Honors Algebra 2 Unit 1 Student Notes 2020-2021

Unit 1 Essential Understanding: Can you represent linear situations with equations, graphs, and inequalities, and model constraints to optimize solutions?

1.1 Notes: Function Notation

Function Notation: Intro *Article taken from purplemath.com*

You've been playing with "$y =$" sorts of equations for some time now. And you've seen that the "nice" equations (straight lines, say, rather than ellipses) are the ones that you can solve for "$y =$" and then plug into your graphing calculator. These "$y =$" equations are functions. But the question you are facing at the moment is "Why do I need this 1unction notation, and how does it work?"

Think back to when you were in elementary school: Your teacher gave you worksheets containing statements like "$[\ \ ] + 2 = 4$" and told you to fill in the box. Now that you're grown, your teacher will give you worksheets containing statements like "$x + 2 = 4$" and will tell you to "solve for x". Why did your teachers switch from boxes to variables? Well, think about it: How many shapes would you have to use for formulas like the one for the area A of a trapezoid with upper base a, lower base b, and height h? $A = (\,^{h}/_{2}\,)(a + b)$

If you try to express the above, or something more complicated, using variously-shaped boxes, you'd quickly run out of shapes. Besides, you know from experience that "A" stands for "area", "h" stands for "height", and "a" and "b" stand for the lengths of the parallel top and bottom sides. Heaven only knows what a square box or a triangular box might stand for. So they switched from boxes to variables because, while the boxes and the letters mean the exact same thing (namely, a slot waiting to be filled with a value), variables are better. Variables are more flexible, easier to read, and can give you more information.

The same is true of "y" and "$f(x)$" (pronounced as "eff-of-eks"). For functions, the two notations mean the exact same thing, but "$f(x)$" gives you more flexibility and more information. You used to say "$y = 2x + 3$; solve for y when $x = -1$". Now you say "$f(x) = 2x + 3$; find $f(-1)$" (pronounced as "f-of-x is $2x$plus three; find f-of-negative-one"). You do exactly the same thing in either case: you plug in -1 for x, multiply by 2, and then add the 3, simplifying to get a final value of $+1$.

But function notation gives you greater flexibility than using just "y" for every formula. Your graphing calculator will list different functions as y1, y2, etc. In textbooks and when writing things out, we use names like $f(x)$, $g(x)$, $h(x)$, $s(t)$, etc. With this notation, you can now use more than one function at a time without confusing yourself or mixing up the formulas, wondering "Okay, which 'y' *is* this, anyway?" And the notation can be usefully explanatory: "$A(r) = (pi)r^2$" indicates the area of a circle, while "$C(r) = 2(pi)r$" indicates the circumference. Both functions have the same plug-in variable (the "r"), but "A" reminds you that this is the formula for "area" and "C" reminds you that this is the formula for "circumference".

Questions for Discussion:

- **Where is the input of a function written in function notation?**
- **What is the output of a function written in function notation?**
- **Why would we use function notation?**

1.1: Partner Discovery - Function Notation

Topic #1: Use functional notation to evaluate a function with a given input.

Example: Find $f(3)$ if $f(x) = 8x – 1$.
$= 8(3) – 1$
$= 24 – 1$
$f(3) = 23$

1) Find $h(5)$ if $h(x) = -2x^2 + 23$

2) Find $d(-8)$ if $d(x) = \frac{3}{4}x + 6$

Topic #2: Use functional notation to solve for the input with a given output.

Example: Solve for x if $f(x) = 5x – 3$ and $f(x) = 17$.
$17 = 5x – 3$
$20 = 5x$
$4 = x$

3) Solve for x if $b(x) = -2x – 3$ and $b(x) = 6$.

4) Solve for x if $p(x) = \frac{1}{4}x – 8$ and $p(x) = -2$

Topic #3: Use functional notation to perform operations on functions.

Examples: If $f(x) = 6x + 18$, $g(x) = 9x – 1$, and $h(x) = 3$, then find the following.

a) $f(x) + g(x)$
$= 6x + 18 + 9x – 1$
$= 17x + 17$

b) $f(x) – g(x)$
$= 6x + 18 – (9x – 1)$
$= 6x + 18 – 9x + 1$
$= -3x + 19$

c) The product of $f(x)$ and $g(x)$
$= (6x + 18)(9x – 1)$
$= 54x^2 – 6x + 162x – 18$
$\mathbf{= 54x^2 + 156x – 18}$

d) $\frac{f(x)}{h(x)}$
$= \frac{6x+18}{3}$
$= 2x + 6$

4) Find $f(x) – g(x) + h(x)$

5) Find the product of $h(x)$ *and* $f(x)$.

