Name: ______________________________ Date: ______________________

LINEAR FUNCTIONS
N-GEN MATH® 8

There are many different types of functions. **Linear functions**, ones whose graphs form **lines**, are one of the most important. In this lesson we will begin to understand how to work with them.

***Exercise* #1:** Consider the **linear function** $y=\frac{3}{2}x+2$. Answer the following questions.

(a) Find the average rate of change for each of the following intervals. Show your work.

from $x=0$ to $x=6$ from $x=-4$ to $x=4$

(b) What important characteristic of the line do both of your answers from (a) equal?

THE DEFINING CHARACTERISTIC OF LINEAR FUNCTIONS

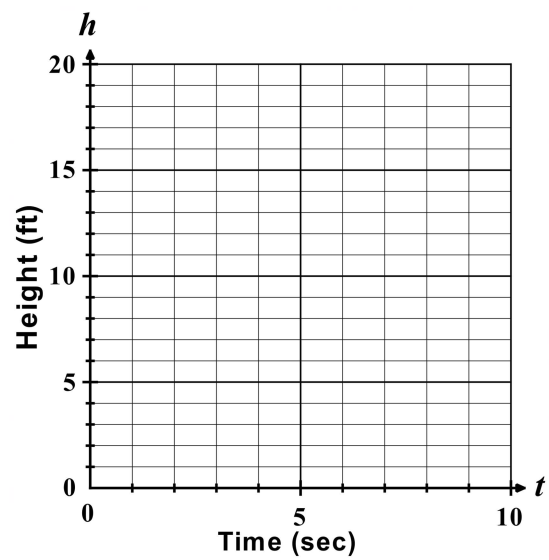
Linear functions have **constant rates of change** equal to their **slopes**. Any two points on a linear function will allow you to calculate its rate of change.

Almost any situation with a **constant rate of change** can be modeled with a linear function.

***Exercise* #2:** A balloon is let go at a height of 4 feet above the ground and rises at a (constant) rate of 2 feet per second.

(a) Fill in the table below for the height of the balloon.

t (sec)	0	1	2	3	4	5
h (ft)						



(b) Graph the data from the table and connect with a line.

(c) What are the slope and y-intercept of this line?

$m=\text{slope}=$ __________ $b=y-\text{int}=$ __________

If we can identify the **slope** and ***y*-intercept** of a linear function then we can write its equation.

***Exercise* #3:** In the last exercise our input variable was time, t, and our output variable was height, h. Given your answers to *Exercise* #2 (c), write the equation of the line.

(a) in $y = mx + b$ form

(b) in $h = mt + b$ form

If we are given the **rate** (slope) and **initial value of the output** (y-intercept) then we can always write the equation of the linear function.

EQUATIONS OF LINEAR FUNCTIONS

The equation of all linear functions can be summarized by: $y = (\text{rate}) \cdot x + (\text{initial value})$.

***Exercise* #4:** For each of the following scenarios, identify a rate and an initial value and write the linear equation that models the scenario.

(a) Lizzie has $50 in her bank account. She decides to save an additional $15 per week of her allowance. If she doesn't spend any more money, write a linear function for the amount of money she has saved, a, as a function of the number of weeks, w, she has been saving.

slope = rate = m = __________ y − intercept = initial value = __________

equation: ________________________________

(b) An elevator begins 120 feet above the ground floor. Its height **decreases** at a rate of 4 feet per second. Write a linear function for the height, h, of the elevator above the ground floor as a function of the time, t, in seconds it has been moving downward.

slope = rate = m = __________ y − intercept = initial value = __________

equation: ________________________________

(c) A container weighs 6.5 pounds and is filled with bricks that weigh 1.5 pounds per brick. Write a linear function for the total weight of the container, w, as a function of the number of bricks, n, that have been placed in it.

slope = rate = m = __________ y − intercept = initial value = __________

equation: ________________________________

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LINEAR FUNCTIONS
N-GEN MATH® 8 HOMEWORK

FLUENCY

1. All linear functions have which of the following?

(1) a non-constant average rate of change

(2) a constant average rate of change

(3) a positive y-intercept

(4) a positive slope

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2. For the function $y=\frac{2}{7}x+\frac{1}{3}$ what is its average rate of change from $x=3$ to $x=8$?

(1) $\frac{2}{7}$ (3) $\frac{1}{3}$

(2) $\frac{13}{21}$ (4) $\frac{1}{21}$

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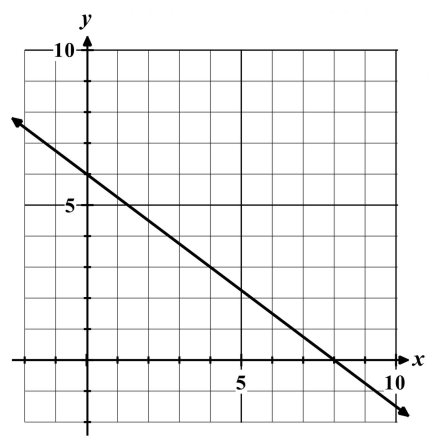
3. What is the rate of change of the linear function shown on the graph grid to the right?

(1) 6 (3) -6

(2) $\frac{3}{4}$ (4) $-\frac{3}{4}$



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USING YOUR MATH

4. The population of a small town is given by the function $p=35t+1450$, where t is the number of years since 2015. What would the town's population be in 2020?

(1) 1,485 (3) 1,625

(2) 1,570 (4) 1,700

____

5. When born, a baby weighed 8.5 pounds and gained 1.6 pounds per week for the first 10 weeks. Which of the following functions accurately models the number of pounds, p, the baby weighs as function of the number of weeks, w, since it was born?

(1) $p = 8.5w + 1.6$ (3) $p = \frac{w}{1.6} + 8.5$

(2) $p = 1.6w + 8.5$ (3) $p = \frac{w}{8.5} + 1.6$ ________

6. For each of the following scenarios, write the linear equation that is asked for by first identifying the rate (slope) and initial value (y-intercept). Think about whether your rate should be positive or negative.

(a) Michelle is climbing a flight of stairs. She starts at a height of 25 feet above the ground and climbs upward at a rate of 2.4 feet per second. Write a linear function for Michelle's height, h, as a function of the time, t, in seconds she has been climbing.

slope = rate = m = __________ y − intercept = initial value = __________

equation: ________________________________

(b) Sean has to paint a room that has 1,250 square feet of wall area. He can paint at a rate of 75 square feet per hour. Write a linear function for the area that Sean still has remaining to paint, a, as a function of the time, t, in hours he has been painting.

slope = rate = m = __________ y − intercept = initial value = __________

equation: ________________________________

REASONING

7. The number of people in a concert hall can be modeled by the function $n = 35t + 28$, where n is the number of people and t is the time since the doors opened, in minutes. Explain what the parameters 35 and 28 mean given the context of the problem.

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