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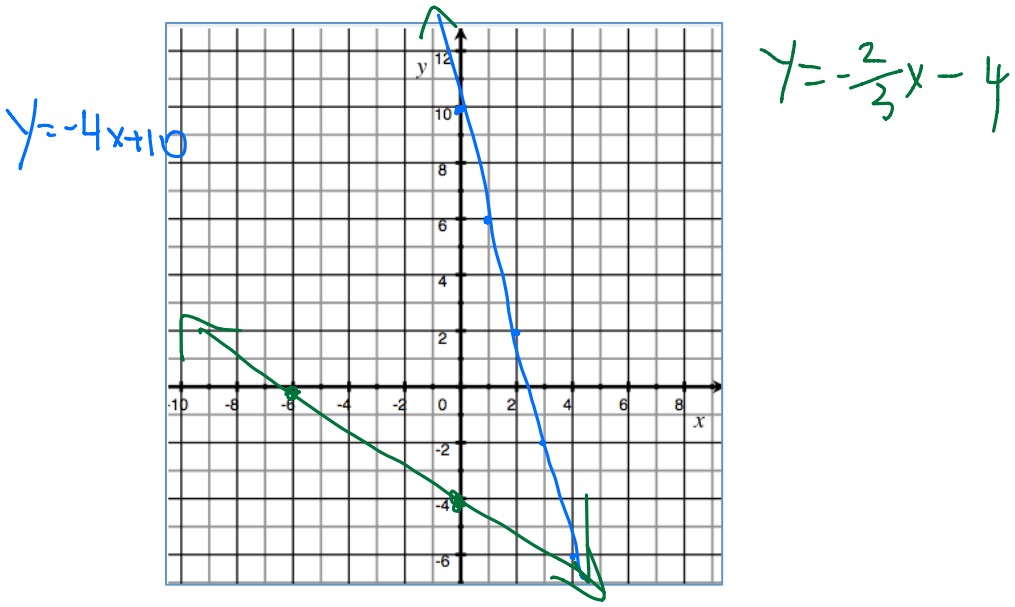
LEARNING OBJECTIVE: We will use rudimentary computer programming to explain the graph of a function. (Lesson 97)

ACTIVATING PRIOR KNOWLEDGE:

We have plotted linear equations on coordinate planes before.

Graph $y = 10 - 4x$	Graph $2x + 3y = -12$



CONCEPT DEVELOPMENT:

"Pseudocode"

"For loop"

Declare x integer — SPECIFY DOMAIN

For all x from 1 to 5 — INSTRUCTIONS FOR LOOP

Print 2^x — LOOP BODY/ACTION

Next x.

OUTPUT: 2, 4, 8, 16, 32

What is the domain of the variable x?

All integers

If f is a function given by evaluating the expression 2^x for a number x, what is the domain of the function given by the program?

{1, 2, 3, 4, 5}

What is the range of f?

{2, 4, 8, 16, 32}

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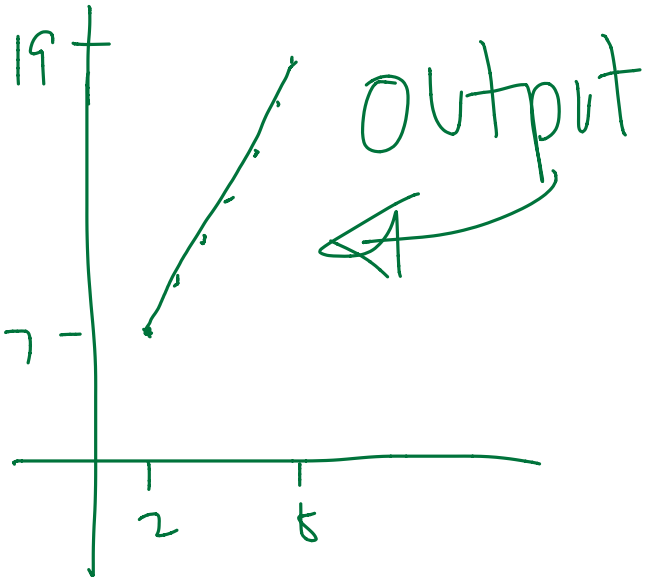
"More pseudocode"

```
Declare x integer
Initial G as { }
For all x from 2 to 8
    Append (x, 2x + 3) to G
Next x.
Print G
```

{(2,7), (3,9), (4,11), (5,13), (6,15), (7,17), (8,19)}

What is different about this code??

```
Declare x real
Let f(x) = 2x + 3
Initialize G as { }
For all x such that 2 ≤ x ≤ 8
        Append (x, f(x)) to G
Next x.
Plot G.
```



Set Builder Notation

This can be a way to quickly write a set similar to what we built above using our pseudocode. Written as follows:

$$\{type\ of\ element \mid condition\ on\ each\ element\}$$

or

$$\{(x, f(x)) \mid x \in D\}$$

Domain; input, output; "in"

$\{(x, 3x-1) \mid x \text{ int}, -1 \le x \le 2\}$

Example:

$\{(x, 2x+3) \mid x\ integer, 2 \le x \le 8\}$

{(2,7), (3,9), (4,11), (5,13), (6,15), (7,17), (8,19)}

{(-1,-4), (0,-1), (1,2), (2,5)}

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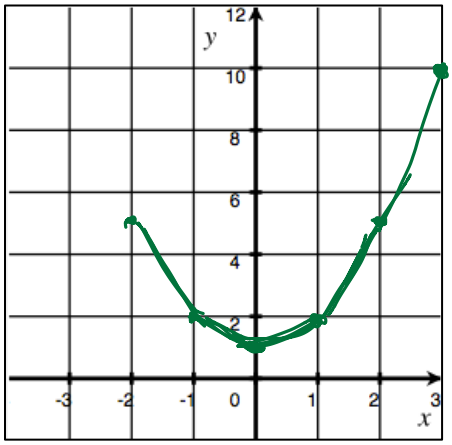
PRACTICE:

Generate the appropriate output based on the code:

Declare x real
Let $f(x) = x^2 + 1$
Initialize G as { }
For all x such that $-2 \leq x \leq 3$
    Append $(x, f(x))$ to G
Next x.
Plot G.



What is the input value for each step of the 'for next' loop?

The number x Placeholder

What is the domain?

$-2 \leq x \leq 3$

What is the range?

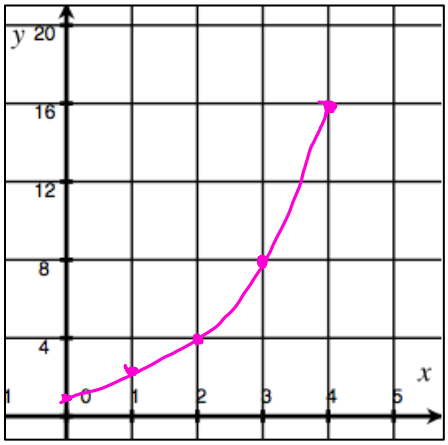
$1 \leq f(x) \leq 10$

Can we write the set of ordered pairs for the graph of f? No! Too many points

$(-2,5), (-1,2), (0,1), (1,2), (2,5)$

$(3,10)$

Declare x real
Let $f(x) = 2^x$ Exponential GROWTH
Initialize G as { }
For all x such that $0 \leq x \leq 4$
    Append $(x, f(x))$ to G
Next x.
Plot G.



What is the output value for each step in the 'for next' loop?

The number f(x)

What is the domain?

$0 \leq x \leq 4$

What is the range?

$1 \leq f(x) \leq 16$

Can we write the set of ordered pairs for the graph of f?

No! Too many!

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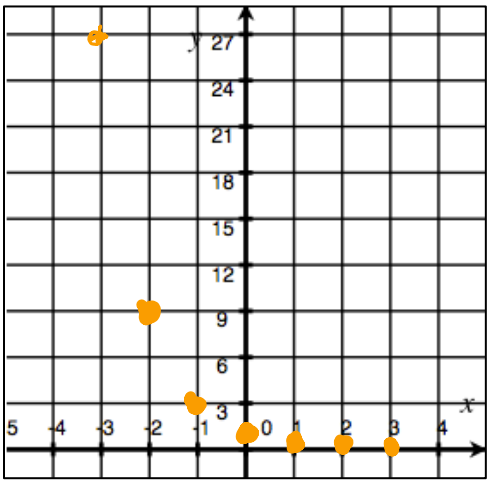
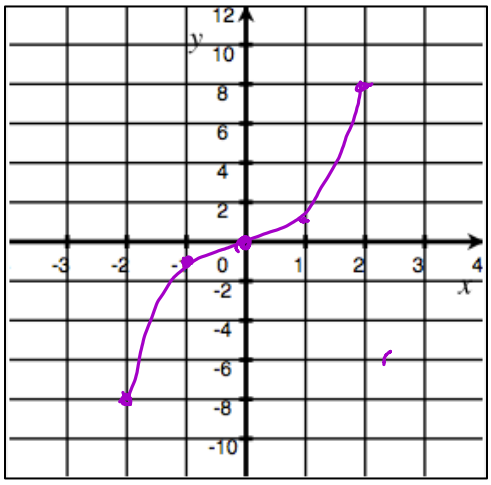
Declare x integer
Let $f(x) = 3^{-x}$ EXPONENTIAL DECAY
Initialize G as $\{\}$
For all x such that $-3 \leq x \leq 3$
Append $(x, f(x))$ to G
Next x.
Plot G. $\{(-3,27),(-2,9),(-1,3),(0,1),(1,\frac{1}{3}),(2,\frac{1}{9}),(3,\frac{1}{27})\}$



Declare x real
Let $f(x) = x^3$
Initialize G as $\{\}$
For all x such that $-2 \leq x \leq 2$
Append $(x, f(x))$ to G
Next x.
Plot G. $f(-2) = -8$
$f(-1) = -1$



Declare x integer
Let $f(x) = 3 \cdot 2^x$
Initialize G as $\{\}$
For all x such that $0 \leq x \leq 6$
Append $(x, f(x))$ to G
Next x.
Print G.

$G = \{(0,3),(1,6),(2,12),(3,24),(4,48),(5,96),(6,192)\}$

Declare x integer
Let $f(x) = 2x - 5$
For all x such that $0 \leq x \leq 3$
Print $f(x)$
Next x.

$\{-5,-3,-1,1\}$

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Independent Practice:

Closure:
Give out exit ticket?

Notes:
This maps to lesson 11 from ENY Module 3, Alg 1.