

Warmup 9/ (The age you are on your quinceanera + the # of strands in a braid)

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*****THERE SHOULD BE A GRAPHING SHEET, MARKER, ERASER INSIDE YOUR DESK!*****

1. Write down two examples of equations that would be LINEAR.
2. Write down two examples of equations that would be NONLINEAR.
3. Find $f(-4)$ if $f(x) = 3x - 6$.
4. Find $g(5)$ if $g(x) = \frac{1}{2}x - 9$.

FUNCTIONS QUIZ THURSDAY!

TOPICS COVERED:

- Creating/matching graphs of stories
- Is it a function? Table/graph/real-world situation
- Evaluating functions (finding $f(3)$, etc.)
- Writing a function rule from a table (guess my rule)
- Writing a function rule from a real-world situation and labeling inputs/outputs
- Graphing functions using a table
- Understanding which equations will be linear and nonlinear
- Identifying key features of graphs
 - Increasing/decreasing
 - X- and Y-intercepts
 - Slope
- **THIS LIST WILL BE POSTED ON MY WEBSITE!**



One more guess my rule...

PATTERNS...

$$f(x) = 4x$$

x	f(x)
1	4
2	8
3	12
4	16
5	20

$$g(x) = 4x + 5$$

x	g(x)
1	9
2	13
3	17
4	21
5	25

$$h(x) = 4x - 2$$

x	h(x)
1	2
2	6
3	10
4	14
5	18

$$j(x) = -5x + 20$$

x	j(x)
1	15
2	10
3	5
4	0
5	-5

$$k(x) = 7x - 3$$

x	k(x)
1	4
2	11
3	18
4	25
5	32

$$l(x) = 100x + 5$$

x	l(x)
1	105
2	205
3	305
4	405
5	505

Multiplication table...

Multiplication

X	0	1	2	3	4	5	6	7	8	9	10	11	12
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	10	11	12
2	0	2	4	6	8	10	12	14	16	18	20	22	24
3	0	3	6	9	12	15	18	21	24	27	30	33	36
4	0	4	8	12	16	20	24	28	32	36	40	44	48
5	0	5	10	15	20	25	30	35	40	45	50	55	60
6	0	6	12	18	24	30	36	42	48	54	60	66	72
7	0	7	14	21	28	35	42	49	56	63	70	77	84
8	0	8	16	24	32	40	48	56	64	72	80	88	96
9	0	9	18	27	36	45	54	63	72	81	90	99	108
10	0	10	20	30	40	50	60	70	80	90	100	110	120
11	0	11	22	33	44	55	66	77	88	99	110	121	132
12	0	12	24	36	48	60	72	84	96	108	120	132	144

NOTICE: The numbers in the “4s” row are all 4 apart.


So the outputs of “ $y = 4x$ ” would all be 4 apart.

If I added one to each number in the 4’s row, would they still all be 4 apart?

Therefore, the outputs of $y = 4x + 1$ would still all be 4 apart.

EXTREMELY IMPORTANT PATTERN:

- If your outputs increase by a certain number, that is the “multiplying” number in the equation.
 - Outputs increase by 4 → Rule has a “4x”
 - Outputs decrease by 2 → Rule has a “-2x”
- NOTE: This only works if your inputs are consecutive numbers.
- (we will write one more thing here in a little bit – leave some space)



So, how does this help me with
“guess my rule???”

- Guess consecutive numbers!!!

COPY:

What's the rule???

x	a(x)
1	4
2	7
3	10
4	13
5	16

- The outputs increase by 3, so $a(x) = 3x + \text{something}$
- Test out numbers & see that you also need to add 1.
- $a(x) = 3x + 1$

Whiteboard: Can you get these rules???

1)

x	a(x)
1	4
2	7
3	10
4	13
5	16

$$a(x) = 3x + 1$$

2)

x	b(x)
5	15
6	20
7	25
8	30
9	35

$$b(x) = 5x - 10$$

3)

x	c(x)
-2	-7
-1	-5
0	-3
1	-1
2	1

$$c(x) = 2x - 3$$

4)

x	d(x)
0	10
1	6
2	2
3	-2
4	-6

$$d(x) = -4x + 10$$

One more...

x	f(x)
1	3
2	6
3	11
4	18
5	27

- The “trick” does not work here, because the outputs do not increase by a constant amount.
- Tables like this have different types of equations that are **NOT** “times something plus or minus something”
- This table was most likely created by an equation with an exponent somewhere.

Look at #1 on your Graphing Functions Sheet...

- Would our “trick” work for this one?
- The outputs are increasing by 2. And the equation has a “ $2x!$ ”
- Based on the table, does it make sense why this graph would be a straight line?

