Spiral Review

Determine the transformations.

1.) $f(x) = -3(x-4)^2 - 1$

reflection over x-axis
vertical stretch
down 1
right 4

2.) $f(x) = (-2x)^3 + 3$

horizontal shrink
up 3
reflection over y-axis

3.1-3.3 Exponential and Logarithmic Functions

Transformations for Exponential Functions: $f(x) = a^x$

$f(x) = 3^{(x+2)}$

left 2

$f(x) = 3^x - 2$

down 2

$f(x) = -3^x$

reflection over x-axis

$f(x) = 3^{-x}$

reflection over the y-axis

Where would I find the horizontal asymptotes?*
Where would I find the vertical asymptotes?**

*exponential functions (shift up/down)
** logarithmic functions (shift right/left)

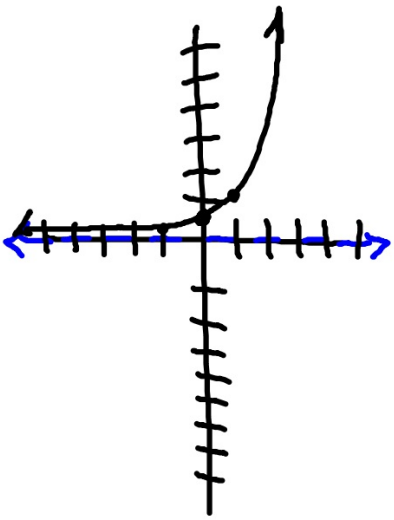
Students will be able to find the asymptotes and y-intercepts of a exponential function.

Example 1: Sketch the graph of the function. Identify any asymptotes and intercepts.

a.) $f(x) = 2^{x-1}$

HA: $y=0$

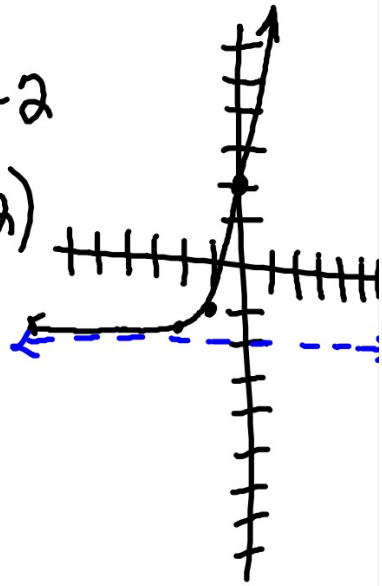
y-int: $\left(0, \frac{1}{2}\right)$



b.) $f(x) = 4^{x+1} - 2$

HA: $y=-2$

y-int: $(0,2)$



Students will be able to write the logarithmic equation in exponential form.

Example 2: Write the logarithmic equation in exponential form.

$$\log_5 25 = 2 \text{ is } 5^2 = 25$$

logarithmic exponential

a.) $\log_3 81 = 4$

$3^4 = 81$

b.) $\log_{16} 8 = \frac{3}{4}$

$16^{\frac{3}{4}} = 8$

c.) $\log_4 2 = \frac{1}{2}$

$4^{\frac{1}{2}} = 2$

Students will be able to write the exponential equation in logarithmic form.

Example 3: Write the exponential equation in logarithmic form.

$$\log_5 25 = 2 \text{ is } 5^2 = 25$$

a.) $8^2 = 64$

$\log_8 64 = 2$

b.) $10^{-3} = \frac{1}{1000}$

$\log_{10} \frac{1}{1000} = -3$

c.) $h^p = 5$

$\log_h 5 = p$

Properties of Logarithms:

1.) $\log_a 1 = 0$ because $a^0 = 1$

2.) $\log_a a = 1$ because $a^1 = a$

3.) $\log_a a^x = x$ and $a^{\log_a x} = x$

4.) If $\log_a x = \log_a y$, then $x = y$

Practice using properties:

1.) $\log_2 x = \log_2 3$

$\boxed{x=3}$

2.) $\log_4 4 = x$

$\boxed{1=x}$

3.) $\log_5 5^x$

$\boxed{x}$

4.) $7^{\log_7 14}$

$\boxed{14}$

Students will be able to find the domain, vertical asymptotes, and x-intercepts of a function.

Example 4: Find the domain, vertical asymptote, and x-intercept of the logarithmic function.

a.) $y = \log_{10}(x-1)$

domain: $(1, \infty)$

VA: $x = 1$

x-int: $(2, 0)$

$0 = \log_{10}(x-1)$

*change to exponential to solve!

$10^0 = x - 1$

$1 = x - 1$

$+1 \quad +1$

$2 = x$

b.) $y = 2 + \log_{10}(x+1)$

domain: $(-1, \infty)$

VA: $x = -1$

x-int: $\left(-\frac{99}{100}, 0\right)$

$0 = 2 + \log_{10}(x+1)$

$-2 \quad -2$

$-2 = \log_{10}(x+1)$

$10^{-2} = x + 1$

$\frac{1}{100} = x + 1$

$-1 \quad -1$

$-\frac{99}{100} = x$

Students will be able to use the change of base formula.

Example 5: Evaluate the logarithm using the change of base formula.

round to 3 places.

Base b

$$\log_a x = \frac{\log_b x}{\log_b a}$$

Base 10

$$\log_a x = \frac{\log_{10} x}{\log_{10} a}$$

Base e

$$\log_a x = \frac{\ln x}{\ln a}$$

a.) $\log_9 243$

$$\frac{\log 243}{\log 9} = \boxed{2.5}$$

b.) $\log_{\frac{1}{8}} 64$

$$\frac{\ln 64}{\ln\left(\frac{1}{8}\right)} = \boxed{-2}$$

c.) $\log_4 .045$

$$\frac{\log .045}{\log 4} = \boxed{-2.237}$$

More Properties of Logarithms:

1.) Product Property: $\log_a uv = \log_a u + \log_a v$

$\ln uv = \ln u + \ln v$

2.) Quotient Property: $\log_a \frac{u}{v} = \log_a u - \log_a v$

$\ln \frac{u}{v} = \ln u - \ln v$

3.) Power Property: $\log_a u^n = n\log_a u$

$\ln u^n = n\ln u$

Practice using Properties: Write using ln 2 and ln 3

1.) ln 6

$\ln(2\cdot 3)$

$\boxed{\ln 2 + \ln 3}$

2.) ln 36

$\ln(9\cdot 4)$

$\ln(3^2\cdot 2^2)$

$\boxed{2\ln 3 + 2\ln 2}$

3.) $\ln \frac{4}{9}$

$\ln \frac{2^2}{3^2}$

$\boxed{2\ln 2 - 2\ln 3}$

Turn-in:
p.190 (48), p.199 (10,18,48)

HW:
p.189 (37-49 odds)
p.199 (7-21,37,39,45-53 odds)
p.207 (13-23 odds)