Graphing Exponential Functions

Apr. 4/2012

Part A: Compare the graphs of $y = 2x$

$y = x^2$

$y = 2^x$

Table of Values:

$y = 2x$

x	y	Δy
-2	-4	
-1	-2	2
0	0	2
1	2	2
2	4	2
3	6	2

$y = x^2$

x	y	Δy	$\Delta^2 y$
-2	4		
-1	1	-3	
0	0	-1	2
1	1	1	2
2	4	3	2
3	9	5	2

$y = 2^x$

x	y	Δy	$\frac{y_2}{y_1}$
-2	0.25		
-1	0.5	0.25	2
0	1	0.5	2
1	2	1	2
2	4	2	2
3	8	4	2

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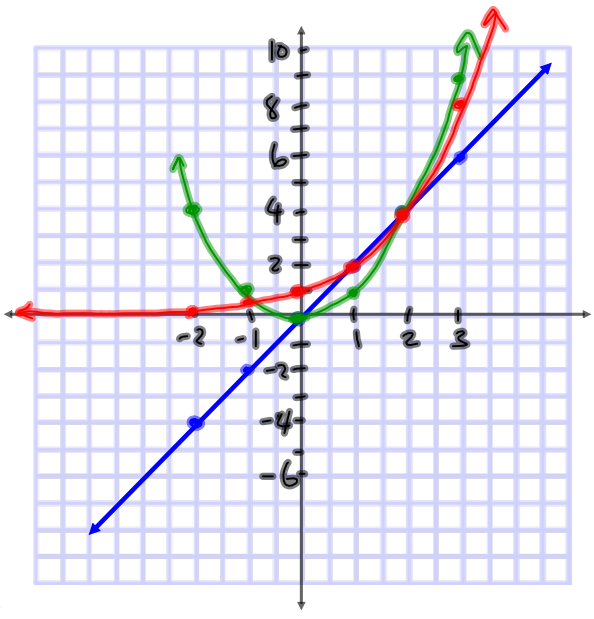
Graph $y = 2x$

$y = x^2$

$y = 2^x$



*use a different colour for each

Properties of $y = 2^x$

- always increasing, and $y > 0$
- y-int of 1

$\Rightarrow$ asymptote at $y = 0$

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Part B: TOV and graph: 1. $y = 3^x$

2. $y = 4^x$

$y = 3^x$

x	y	Δy	$\Delta^2 y$	$\frac{y_2}{y_1}$
-2	$\frac{1}{9} \div 0.11$			
-1	$\frac{1}{3} \div 0.33$			3
0	1			3
1	3			3
2	9			3
3	27			3

$y = 4^x$

x	y	Δy	$\Delta^2 y$	$\frac{y_2}{y_1}$
-2	$\frac{1}{16} = 0.0625$			
-1	$\frac{1}{4}$			4
0	1			4
1	4			4
2	16			4
3	64			4

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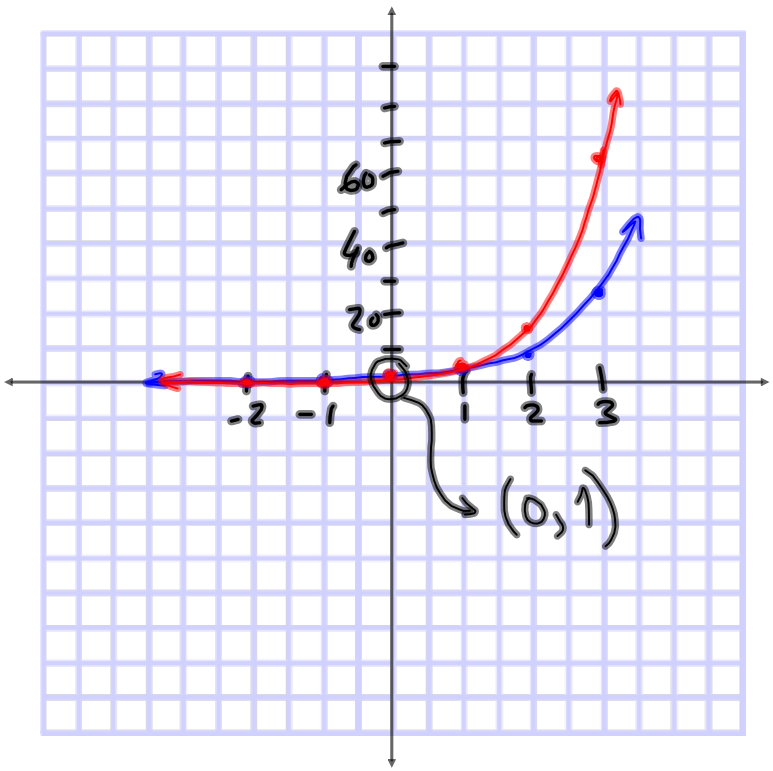
Graph 1. $y = 3^x$

2. $y = 4^x$



* note that both graphs have a y-int of 1.

both are increasing

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Part B: TOV and graph:

3. $y = \left(\frac{1}{2}\right)^x$

4. $y = \left(\frac{1}{3}\right)^x$

$y = \left(\frac{1}{2}\right)^x$

x	y
-2	4
-1	2
0	1
1	0.5
2	0.25
3	0.125

$y = \left(\frac{1}{3}\right)^x$

x	y
-2	9
-1	3
0	1
1	0.33
2	0.11
3	1/27

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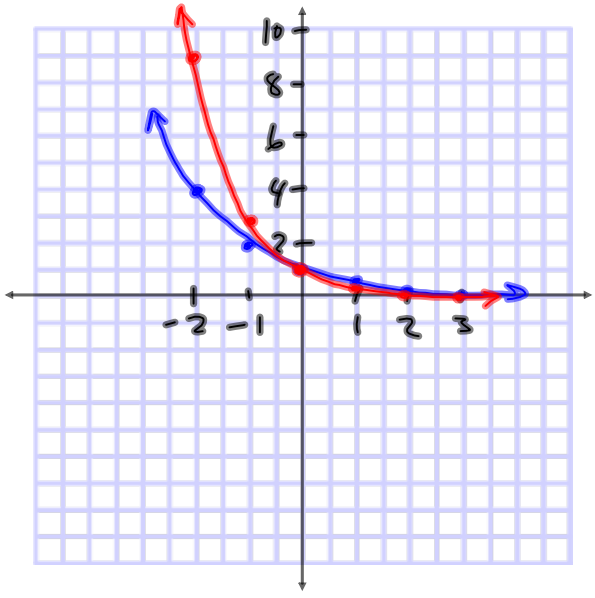
Graph 3. $y = \left(\frac{1}{2}\right)^x$

4. $y = \left(\frac{1}{3}\right)^x$



y-int = 1

asymptote at y = 0

decreasing

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What do you notice when the base is greater than 1?

increasing
asymptote at $y=0$
y-int = 1

$y=2^x$
$y=5^x$
$y=1.1^x$

What do you notice when the base is between 0 and 1?

decreasing
asymptote at $y=0$
y-int = 1.

$y=\left(\frac{1}{2}\right)^x$
$y=(0.33)^x$
$y=(0.999)^x$

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Part B: TOV and graph:

5. $y=\left(\frac{1}{4}\right)^x$
6. $y=4^{-x}$

$y=\left(\frac{1}{4}\right)^x$

$y=4^{-x}$
$=\frac{1}{4^x}$
$=\left(\frac{1}{4}\right)^x$

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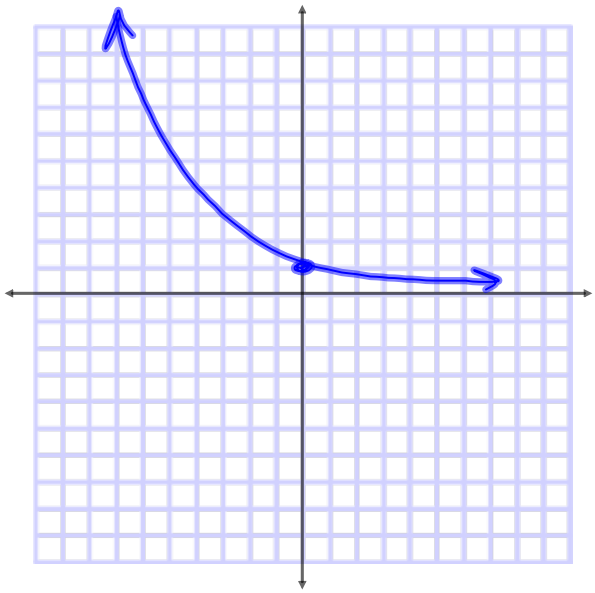
Graph 5. $y = \left(\frac{1}{4}\right)^x$

6. $y = 4^{-x}$



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What conclusion can you draw about negative exponents?

same as having a fraction with a positive exponent $4^{-x} = \left(\frac{1}{4}\right)^x$

Compare $y = 2^x$

$y = \left(\frac{1}{2}\right)^x$

$y = 2^{-x}$

What point do they have in common? Why?

all have same y-intercept (0, 1)

$a^0 = 1,\ a \neq 0$

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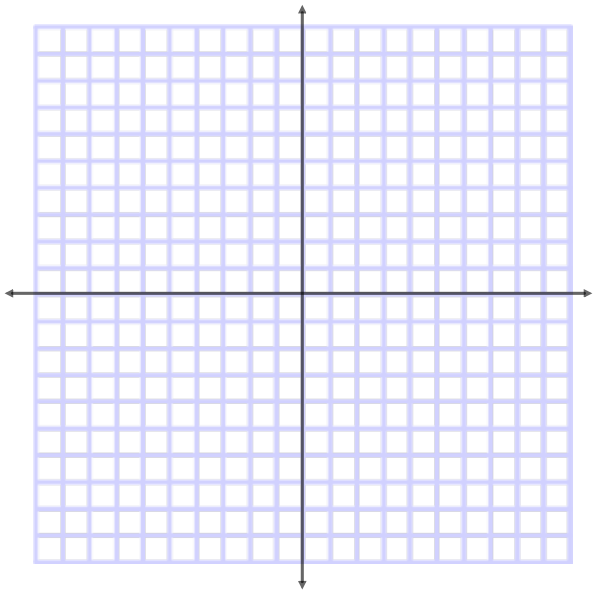
Graph 7. $y = 1^x$

8. $y = 0^x$

9. $y = (-2)^x$



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