NOTICE:

- #3 had a “ $\frac{1}{2}x$ ” in the rule. And the outputs increase by $\frac{1}{2}$.
- #5 had a “ $-3x$ ” in the rule. And the outputs decrease by -3 .

EXTREMELY IMPORTANT PATTERN:

- If your outputs increase by a certain number, that is the “multiplying” number in the equation.
 - Outputs increase by 4 → Rule has a “4x”
 - Outputs decrease by 2 → Rule has a “-2x”
- NOTE: This only works if your inputs are consecutive numbers.
- *****If the outputs increase or decrease by a constant number, your graph will be a straight line!!!*****

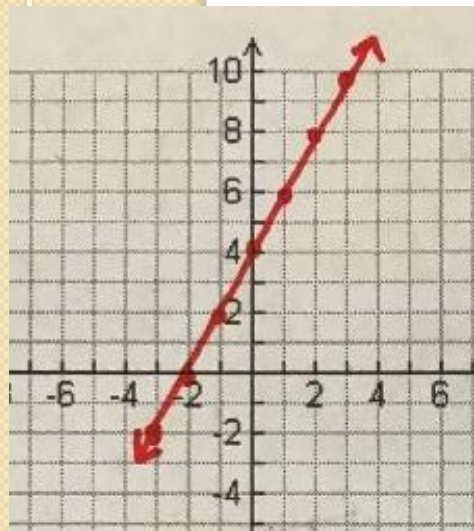
Summarizing everything today...

- Any equation with something like a “ $5x$ ” will have outputs that increase by 5.
- This will also cause the graph to be a straight line (linear).
- Things like exponents, square roots, and absolute value make the outputs NOT have a constant increase.
- These graphs will NOT be a straight line.

