Date: _____

Today's Learning Goal(s):

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

a) describe the characteristics of the graphs and equations of exponential functions.

Last day's work:

pp. 235-237 #(1 – 2)ace, 3, (4 – 9)ace [14]

Review p. 239

5 a c e

6 c e

9 c

8 a c

p. 236 **5.** Simplify. Express answers with positive exponents.

a) $(3xy^4)^2(2x^2y)^3$

$= (3)^2(x)^2(y^4)^2(2)^3(x^2)^3(y^1)^3$

$= 9x^2y^8 \cdot 8x^6y^3$

$= 72x^{2+6}y^{8+3}$

$= 72x^8y^{11}$

c) $\dfrac{(10x)^{-1}y^3}{15x^3y^{-3}}$

$= \dfrac{10^{-1}(x^{-1})y^3}{15x^3y^{-3}}$

$= \dfrac{1}{10}\cdot\dfrac{1}{15}x^{-1-3}y^{3-(-3)}$

$= \dfrac{1}{150}x^{-4}y^6$

$= \dfrac{y^6}{150x^4}$

e) $\dfrac{p^{-5}(r^3)^2}{(p^2r)^2(p^{-1})^2}$

$= \dfrac{p^{-5}r^6}{p^4r^2p^{-2}}$

$= p^{-5-4-(-2)}r^{6-2}$

$= p^{-7}r^4$

$= \dfrac{r^4}{p^7}$

p. 236 **6.** Simplify. Express answers with positive exponents.

c) $\dfrac{\sqrt{25m^{-12}}}{\sqrt{36m^{10}}}$

$= \dfrac{(25m^{-12})^{\frac{1}{2}}}{6(m^{10})^{\frac{1}{2}}}$

$= \dfrac{25^{\frac{1}{2}}(m^{-12})^{\frac{1}{2}}}{6m^5}$

$= \dfrac{\sqrt{25}\,m^{-6}}{6m^5}$

$= \dfrac{5m^{-6}}{6m^5}$

$= \dfrac{5}{6}m^{-6-5}$

$= \dfrac{5}{6}m^{-11}$

$= \dfrac{5}{6m^{11}}$

e) $\left(\dfrac{(32x^5)^{-2}}{(x^{-1})^{10}}\right)^{0.2}$

$= \left(\dfrac{32^{-2}x^{-10}}{x^{-10}}\right)^{\frac{2}{10}}$

$= \left(\dfrac{1}{32^2}\cdot x^{-10-(-10)}\right)^{\frac{1}{5}}$

$= \left(\dfrac{1}{32^2}x^0\right)^{\frac{1}{5}}$

$= \left(\dfrac{1}{32^2}\right)^{\frac{1}{5}}$

$= \dfrac{1}{(\sqrt[5]{32})^2}$

$= \dfrac{1}{2^2}$

$= \dfrac{1}{4}$

1024

$= \left(\dfrac{1}{1024}\right)^{\frac{1}{5}}$

$= \dfrac{1}{\sqrt[5]{1024}}$

$= \dfrac{1}{4}$

p. 237

8. Evaluate. Express answers in rational form with positive exponents.

a) $(\sqrt{10\,000x})^{\frac{3}{2}}$ for $x = 16$

$= (100x^{\frac{1}{2}})^{\frac{3}{2}}$

$= 100^{\frac{3}{2}}(x^{\frac{1}{2}})^{\frac{3}{2}}$

$= (2\sqrt{100})^3 (x^{\frac{3}{4}})$

$= 10^3 (16)^{\frac{3}{4}}$

$= 1000 (\sqrt[4]{16})^3$

$= 1000(2)^3$

$= 1000(8)$

$= 8000$

c) $(-2a^2b)^{-3}\sqrt{25a^4b^6}$ for $a = 1, b = 2$

$= (-2)^{-3}(a^2)^{-3}(b)^{-3}(5)(a^4)^{\frac{1}{2}}(b^6)^{\frac{1}{2}}$

$= \frac{1}{(-2)^3} a^{-6} b^{-3} \cdot 5 a^2 b^3$

$= \frac{1}{-8} a^{-6+2} b^{-3+3} (5)$

$= \frac{5}{-8} a^{-4} b^0$

$= -\frac{5}{8}(1)^{-4}(1)$

$= -\frac{5}{8}$

p. 237 **9.** Simplify. Express answers in rational form with positive exponents.

