Welcome Back MYP Math 9!

	Assignment Effort Grade (Circle One)	Comments (What was interesting or challenging?)
Monday Date: 2/12 Topic: Nothing due... Index Laws Quiz was Friday!	0 1 2	
Tuesday Date: _____ Topic: _____	0 1 2	
Wednesday Date: _____ Topic: _____	0 1 2	
Thursday Date: _____ Topic: _____	0 1 2	
Friday Date: _____ Topic: _____	0 1 2	

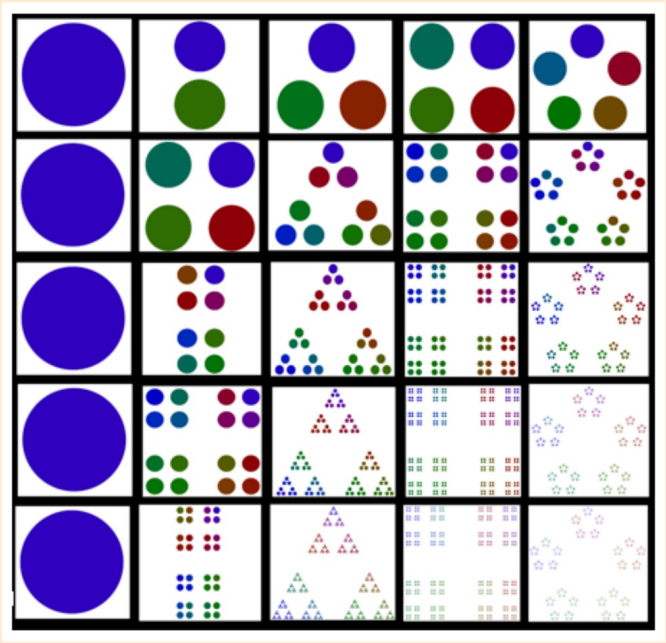
Class Plan:

1. Warm-up
2. Exponential Visual

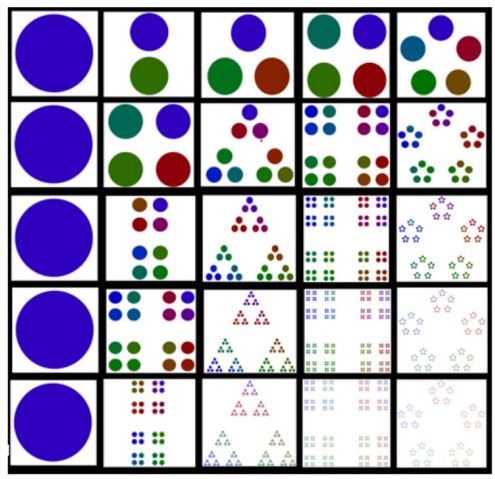
   https://saravanderwerf.com/2016/10/30/visualizing-exponential-power-logarithmic-functions/

3. Exponential Equations & Graphs

What do you notice?