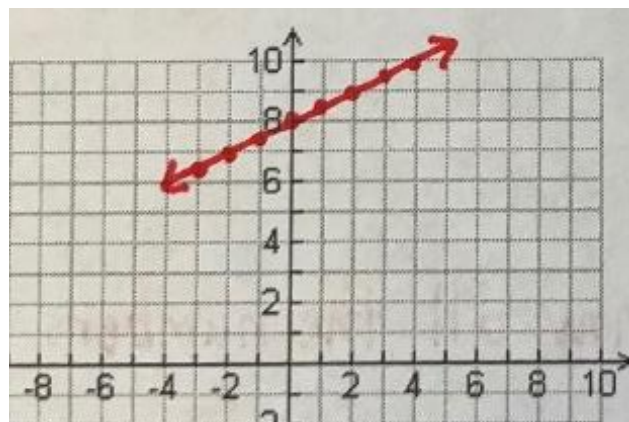


KEY FEATURES OF GRAPHS

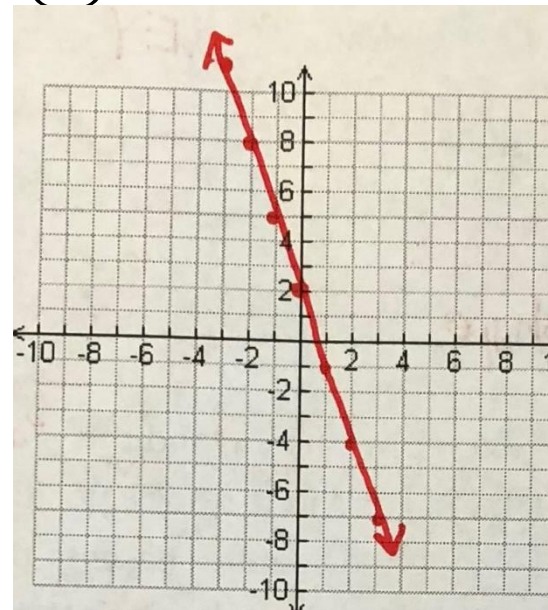
$$a(x) = 2x + 4$$



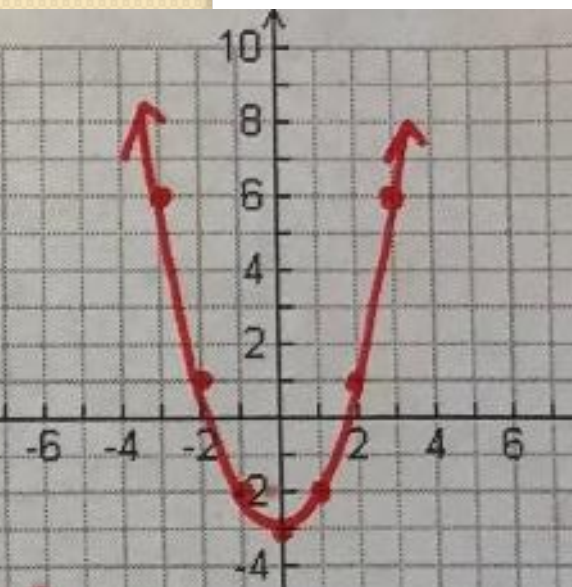
$$c(x) = \frac{1}{2}x + 8$$



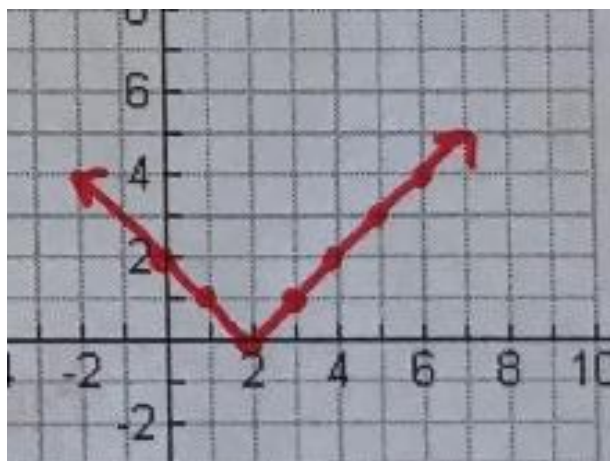
$$e(x) = 2 - 3x$$



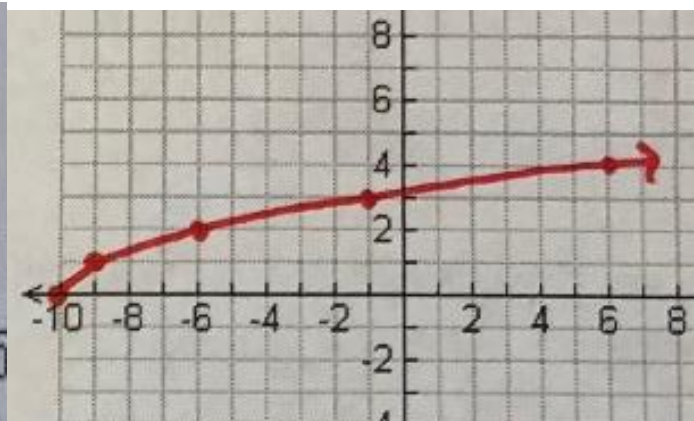
$$b(x) = x^2 - 3$$



$$d(x) = |x - 2|$$



$$f(x) = \sqrt{x + 10}$$



Key Features of Graphs

Increasing: Where the y-values go up (from left to right)

Decreasing: Where the y-values go down (from left to right)

X-intercept: Where the graph crosses the x-axis

Y-intercept: Where the graph crosses the y-axis

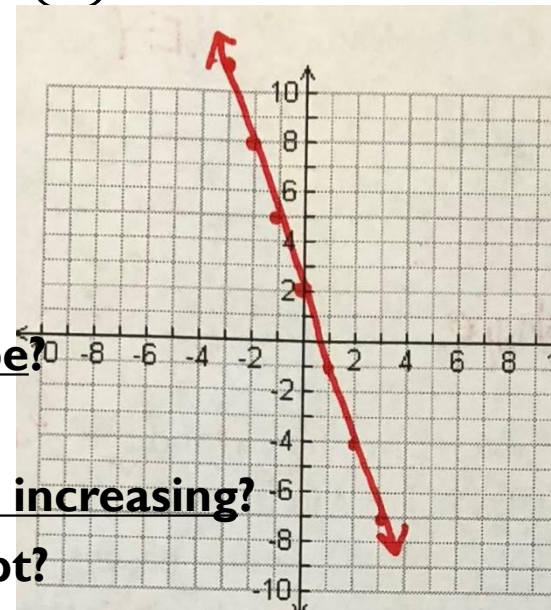
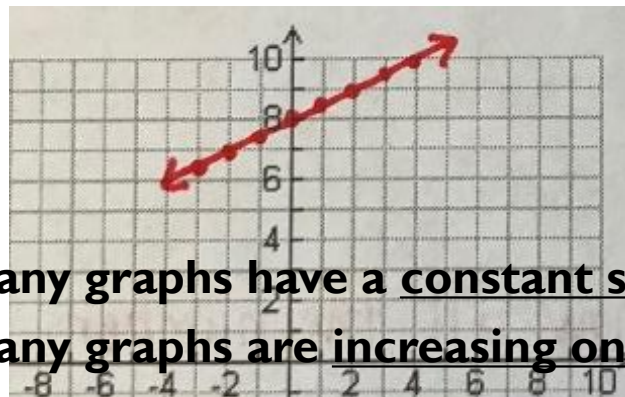
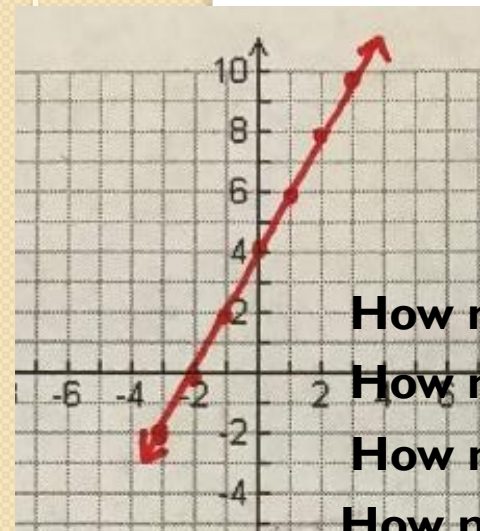
Slope: How steep the graph is