c) $\left(\frac{\sqrt{64a^{12}}}{(a^{1.5})^{-6}}\right)^{\frac{2}{3}}$

$= \left(\frac{(64a^{12})^{\frac{1}{2}}}{(a^{\frac{3}{2}})^{-6}}\right)^{\frac{2}{3}}$

$= \frac{\left((64a^{12})^{\frac{1}{2}}\right)^{\frac{2}{3}}}{\left((a^{\frac{3}{2}})^{-6}\right)^{\frac{2}{3}}}$

$= \frac{(64a^{12})^{\frac{1}{3}}}{(a^{\frac{3}{2}})^{-4}}$

$= \frac{64^{\frac{1}{3}}(a^{12})^{\frac{1}{3}}}{a^{-6}}$

$= \sqrt[3]{64}\, a^4 \div a^{-6}$

$= 4a^{4-(-6)}$

$= 4a^{10}$

4.5 Exploring Properties of Exponential Functions

Date: Oct 28

p. 240 Invesgate – students complete A – E individually (or in pairs).

A. $g(x) = x$

x	y
-3	-3
-2	-2
-1	-1
0	0
1	1
2	2
3	3
4	4
5	5

1st diff

$-2-(-3)=1$, $-1-(-2)=1$, $0-(-1)=1$, $1-0=1$

$h(x) = x^2$

x	y
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9
4	16
5	25

FD. SD.

$4-9=-5$, $1-4=-3$, $0-1=-1$, $1-0=1$

$-3-(-5)=2$, $-1-(-3)=2$, $1-(-1)=2$

$k(x) = 2^x$

x	y
-3	1/8
-2	¼
-1	½
0	1
1	2
2	4
3	8
4	16
5	32

$\frac{1}{4}-\frac{1}{8}=\frac{1}{8}$, $\frac{1}{2}-\frac{1}{4}=\frac{1}{4}=2$, $1-\frac{1}{2}=\frac{1}{2}$, $2-1=1$

y-ratio

$\frac{1}{4}\div\frac{1}{8}=\frac{1}{4}\times\frac{8}{1}=2$, $\frac{1}{2}\div\frac{1}{4}=\frac{1}{2}\times\frac{4}{1}=2$

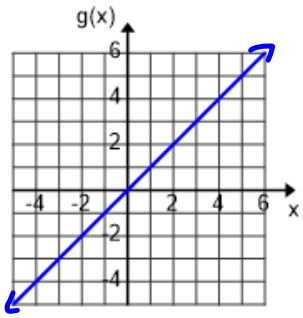
B. $g(x)$ → first differences are equal

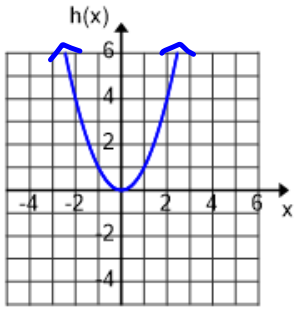
$h(x)$ → second differences are equal

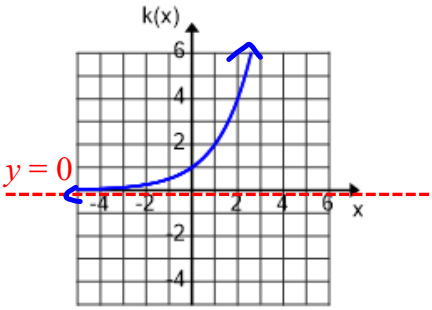
$k(x)$ → ratio of successive y-values are equal

use first differences to eliminate translation?

C.







D.