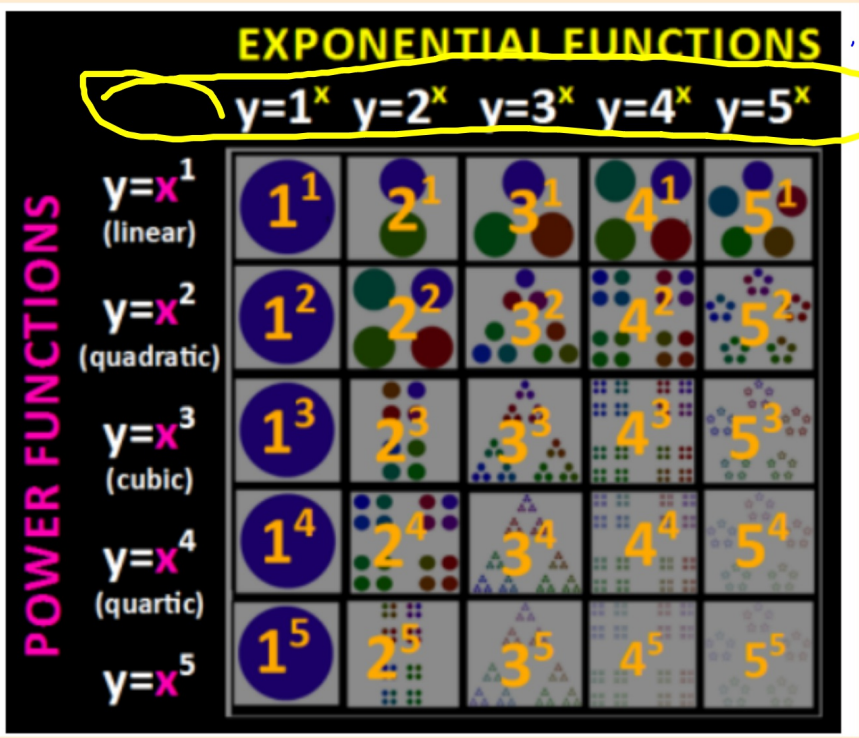


What do you notice?

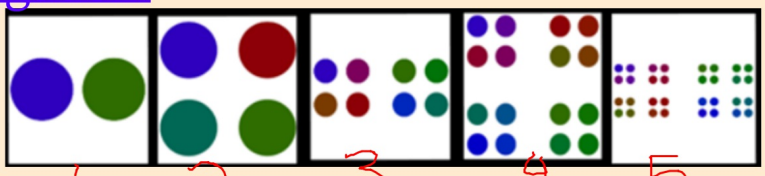


.1	.2	.3	.4	.5
1	2	3	4	5
1		9		
1	8	27		
1				
1				


1 Power
2 Power
3 Power
4 Power
1 2 3 4 5
1 4 9 16 25
1 8 27 64 125
1 16 81 256 625
1 32 243 1024 3125
1^1 2^1 3^1 4^1 5^1
1^2 2^2 3^2 4^2 5^2
1^3 2^3 3^3 4^3 5^3
1^4 2^4 3^4 4^4 5^4
1^5 2^5 3^5 4^5 5^5


EXPONENTIAL FUNCTIONS
y=1^x y=2^x y=3^x y=4^x y=5^x
POWER FUNCTIONS
y=x^1 (linear)
y=x^2 (quadratic)
y=x^3 (cubic)
y=x^4 (quartic)
y=x^5

Investigation:



Word description:

How can the next stage be created?

Multiply by 2 repeatedly.

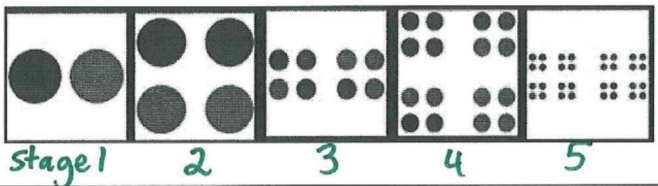
2, 4, 8, 16, 32.....

Investigation:

Word description:

Representations of an Exponential Pattern

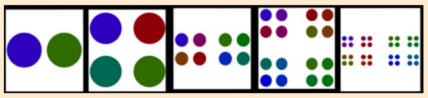
Dot Pattern:



Word Description (How can the next stage be created?):

64 dots, adding 32 dots to stage 5 for stage 6.

Investigation:

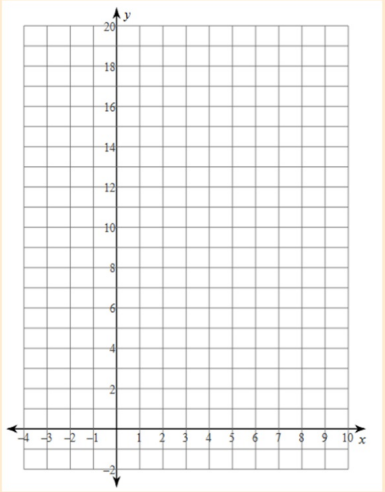


Do: 1) Complete pattern in table.

