Are there any Homework Questions you would like to see on the board?

p. 415 # 1, 2cef, 3, 6, 7, 9 – 12, 14, 15
p. 419 # 1 – 8

9a

Today's Learning Goal(s):

By the end of the class, I will be able to:

a) Examine the features of exponential functions and compare them with the graphs of linear and quadratic functions.
b) Graph an exponential function (growth and decay).

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9. Write each expression using powers, then simplify. Evaluate your simplified expression.

a) $\frac{\sqrt{200}}{\sqrt{2}}$

$= \frac{(200)^{\frac{1}{2}}}{(2)^{\frac{1}{2}}}$

$= \left(\frac{200}{2}\right)^{\frac{1}{2}}$

$= 100^{\frac{1}{2}}$

$= \sqrt{100}$

$= 10$

$b^{\frac{m}{n}} = \left(\sqrt[n]{b}\right)^m$

$9^{\frac{1}{2}} = \sqrt[2]{9} = 3$

$2^5 = 2^3 \times 2^2$

$a^{m \times n} = (a^m)^n$

$\frac{a^m}{b^m} = \left(\frac{a}{b}\right)^m$

a) $\frac{\sqrt{200}}{\sqrt{2}}$

$= \sqrt{200} \div \sqrt{2}$

$= \sqrt{200 \div 2}$

$= \sqrt{100}$

$\sqrt{a} \times \sqrt{b} = \sqrt{a \times b}$

$\sqrt{4} \times \sqrt{9} = \sqrt{4 \times 9} = \sqrt{36} = 6$

$\sqrt{x} + \sqrt{x} = 2\sqrt{x}$

$y + y = 2y$

$2\sqrt{3} + 5\sqrt{3} = 7\sqrt{3}$

MCF 3MI

7.5 Exploring the Properties of Exponential Functions

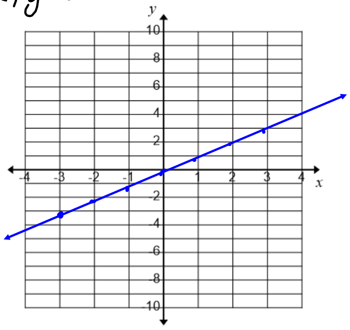
Comparing Linear, Quadratic and Exponential Functions

Date: May 16/18

A) Linear $g(x) = x$ Other examples: $y=x$ $y=x^2$ $y=2^x$

$y=3x$; $y=5x-2$

x	$g(x)=x$	1st diff.	2nd diff.
-3	-3	$-2-(-3)=1$	$1-1=0$
-2	-2	$-1-(-2)=1$	$1-1=0$
-1	-1	$0-(-1)=1$	$1-1=0$
0	0	$1-0=1$	
1	1	$2-1=1$	
2	2	$3-2=1$	
3	3		



$\because$ the 1st difference are constant

$\therefore$ the table represents a linear relation

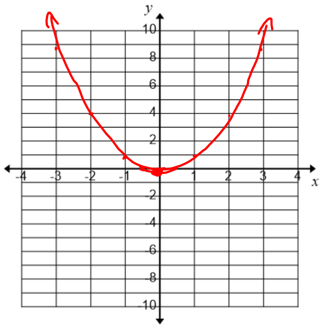
Domain: $\{x \in \mathbb{R}\}$

Range: $\{y \in \mathbb{R}\}$

B) Quadratic $h(x) = x^2$ Other examples: $y=2x^2$, $y=3(x-4)^2+7$

$=(\ )^2$

x	$h(x)=x^2$	1st diff.	2nd diff.
-3	$(-3)^2 = 9$	$4-9=-5$	$-3-(-5)=2$
-2	4	$1-4=-3$	$1-(-3)=2$
-1	1	$0-1=-1$	$1-(-1)=2$
0	0	$1-0=1$	$3-1=2$
1	1	$4-1=3$	$5-3=2$
2	4	$9-4=5$	
3	9		



$\because$ 2nd difference are constant

$\therefore$ the table represents a quadratic relation.

