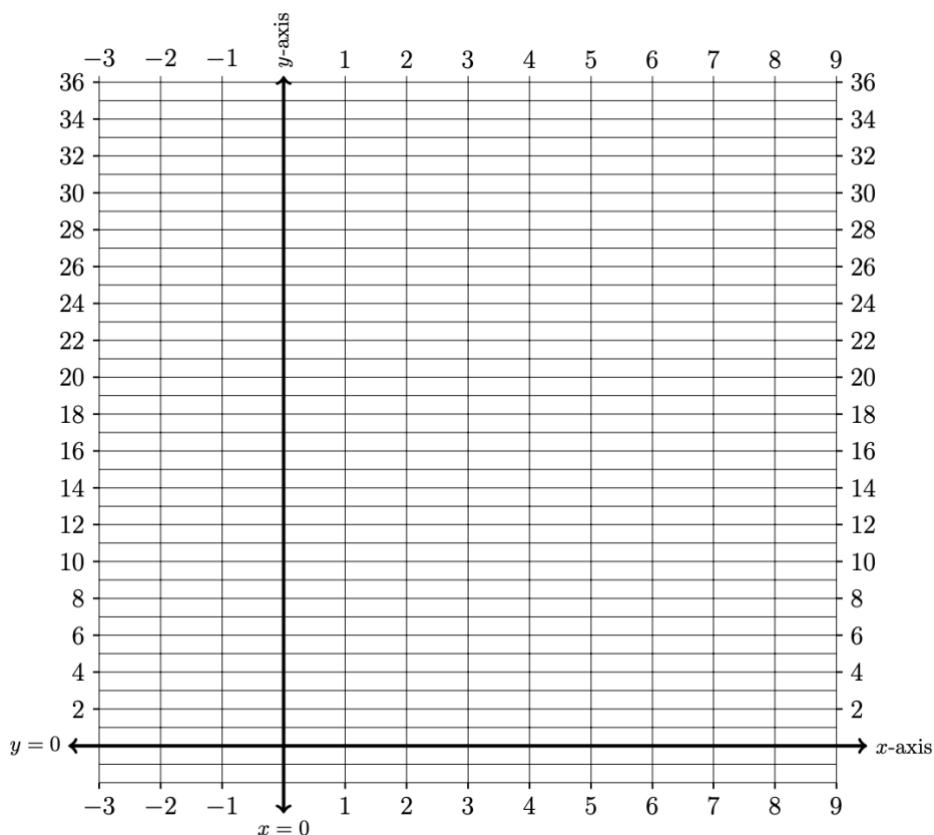| 1. | LINEAR FUNCTIONS HAVE CONSTANT RATES OF CHANGE |
|---|---|

1A. Consider the linear functions
$$f(x) = -2x + 23 \qquad \text{and} \qquad g(x) = 3x + 3$$
Create a table of values and graph the resulting lines on these axes below.

| $x$ | $f(x)$ | $g(x)$ |
|---|---|---|
| $-4$ | | |
| $-3$ | | |
| $-2$ | | |
| $-1$ | | |
| $0$ | | |
| $1$ | | |
| $2$ | | |
| $3$ | | |
| $4$ | | |
| $5$ | | |
| $6$ | | |
| $7$ | | |
| $8$ | | |
| $9$ | | |

1B. Which function is increasing? Which function is decreasing? Explain why.

Calculate the average rate of change of $f(x)$ and $g(x)$ between the points

     1C.   between $x = 1$ and $x = 6$.
     1D.   between $x = a$ and $x = a + h$.

How are your answers related to your work on problem 1B?

| 2. | GENERAL FORMS FOR A LINE |
|----|--------------------------|

Write your 1st draft of your description for three different forms for the equation of a line including:

Slope-intercept form: $y = m\,x + b$

Point-slope form: $y - y_1 = m\,(x - x_1)$

Polynomial form: $y = a_1 x + a_0$

As you craft your descriptions of these equations, be sure to use both:

Abuelita language:     Use language that your abuelita can understand.

