

Name: \_\_\_\_\_

Class: \_\_\_\_\_

**Algebra Quarterly 1 Review Sheet 3**Question 1Solve for  $x$ . Explain what's different between (a) and (b) and why you get two different kinds of answers.

(a)  $\frac{9}{4}x - 5 = 2(x - 5) + 0.25x$

$$\frac{9}{4}x - 5 = 2x - 10 + 0.25x$$

$$\frac{9}{4}x - 5 = 2.25x - 10$$

$$2\frac{1}{4}x - 5 = 2\frac{1}{4}x - 10$$

→ This has **NO SOLUTION** because no matter what you substitute for  $x$ , the right side will always be 5 less than the left side. Can you see why?

(b)  $\frac{9}{4}x - 5 = 2\left(x - \frac{5}{2}\right) + 0.25x$

$$\frac{9}{4}x - 5 = 2x - 5 + 0.25x$$

$$\frac{9}{4}x - 5 = \frac{9}{4}x - 5$$

→ This has **INFINITE SOLUTIONS** because no matter what you substitute for  $x$ , the right side and left sides will always be equal. Can you see why?

Question 2

Ian is borrowing \$1,000 from his parents to buy a notebook computer. He plans to pay them back at the rate of \$60 per month. Ken is borrowing \$600 from his parents to purchase a snowboard. He plans to pay his parents back at the rate of \$20 per month.

(a) Create an expression for the amount that Ian still owes his parents after  $x$  months.  **$1000 - 60x$**

(b) Create an expression for the amount that Ken still owes his parents after  $x$  months.  **$600 - 20x$**

(c) Determine algebraically when the two boys will owe the same amount. **Create an equation and solve:**

$$1000 - 60x = 600 - 20x$$

$$x = 10$$

→ So they will owe the same amount after **10 months**.

(d) Ian claims that he will have his loan paid off 6 months after he and Ken owe the same amount. Determine and state if Ian is correct. Explain your reasoning.

To determine when Ian pays off his loan, set his expression equal to ZERO and solve.

$$1000 - 60x = 0$$
$$x = 16\frac{2}{3}$$

Ian will have his loan paid off in  $16\frac{2}{3}$  months. So Ian is WRONG - he will have his loan paid off  $6\frac{2}{3}$  months after he and Ken owe the same amount, not exactly 6 months.

### Question 3

Year	1980	1990	2000	2010	2020
Population	4.7	6.2	7.7	9.2	10.7

The table above shows the population of a certain mammal (in thousands) on a certain year.

(a) Create an equation “P = ” that gives the population of the mammal (in thousands) in terms of  $t$ , where  $t$  represents the number of decades after 1970.

**Note: 1970 is ZERO. 1980 is ONE. 1990 is TWO. 2000 is THREE. 2010 is FOUR. 2020 is FIVE. Can you figure out why?**

Then the equation is  $P = 4.7 + 1.5(t - 1)$

Note you must use P and t because those are the letters stated in the directions.

(b) Explain why the table represents a linear function. **The table is a linear function because the dependent variable increases by the same amount every time the independent variable increases by 1.**

(c) Identify the y-intercept and explain what it represents in real-world terms.

**The y-intercept is 3.2. It represents the population of the mammal in 1970.**

(d) In what year will the population of the mammal exceed 20,000? Determine this algebraically.

**Note: In the table, the population is expressed in thousands. For example, 4.7 really represents 4,700 mammals. So 20,000 would actually be 20 in the table. So set the expression equal to 20 and solve:**

$$20 = 4.7 + 1.5(t - 1)$$
$$15.3 = 1.5t - 1.5$$
$$16.8 = 1.5t$$
$$t = 11.2$$

So t needs to be equal to 12 for the population to exceed 20 thousand. That corresponds to 120 years after 1970, which is the year 2090.

**NOTE: Part (d) is more difficult than what you can expect on the Quarterly, but not that much harder than what is possible in future quizzes or exams. So study this question well ;)**

Question 4

Find which has the greatest **rate of change**. In addition, find which has the greatest **y-intercept**.