6) Find $\frac{g(x)}{h(x)}$.

1.2 Notes: Equations of Lines

Slope-intercept Form:

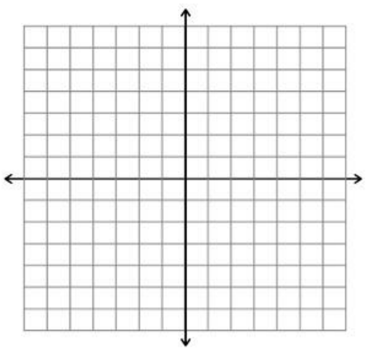
Point-Slope Form:

Standard Form:

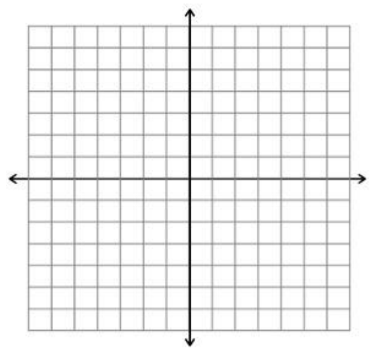
(h, k) Form:

Slope-Intercept Form

Examples: Graph $f(x) = -\frac{5}{2}x + 1$ and $g(x) = 3x$ and identify the domain and range for each function.



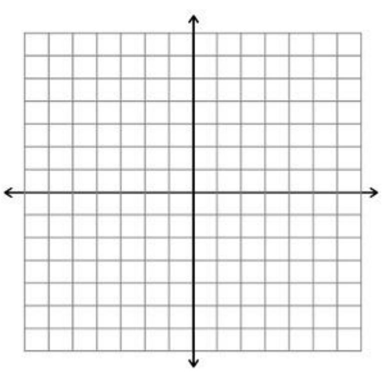
Domain: Range:

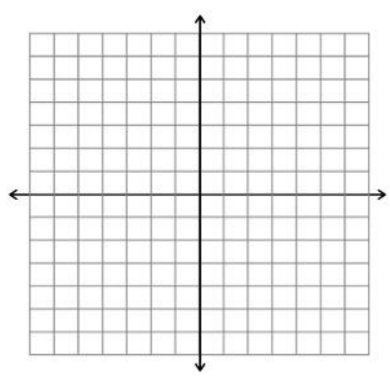


Domain: Range:

Standard Form

Example: Graph $4x + 6y = 16$ and $3x - 5 = 9$

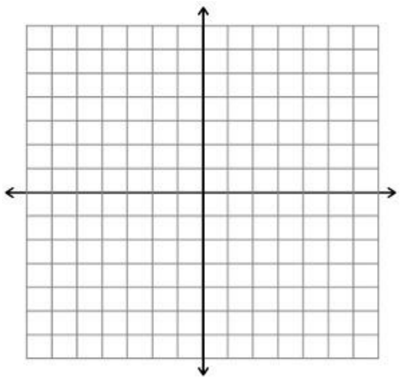




Example: A candy bar costs \$1.25 and a soda costs \$0.75. If Angie spends \$7.50 on soda and candy bars, then write an equation that models this situation.

Point-Slope Form

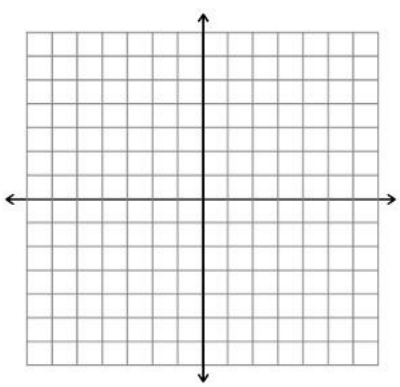
Example: Graph $y - 2 = 3(x + 1)$



Example: Write the equation of a line in slope-intercept form with a slope of $\frac{2}{3}$ passing through (5, -3).

(h, k) Form

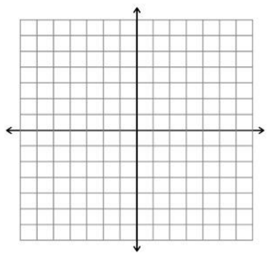
Example: Graph $y = -\frac{2}{3}(x - 4) + 5$



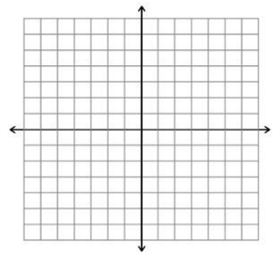
Example: Write the equation in slope-intercept form of a line parallel to $y = 5x + 6$, passing through (-2, -1).