Nerdy language:     Write this out using nerdy language. See if you can include formal mathematical symbols. This is the formal concept definition found in your textbook.

| 3. | EQUATION FOR SLOPE OF A LINE |
|---|---|

Write your 1st draft of your description for the equation for the slope of a line. Identify how this relates to calculating average rates of change from Lesson 6. As you craft your descriptions of these equations, be sure to use both:

Abuelita language:    Use language that your abuelita can understand.

Nerdy language:    Write this out using nerdy language. See if you can include formal mathematical symbols. This is the formal concept definition found in your textbook.

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**4.    IDENTIFY LINEAR FUNCTIONS**

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Determine if the function given in each problem below is linear or not. If the function is linear, express this function in slope-intercept form.

4A.        $f(x) = \dfrac{2x-3}{x}$                      4B.        $f(x) = \dfrac{1}{4}(2 - 3x)$

4C.        $f(x) = \dfrac{4-3x}{5}$                      4D.        $f(x) = (x - 3)^2$

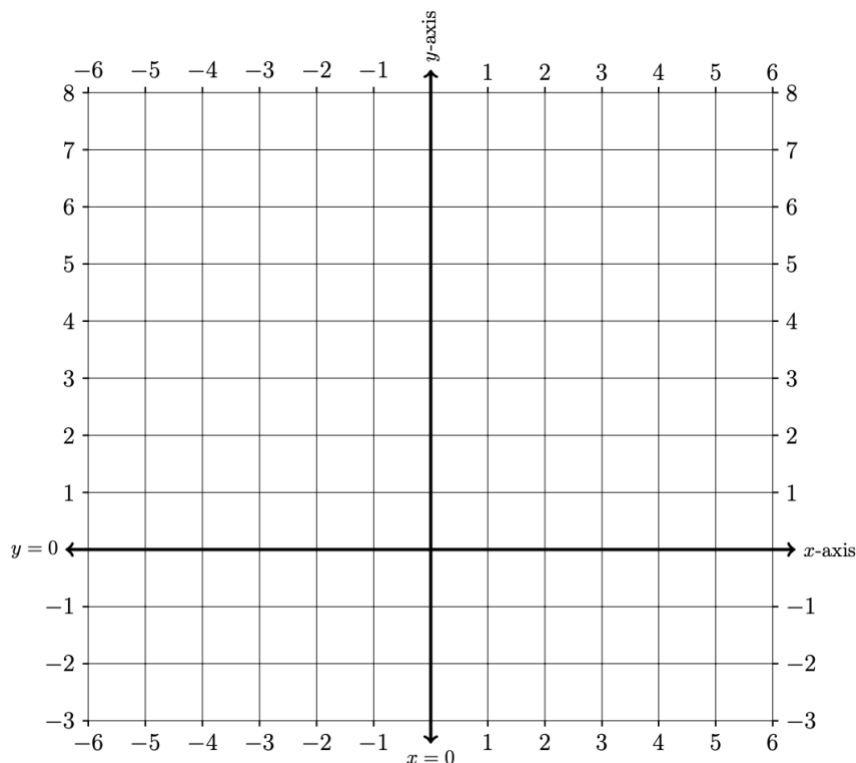## 5.    EQUATION FOR HORIZONTAL LINES

Consider the functions below

$$f(x) = 6 \qquad \text{and} \qquad g(x) = -1$$

Create a table of values and graph these functions.