2) Graph pattern.

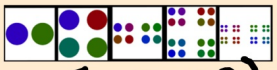
Table:

x (Stage in pattern)	y (Number of Dots)
-3	
-2	
-1	
0	
1	
2	
3	
4	
5	



Done?: Write equation and make predictions

Investigation:

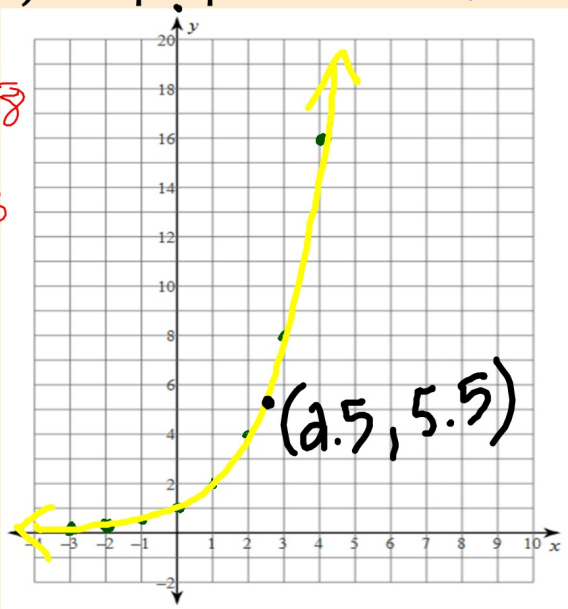


Do: 1) Complete pattern in table.

2) Graph pattern.

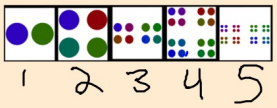
Table:

x (Stage in pattern)	y (Number of Dots)
-3	$\frac{1}{2^3} = 2^{-3} = .125 = \frac{1}{8}$
-2 $\frac{1}{4}$	$\frac{1}{2^2} = 2^{-2} = .25$
-1	$\frac{1}{2} = 2^{-1} = \frac{1}{2^1} = .5$
0	1 y-int.
1	2
2	$4 = 2 \cdot 2 = 2^2$
3	$8 = 2 \cdot 2 \cdot 2 = 2^3$
4	$16 = 2^4$
5	$32 = 2^5$



Investigation:

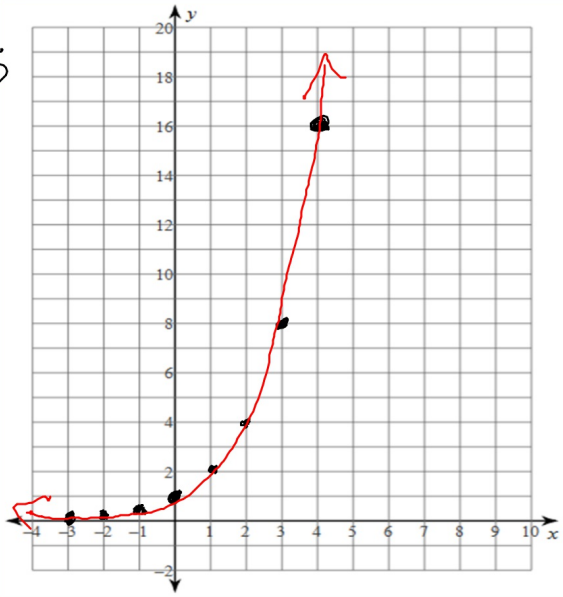
Do: 1) Complete pattern in table.



2) Graph pattern.