Special Lines

Horizontal Lines

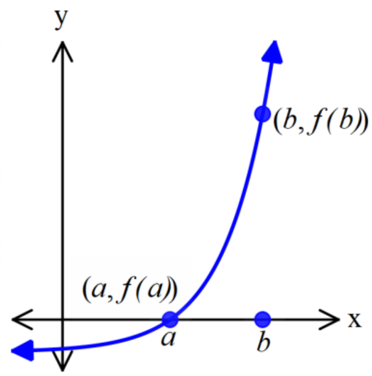


Vertical Lines

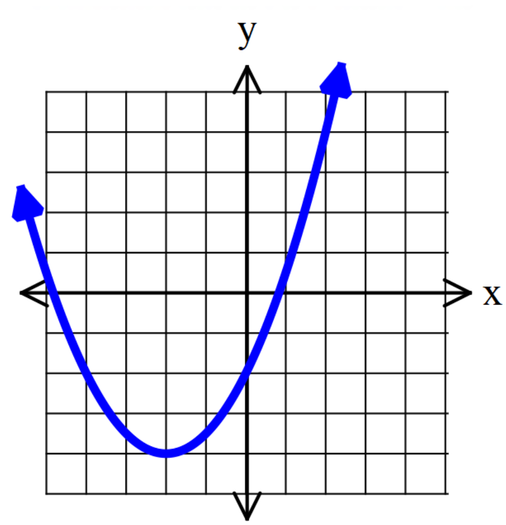


Average Rate of Change

What is the average rate of change of a function $y = f(x)$ over the interval $a \le x \le b$?



Examples: What is the average rate of change of the function y over the interval:



a) $-4 \le x \le -2$

b) $-4 \le x \le 0$

c) $-2 \le x \le 2$

1.3 Notes: Solving Systems of Equations

Example 1: Felicia lives near an amusement park. She has two options to pay for entrance.

Option A: Pay \$40 per visit.
Option B: Buy a season pass for \$140 and then pay \$5 per visit.

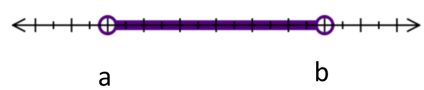
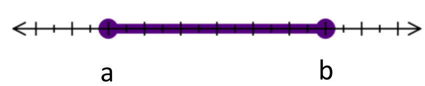
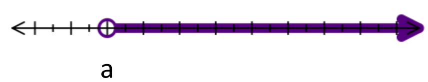
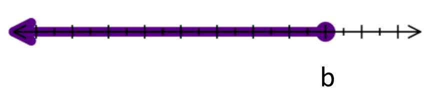
Find the number of visits where Felicia's cost is the same, regardless of the option she chooses. Also, find the price for this number of visits.

Example 4: Set up a system of equations for the following. **DO NOT SOLVE!**
A movie theater charges \$9 for adults and \$7 for children. A group of seven people spend \$57 on tickets.

Example 5: Frankie's cell phone plan charges \$30 per month, plus \$0.10 per text message. Elizabeth's cell phone plan charges \$12 per month, plus \$0.25 per text message. How many text messages would they each send in order to have the same monthly bill? How much would the bill be?

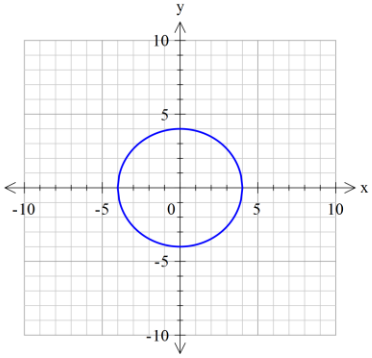
<u>1.4 Notes: Set and Interval Notation for Domain and Range</u>

Function:	**Domain:**	**Range:**

	Set Notation	Interval Notation	Graph	Anything goes
Open Interval	$\{x \mid a < x < b\}$	(a, b)		$x > a$ and $x < b$ x is greater than a and x is less than b
Closed Interval	$\{x \mid a \leq x \leq b\}$	[a, b]		$x \geq a$ and $x \leq b$ x is greater than or equal to a and x is less than or equal to b
Infinite Interval	$\{x \mid x > a\}$	(a, ∞)		$x > a$ x is greater than a
Infinite Interval	$\{x \mid x \leq b\}$	(-∞, b]		$x \leq b$ x is less than or equal to b

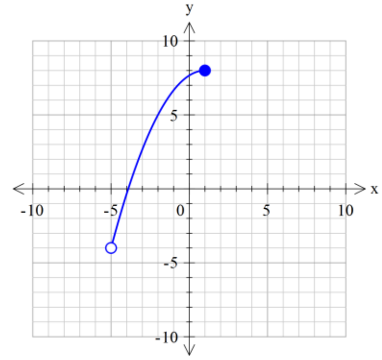
Examples: State the Domain, Range, and whether or not each graph is a function. Find the x- and y-intercepts and identify the intervals where the function is increasing and/or decreasing.

1)



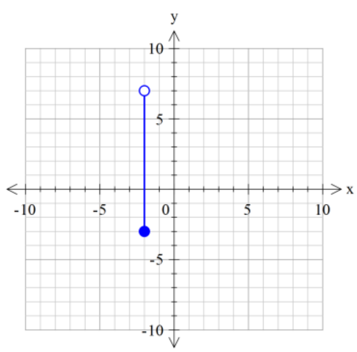
Set notation	**Interval notation**
Domain:	Domain:
Range:	Range:
Function?	
x-int:	Increasing:
y-int:	Decreasing:

2)



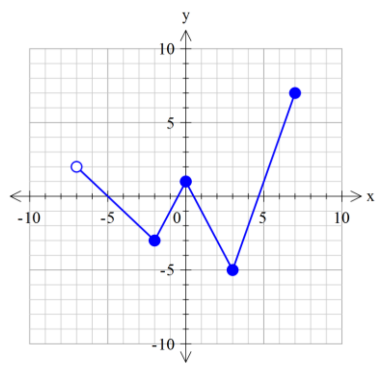
Set notation	**Interval notation**
Domain:	Domain:
Range:	Range:
Function?	
x-int:	Increasing:
y-int:	Decreasing:

3)



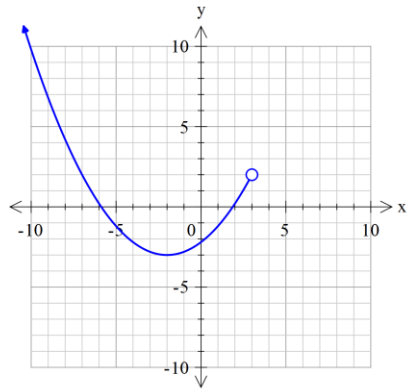
Set notation	**Interval notation**
Domain:	Domain:
Range:	Range:
Function?	
x-int:	Increasing:
y-int:	Decreasing:

4)



Set notation	**Interval notation**
Domain:	Domain:
Range:	Range:
Function?	
x-int:	Increasing:
y-int:	
	Decreasing:

5)



Set notation

Domain:

Range:

Function?

x-int:

y-int:

Interval notation

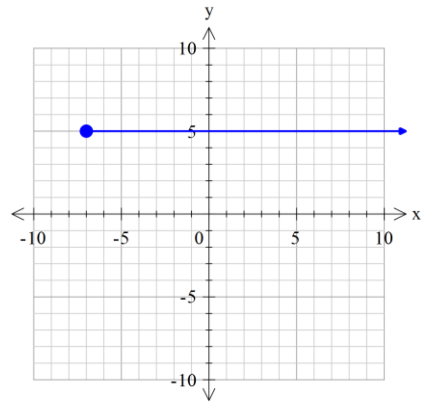
Domain:

Range:

Increasing:

Decreasing:

6)



Set notation

Domain:

Range:

Function?

x-int:

y-int:

Interval notation

Domain:

Range:

Increasing:

Decreasing:

7) If $f(x)$ is the graph represented in #5 above and $g(x) = f(x+3)$, fill in the table below for g(x).

Set notation

Domain:

Range:

Function?

x-int:

y-int:

Interval notation

Domain:

Range:

Increasing:

Decreasing:

8) If $h(x)$ is represented in #6 above and $b(x) = h(x) + 3$, fill in the table below for b(x).

Set notation

Domain:

Range:

Function?

x-int:

y-int:

Interval notation

Domain:

Range:

Increasing:

Decreasing:

9) Describe the transformation associated with $f(x)$ and $f(-x)$.

2.1 Intro: Simplifying Radicals & Rational Exponents (After Unit 1 Test)

Examples: Simplifying each radical. Make a Factor Tree for simplifying square roots!

1) $\sqrt{180}$

2) $5\sqrt{24} \cdot 3\sqrt{10}$

3) $4\sqrt{5}\sqrt{18}$

4) $\sqrt{\dfrac{32}{49}}$

5) $\dfrac{7}{\sqrt{3}}$

6) $\dfrac{4\sqrt{6}}{\sqrt{8}}$