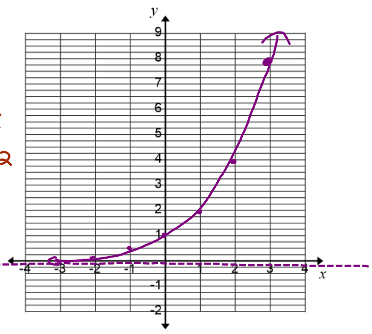
Domain: $\{x \in \mathbb{R}\}$

Range: $\{y \in \mathbb{R} \mid y \geq 0\}$

C) Exponential $f(x) = b^x$ Other examples: $y=3^x$, $y=2(3^x)$

x	$f(x)=2^x$	1st diff.	2nd diff.	y-ratio
-3	$2^{(-3)} = \frac{1}{8}$	$\frac{1}{4}-\frac{1}{8}=\frac{1}{8}$	$\frac{1}{8}$	
-2	$2^{-2} = \frac{1}{4}$	$\frac{1}{2}-\frac{1}{4}=\frac{1}{4}$	$=\frac{1}{4}$	
-1	$2^{-1} = \frac{1}{2}$	$1-\frac{1}{2}=\frac{1}{2}$	$1-\frac{1}{2}=\frac{1}{2}$	$\frac{1}{2} \div \frac{1}{4} = \frac{1}{2} \times \frac{4}{1} = 2$
0	$2^0 = 1$	$2-1=1$	$2-1=1$	$\frac{2}{1}=2$
1	$2^1 = 2$	$4-2=2$	$4-2=2$	$\frac{4}{2}=2$
2	$2^2 = 4$	$8-4=4$		
3	$2^3 = 8$			

H.A. $y=0$



horizontal asymptote

$\because$ y ratios are constant

$\therefore$ the table is exponential

Domain: $\{x \in \mathbb{R}\}$

Range: $\{y \in \mathbb{R} \mid y > 0\}$

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

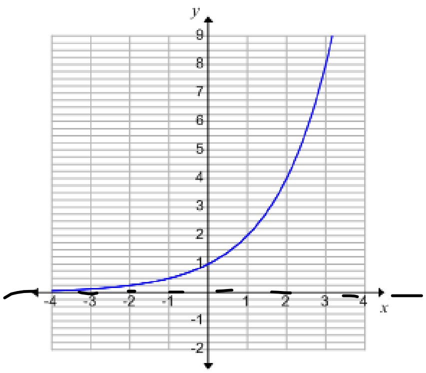
$2^{-2} = \left(\frac{1}{2}\right)^2 = \frac{1}{4}$

$2^{-3} = \left(\frac{1}{2}\right)^3 = \frac{1}{8}$

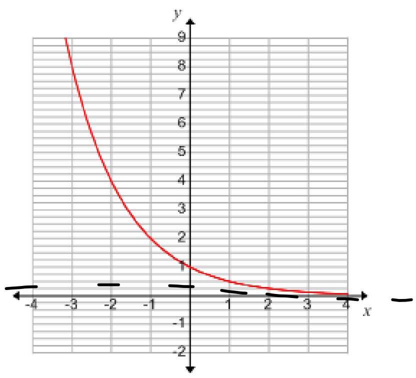
The exponential function $f(x)=b^x$ has the following characteristics:

- it is defined if $b>0$ and $b\neq 1$ [$b>0$ means that the base MUST be positive]
- it has a y-intercept of 1
- it has a horizontal *asymptote*, which is the x-axis
- If $b>1$, the greater the value, the faster the growth
- If $0<b<1$, the lesser the value, the faster the decay
- Domain: $\{x\in R\}$
- Range: $\{y\in R \mid y>0\}$

Exponential Growth: $f(x)=b^x$, $b>1$



Exponential Decay: $f(x)=b^x$, $0<b<1$



What are some real-life examples of where these functions exist?

Compound Interest
Cell growth
Bacteria growth
Population growth
Radioactive decay

Ex. 1: Use each table of values to identify each function as linear, quadratic or exponential.
Justify your answer using difference tables.

a)

x	y	FD
-2	-7	
		$-4-(-7)=3$
-1	-4	
		$-1-(-4)=3$
0	-1	
		$2-(-1)=3$
1	2	
		$5-2=3$
2	5	

$\therefore$ First Differences are constant
$\therefore$ the table represent a linear function.

b)

x	y	FD	SD
-2	-2		
		$.5-(-2)=1.5$	
-1	-0.5		$0.5-1.5=-1$
		$0-(-.5)=0.5$	
0	0		$-0.5-0.5=-1$
		$-0.5-0=-0.5$	
1	-0.5		$-1.5-(-0.5)=-1$
		$-2-(-0.5)=-1.5$	
2	-2		

$\therefore$ the 2nd diff are constant
$\therefore$ the table represent a quadratic.

c)

x	y	FD	y ratios
-2	0.25		
		$0.5-0.25=0.25$	$\frac{0.5}{0.25}=2$
-1	0.5		
		$1-0.5=0.5$	$\frac{1}{.5}=2$
0	1.0		
		$2-1=1$	$\frac{2}{1}=2$
1	2.0		
		$4-2=2$	
2	4.0		

$\therefore$ the y-ratios are constant
$\therefore$ the table represents an exponential

Today's Homework:

READ p. 422 "In Summary" **AND**
Complete p. 423 # 1, 3