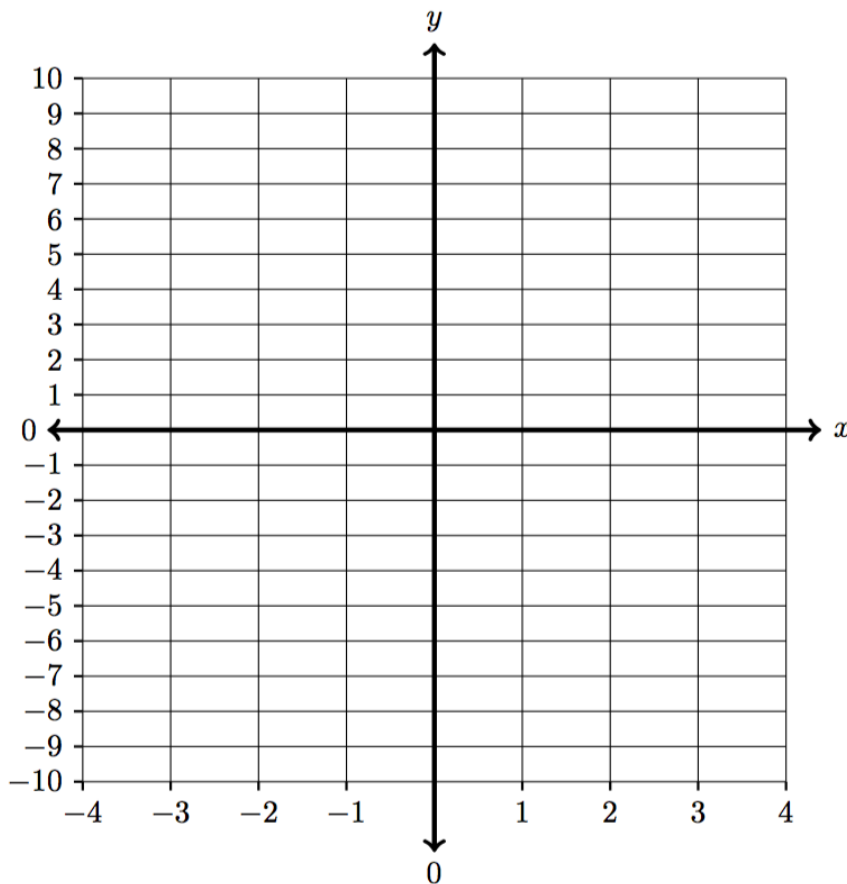| $x$ | $f(x)$ | $g(x)$ |
|-----|--------|--------|
| $-6$ |  |  |
| $-5$ |  |  |
| $-4$ |  |  |
| $-3$ |  |  |
| $-2$ |  |  |
| $-1$ |  |  |
| $0$ |  |  |
| $1$ |  |  |
| $2$ |  |  |
| $3$ |  |  |
| $4$ |  |  |
| $5$ |  |  |
| $6$ |  |  |

| 6. | EQUATIONS FOR VERTICAL LINES |
|---|---|

Consider the equation below

$$x = -3$$

Create a table of values and graph these equations.

| $x$ | $y$ |
|---|---|
|  | $-6$ |
|  | $-5$ |
|  | $-4$ |
|  | $-3$ |
|  | $-2$ |
|  | $-1$ |
|  | $0$ |
|  | $1$ |
|  | $2$ |
|  | $3$ |
|  | $4$ |
|  | $5$ |
|  | $6$ |

| 7. | EQUATIONS FOR X-AXIS AND Y-AXIS |
|---|---|

Using the work you did in problems 6 and 7, determine the equations for the x-axis and the y-axis. Explain your reasoning.

## 8.    GRAPH A PIECEWISE FUNCTION

Consider the piecewise function below:

$$f(x) = \begin{cases} 9 & \text{if} & x < -3 \\ x^2 & \text{if} & -3 \le x < 1 \\ 2x + 1 & \text{if} & 1 \le x \end{cases}$$

| Input | Output |
|-------|--------|
| $x$ | |
| $-5$ | |
| $-4$ | |
| $-3$ | |
| $-2$ | |
| $-1$ | |
| $0$ | |
| $1$ | |
| $2$ | |
| $3$ | |
| $4$ | |
| $5$ | |

$f(x) = x^2$