A line that passes through the point (-3, -1) and has a y-intercept of 0.

**Make a table knowing that (-3, -1) and (0, 0) are points on the line.**

x	y
-3	-1
0	0

**Rate of Change: 1/3**  
**Y-Intercept: 0**

x	y
0	5
1	5
2	5
3	5

HINT: Hmm, this is weird. For the slope, think about how much you need to add to the y-values to get from one row to the next row...

**Rate of Change: 0**  
**y-Intercept: 5**

$$2y = \frac{1}{8}x - 10$$

Simplify by multiplying both sides by  $\frac{1}{2}$ . This is useful because it makes it more clear what we do with the  $\frac{1}{8}$  on the right-hand side.

Of course, it's the same thing as dividing both sides by 2. But then you might get confused when trying to divide  $\frac{1}{8}$  by 2.

$$\frac{1}{2}(2y) = \frac{1}{2}\left(\frac{1}{8}x - 10\right)$$

$$y = \frac{1}{16}x - 5$$

**Rate of Change:  $\frac{1}{16}$**

**Y-Intercept: -5**

$$y = \frac{1}{8}(x - 1) + \frac{1}{8}$$

**Simplify:**

$$y = \frac{1}{8}x - \frac{1}{8} + \frac{1}{8}$$

$$y = \frac{1}{8}x$$

**Rate of Change: 1/8**

**y-Intercept: 0**

**NOTE: Even though the simplified expression does not appear to have a constant, it DOES have a slope. If there is no constant, the constant is zero.**

**The upper-left has the largest rate of change. The upper-right has the largest y-intercept.**

Question 5

Find the number of blocks in the 107<sup>th</sup> design.

Design 2 

Design 7 

Design 12 

**METHOD 1**

First, find the rate of change:  $\frac{3-2}{7-2} = \frac{1}{5}$

We can make an expression using a table:

x	y
2	2
3	$2 + \frac{1}{5}$
4	$2 + \frac{1}{5}(2)$
5	$2 + \frac{1}{5}(3)$
x	$2 + \frac{1}{5}(x - 2)$

**METHOD 2**

First, find the rate of change:  $\frac{3-2}{7-2} = \frac{1}{5}$

Next, find the y-intercept. Logically...

→ Design 1 has  $2 - \frac{1}{5} = 1\frac{4}{5}$  blocks

→ Design 0 has  $1\frac{4}{5} - \frac{1}{5} = 1\frac{3}{5}$  blocks

Using  $y = mx + b$ , the expression would be  $\frac{1}{5}x + 1\frac{3}{5}$

**NOTE:** Can you show that the answer for Method 1 and Method 2 are the same?

Question 6

Solve for  $x$ . Express your answer as a decimal.

$$\frac{7}{3}\left(x + \frac{9}{28}\right) = 20$$

$$\frac{7}{3}x + \frac{3}{4} = 20$$

$$\frac{7}{3}x = 19.25$$

$$x = 8.25$$

Question 7

The cost,  $c$ , in dollars of running a particular factory that produces  $w$  widgets can be modeled using the linear function:

$$c = 1.25(w - 2) + 2175$$

(a) Find the slope and explain what it means in the context of the problem.

**Simplify:**

$$c = 1.25w - 2.5 + 2175$$
$$c = 1.25w + 2172.5$$

**The slope is 1.25 and represents the cost of producing 1 additional widget.**

(b) Find the y-intercept and explain what it means in the context of the problem.

**The y-intercept is 2172.5 and represents the cost of producing ZERO widgets. This means it's the cost of setting up the factory before you start making anything.**

Question 8

The ages of three brothers are consecutive even integers. Three times the age of the youngest brother exceeds the oldest brother's age by 48 years. What is the age of the youngest brother?

**Youngest:  $x$**

**Middle:  $x + 2$**

**Oldest:  $x + 4$**

**"Exceeds" is another way of saying subtraction, so...**

**The equation is:**

$$3x - (x + 4) = 48$$

**NOTE: The parentheses are very important because they show that the " $x + 4$ " is being treated as a single object.**