$D = \{x \in \mathbb{R}\}$, $R = \{y \in \mathbb{R}\}$

$D = \{x \in \mathbb{R}\}$, $R = \{y \in \mathbb{R} \mid y \geq 0\}$

$D = \{x \in \mathbb{R}\}$, $R = \{y \in \mathbb{R} \mid y > 0\}$

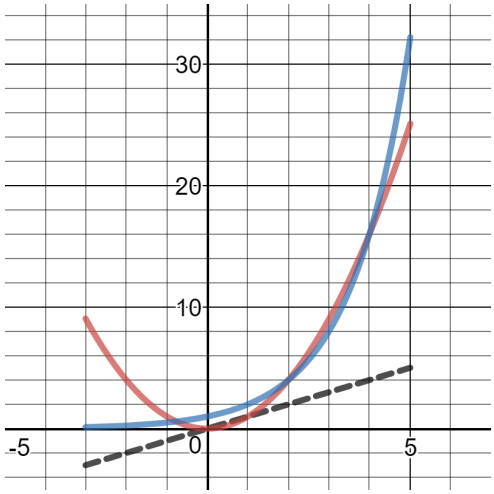
E. $g(x)$ → as independent variable (x) increases, the dependent variable (y) also increases at a consistent rate

$h(x)$ → as independent variable (x) increases, the dependent variable (y) decreases until $x = 0$ and then increases

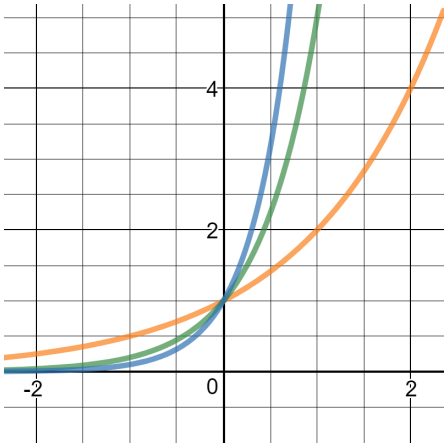
$k(x)$ → as independent variable (x) increases, the dependent variable(y) also increases, slowly at first and then quickly.

Show with DESMOS?

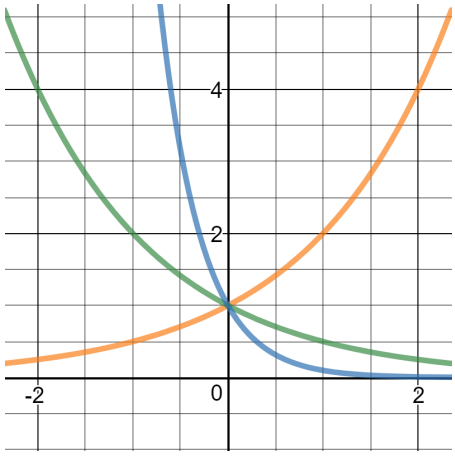
C https://www.desmos.com/calculator/dcbvlufgmb



F https://www.desmos.com/calculator/snogpkesaw

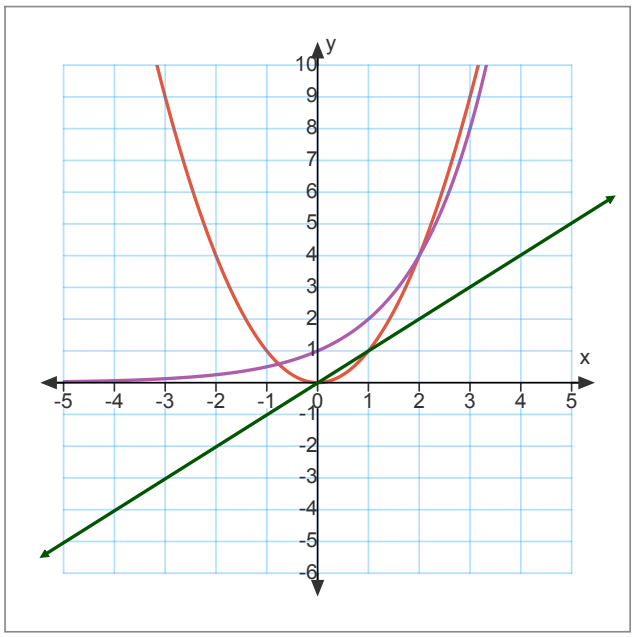


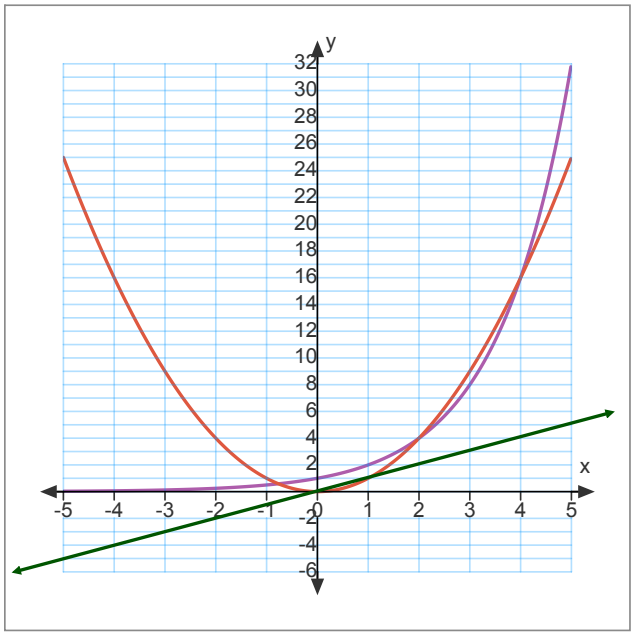
I https://www.desmos.com/calculator/yabmbc4wcd



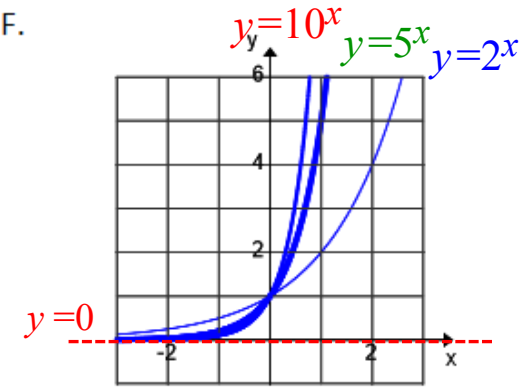
$y = x$ $y = x^2$ $y = x^2$ $y = 2^x$

$y = 2^x$





F.

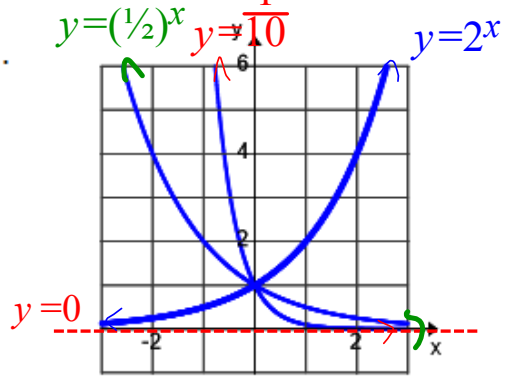


Reminder:
Asymptotes MUST always be drawn and labelled.

G. For all 3 functions, D = $\{x \in \mathbb{R}\}$ and R = $\{y \in \mathbb{R} \mid y>0\}$.
The y-intercept = 1, there are no x-intercepts,
and there is a Horizontal Asymptote [H.A.] at $y = 0$ (x-axis).

H. $y = 10^x$ increases fastest, and $y = 2^x$ has the slowest rate of increase.

I.



J. All properties remain the same as G.

K. As the values of x increase the graphs with fractional bases decrease (decay).

Summary: Properties of $y = b^x$

- b > 0 , $b \neq 1$
- y-int = 1
- H.A.: y = 0 (x-axis) [Horizontal Asymptote]
- D = $\{x \in \mathbb{R}\}$
- R = $\{y \in \mathbb{R} \mid y > 0\}$
- Increasing when b > 1 (growth)
- The greater the value of b, the faster the growth
- Decreasing when 0 < b < 1 (decay)
- Equal ratios of successive y-values

For tomorrow, think about the general form of $y = a(b^x) + c$
and how the values of a and c relate to the graphs we drew today.

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

Last day's work:

pp. 235-237 #(1 – 2)ace, 3, (4 – 9)ace [14]

Review p. 239

Today's Homework Practice includes:

pp. 240-241 A - P

READ p. 242

p. 243 #1, 2