Table:

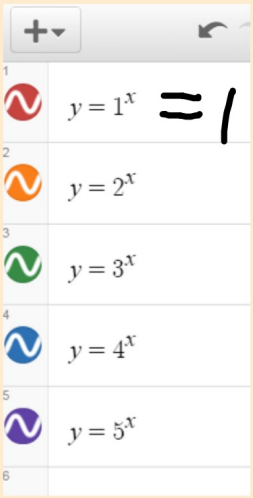
x (Stage in pattern)	y (Number of Dots)
-3	$2^{-3} = \frac{1}{2^3} = \frac{1}{8} = .125$
-2	$2^{-2} = \frac{1}{2^2} = \frac{1}{4} = .25$
-1	$2^{-1} = \frac{1}{2^1} = .5$
0	$2^0 = 1$
1	2
2	$4 = 2 \cdot 2 = 2^2$
3	$8 = 2 \cdot 2 \cdot 2 = 2^3$
4	$16 = 2 \cdot 2 \cdot 2 \cdot 2 = 2^4$
5	$2^5 = 32$

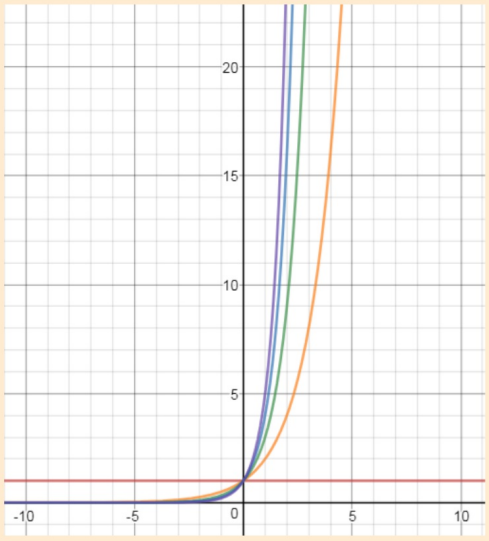


B EXPONENTIAL FUNCTIONS

An **exponential function** is a function in which the variable occurs as part of the index or exponent.

Examples of exponential functions are $y = 5^x$, $y = 3^{x+1}$, and $y = 2^{-x} - 6$.





B | NOTES :) EXPONENTIAL FUNCTIONS

What is an exponential equation?

$$y = a \cdot b^x$$

What are the parts of the equation?

a: The starting, *initial* value.

The value when x = 0 y-intercept: a

b: The constant multiplier, the value being multiplied repeatedly

C GRAPHS OF EXPONENTIAL FUNCTIONS

What is a graph of an exponential function?

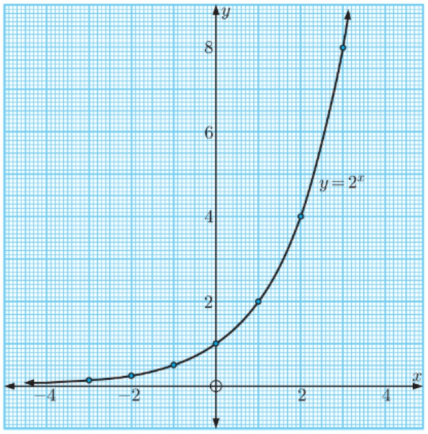
One of the simplest exponential functions is $y = 2^x$. To help graph the function, we can construct a **table of values**.

x	-3	-2	-1	0	1	2	3
y	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	1	2	4	8

When $x = -3$, $y = 2^{-3} = \frac{1}{8}$

When $x = 0$, $y = 2^0 = 1$

When $x = 3$, $y = 2^3 = 8$



To the left of the y-axis, the graph gets closer to the x-axis but always lies above it. We say that the graph of $y = 2^x$ is **asymptotic** to the x-axis, or the x-axis is a **horizontal asymptote** of the graph.

To the right of the y-axis, the graph becomes very steep as the x values increase.

We can use the graphs of exponential functions to estimate the value of numbers raised to **decimal** powers. We can also use them to help solve exponential equations such as $2^x = 5$, which cannot easily be solved by equating indices.

Building the equation:

(a) How many dots at stage zero? 1

(b) What value is being multiplied? 2

Equation: $y = 1 \cdot 2^x = 2^x$

Equation: $y = 2^x$

x: stage
y: number of dots

(What does "y" equal in relation to "x"? How can I use the input to get an output?)

x: Stage

y: number of dots.