*****ALWAYS READ A GRAPH
FROM LEFT TO RIGHT!!!*****

$$a(x) = 2x + 4$$

$$c(x) = \frac{1}{2}x + 8$$

$$e(x) = 2 - 3x$$



How many graphs have a constant slope?

How many graphs are increasing only?

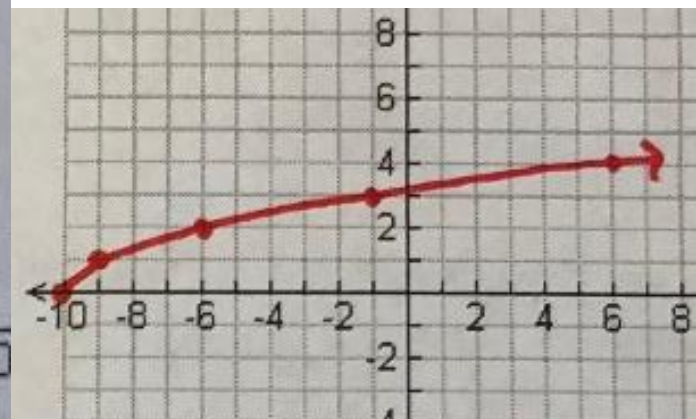
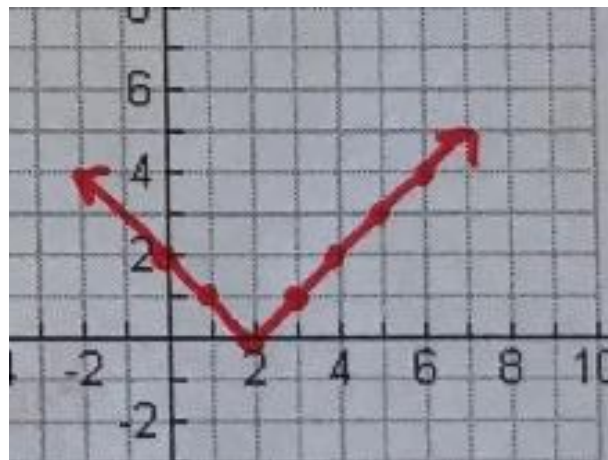
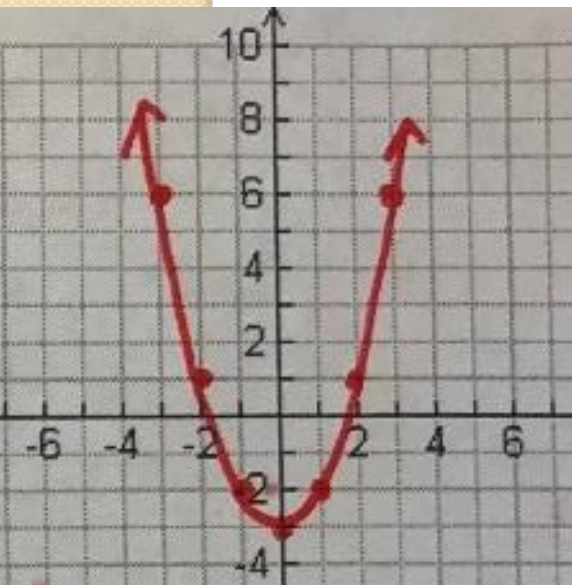
How many graphs are decreasing, then increasing?

How many graphs have **ONE** x-intercept?

$$b(x) = x^2 - 3$$

$$d(x) = |x - 2|$$

$$f(x) = \sqrt{x + 10}$$



Increasing/decreasing?

Constant slope?

x-intercept?

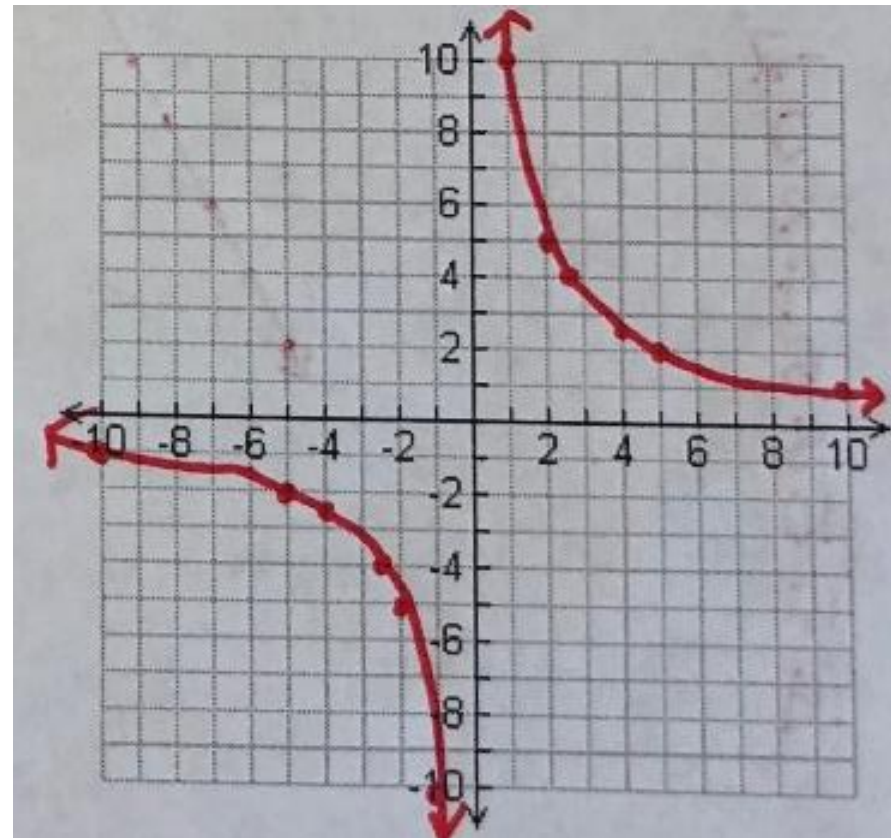
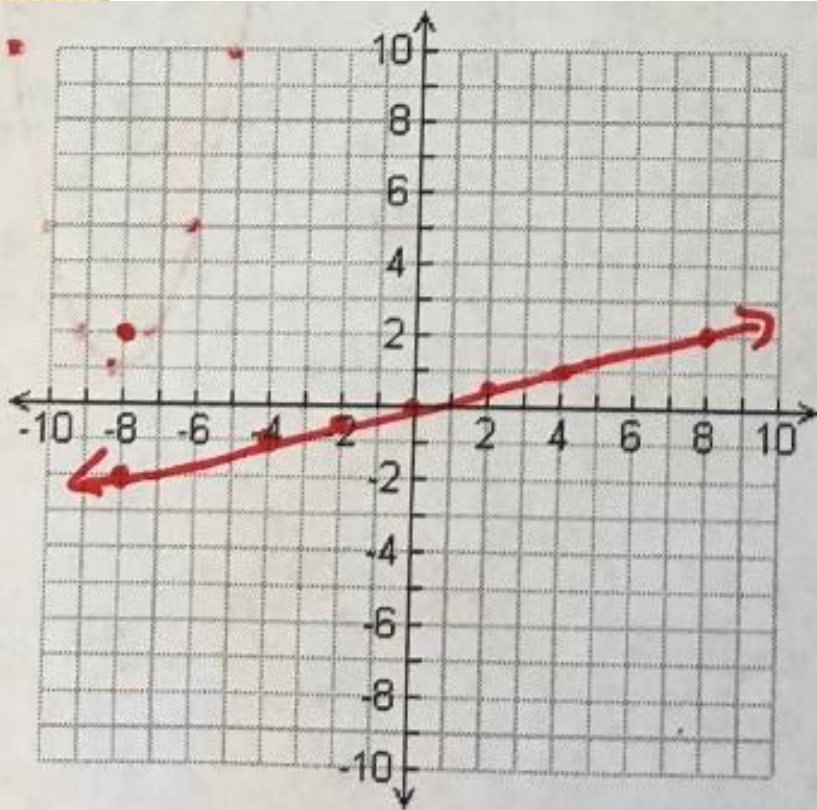
y-intercept?

Increasing/decreasing?

Constant slope?

x-intercept?

y-intercept?



Increasing/Decreasing?

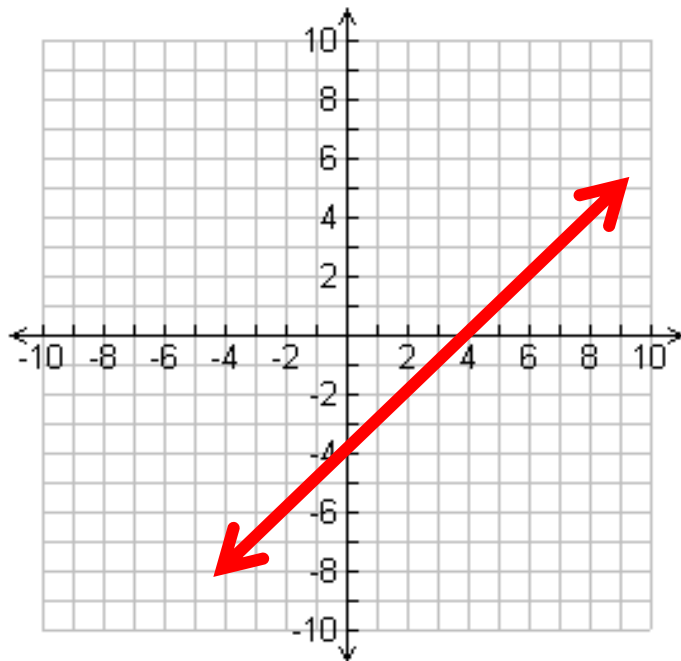
Both increasing

Which graph has a greater **x-intercept**? **Graph 1**

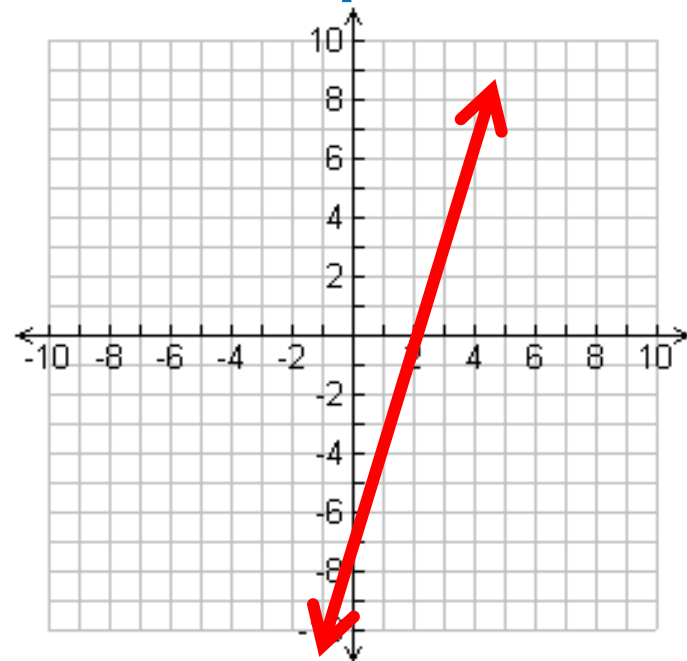
Which graph has a greater **y-intercept**? **Graph 1**

Which graph has a greater **slope**? **Graph 2**

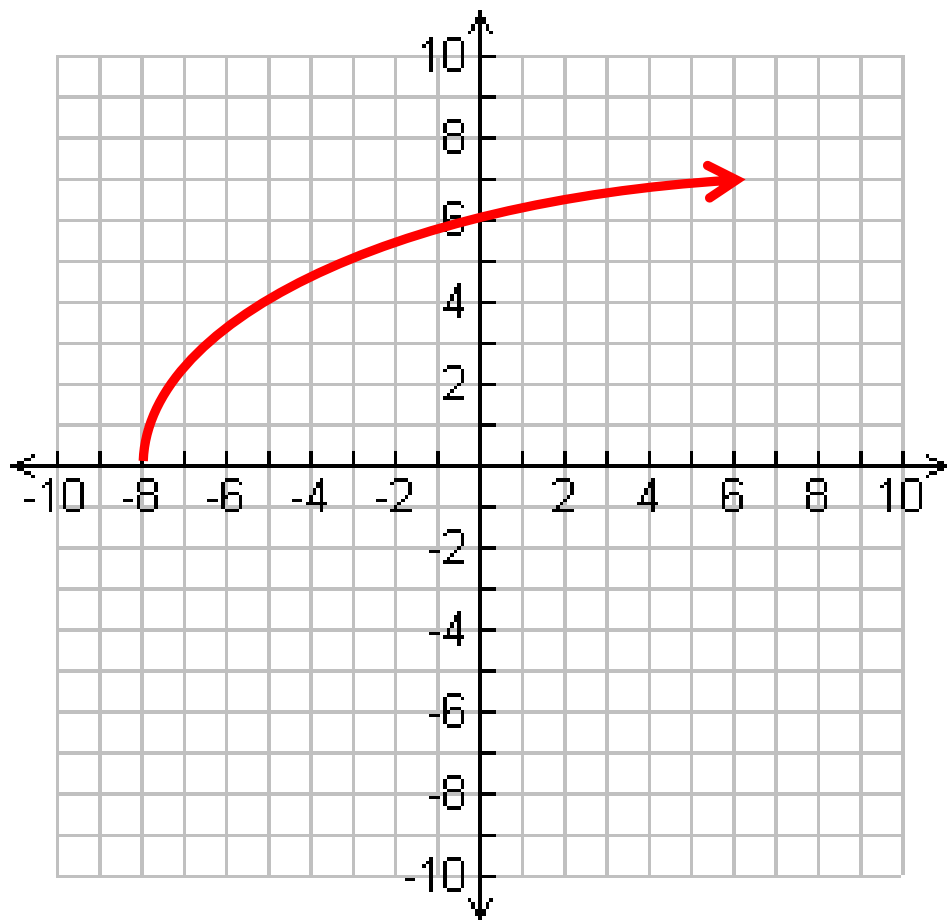
Graph 1



Graph 2



Key features?



Increasing/decreasing?

Always increasing

X-intercept?

-8

Y-intercept?

6

Describe the **slope**.

The slope is not constant.

**Above and beyond answer:
the slope starts out very
steep, then gets gradually
less steep**

Key features?

Increasing/decreasing?

Increasing, then decreasing, then increasing, then decreasing, etc.

X-intercept?

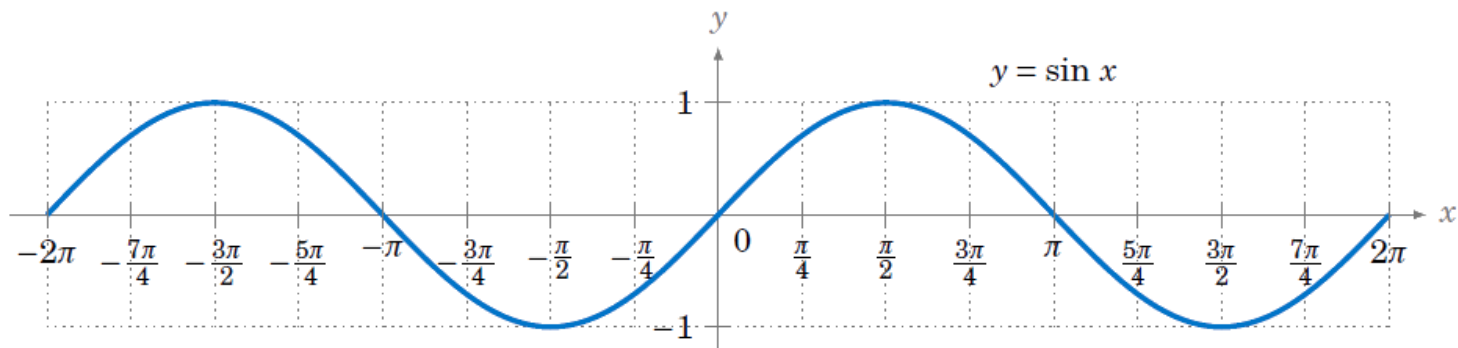
$-2\pi, -\pi, 0, \pi, 2\pi$

Y-intercept?

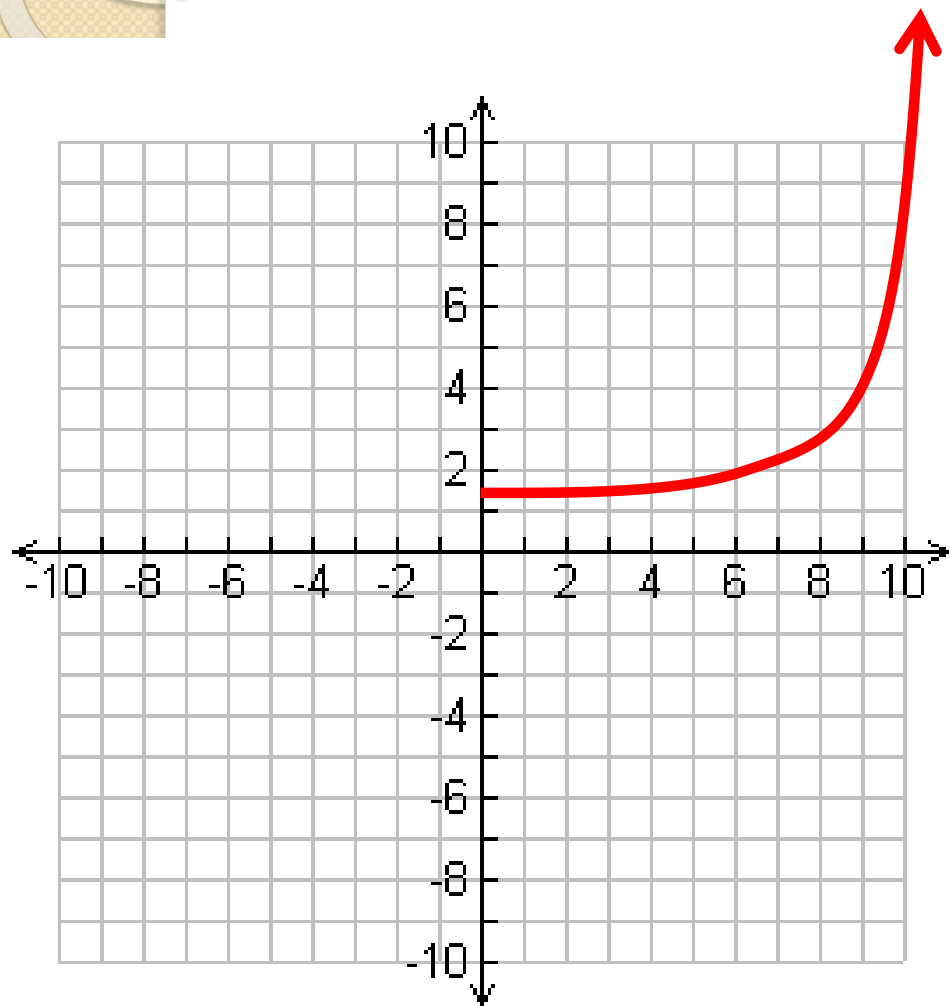
0

Describe the **slope**.

The slope is not constant.



Key features?



Increasing/decreasing?

Always increasing

X-intercept?

None

Y-intercept?

About 1.5

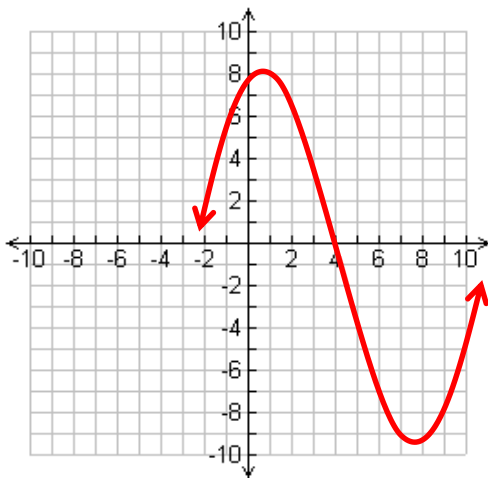
Describe the **slope**.

The slope is not constant. It starts not very steep, then gets steeper and steeper.

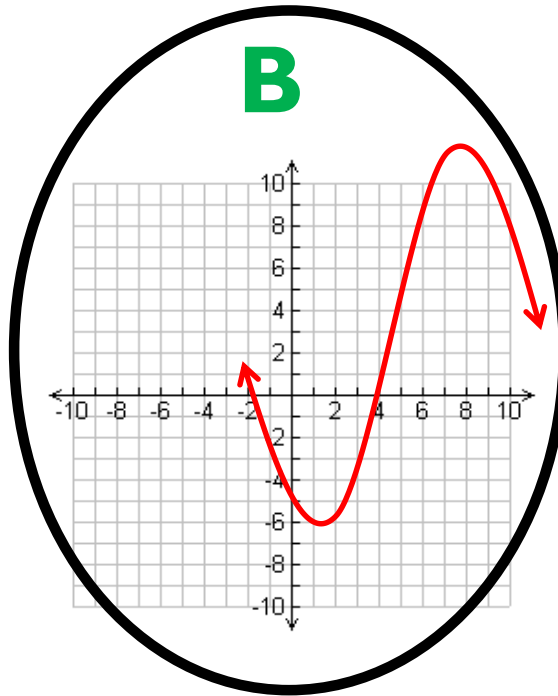
Choose the graph that is:

- Decreasing, then increasing, then decreasing
- Has an x-intercept of 4

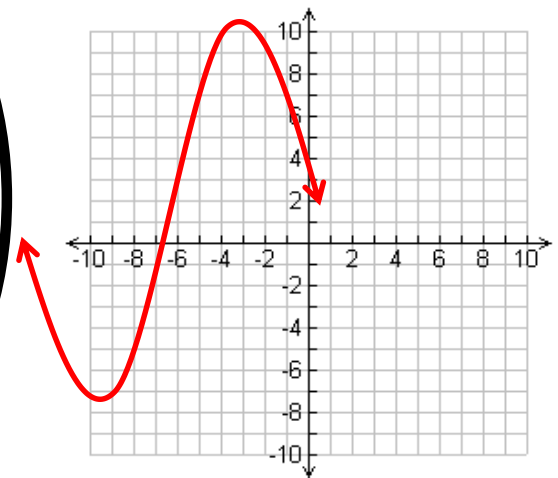
A




B



C





Draw a graph with the following characteristics:

- **x and y-intercepts are both zero**
- **Always decreasing**
- **Slope doesn't change**



Draw a graph with the following characteristics:

- **Always increasing**
- **The slope changes**

HOMEWORK

- Create your own functions WS