Table:

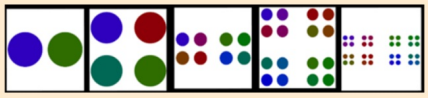
x (Stage in pattern)	y (Number of Dots)
-3	$\frac{1}{8}$
-2	$\frac{1}{4}$
-1	$\frac{1}{2}$
0	1
1	2
2	4
3	8
4	16
5	32

Joke break!


OF COURSE IT'S MONDAY...
...DOES THIS LOOK LIKE MY FRIDAY FACE?


EVERYBODY HATES ME
MOZART

Investigation:



2) Model the pattern with an equation.

$$y = a \cdot b^x$$

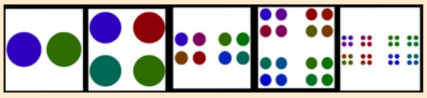
a = 1
b = 2

Equation: $y = 2^x$

x: Stage
y: number of dots

(What does "y" equal in relation to "x"? How can I use the input to get an output?)

C GRAPHS OF EXPONENTIAL FUNCTIONS



Use pattern, graph, table, and/or equation to make predictions.

Solve for number of dots (y-value):

1. How many dots are in stage 4? look! Ko	2. How many dots will be in stage 6? Stage 5 = 32 32 · 2 = 64
3. How many dots will be in stage 10?	4. Approximately, how many dots would be in stage 2.5? $2^{2.5} = 5.65$

C GRAPHS OF EXPONENTIAL FUNCTIONS

Use pattern, graph, table, and/or equation to make predictions.

Solve for stage in the pattern (x-value):

5. What stage has 16 dots?	6. When will there be 128 dots in the pattern?
7. When will there be 4096 dots in the pattern?	8. Approximately, when will there be about 23 dots in the pattern?

C GRAPHS OF EXPONENTIAL FUNCTIONS

Use pattern, graph, table, and/or equation to make predictions.

Predictions: Show work or explain how you solved. You may use the description, table, graph, or equation.

Solve for number of dots (y-value):

1. How many dots are in stage 4? 16 $y = 2^4 = 2 \cdot 2 \cdot 2 \cdot 2 = 16$	2. How many dots will be in stage 6? $y = 2^6$ 64 $2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 =$ [redacted] dots!
3. How many dots will be in stage 10? $y = 2^{10}$ $2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$ 1024 = [redacted]	4. Approximately, how many dots would be in stage 2.5? $y = 2^{2.5} \approx 5.7$ dots [Somewhere between stage 2 + 3 so between 4 + 8 dots]

C GRAPHS OF EXPONENTIAL FUNCTIONS

Solve for stage in the pattern (x-value): *Use pattern, graph, table, and/or equation to make predictions.*

5. What stage has 16 dots?

Stage 4! I looked back at the pattern!

6. When will there be 128 dots in the pattern?

Stage 7. From #2 above I know 64 is stage 6.
$64 \times 2 = 128$, so $y = 2^7 = 128$.

7. When will there be 4096 dots in the pattern? (12th stage)

$4096 = 4(1024) = 2 \cdot 2 \cdot 1024$
This means 2 stages after stage 10.
$y = 2^{12} = 4096$

8. Approximately, when will there be about 23 dots in the pattern?

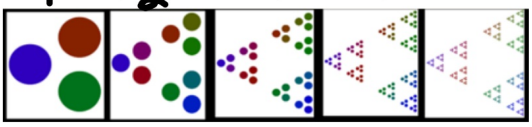
Between stage 4 and 5.
About stage 4.5.
$2^{4.5} \approx 22.6$ dots.

Exercises: Explore the 3-dot pattern!

EXERCISES - Unit 5: Exponentials Name_____

Representations of an Exponential Pattern

Dot Pattern:



Word Description (How can the next stage be created?):

Afterschool
Ms. BERG

Table:

x (Stage in pattern)	y (Number of Dots)
-3	
-2	
-1	
0	
1	
2	
3	
4	
5	

Graph: