

3.1 Exponential Functions and Their Graphs

Exponential Function: $f(x) = a^x$, $a > 0$, $a \neq 1$, x is a real #

Graph and discuss: $y = 2^x$ $y = 4^x$ $y = 6^x$

$(\frac{1}{2})^x = 2^{-x}$ $y = 2^{-x}$ $y = 4^{-x}$ $y = 6^{-x}$
 $y = (\frac{1}{2})^x$ $y = (\frac{1}{4})^x$ $y = (\frac{1}{6})^x$

I. Use a calculator to evaluate each to 3 decimal places.

Ex 1) $f(x) = 3.4^x$ when $x = 6.8$

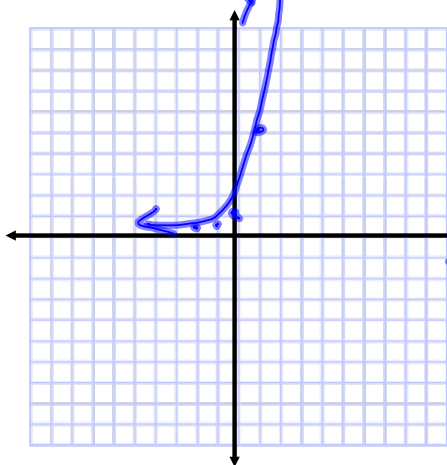
$f(x) = 4112.033$

Ex 2) $f(x) = 8.6^{-3x}$ when $x = -\sqrt{2}$

$f(x) = 9220.217$

II. Graph by hand. ID asymptotes and intercepts. Determine if increasing or decreasing.

Ex 3) $f(x) = 5^x$



x	y
-2	$\frac{1}{25}$
-1	$\frac{1}{5}$
0	1
1	5
2	25

$5^{-2} = \frac{1}{25}$
 $5^{-1} = \frac{1}{5}$

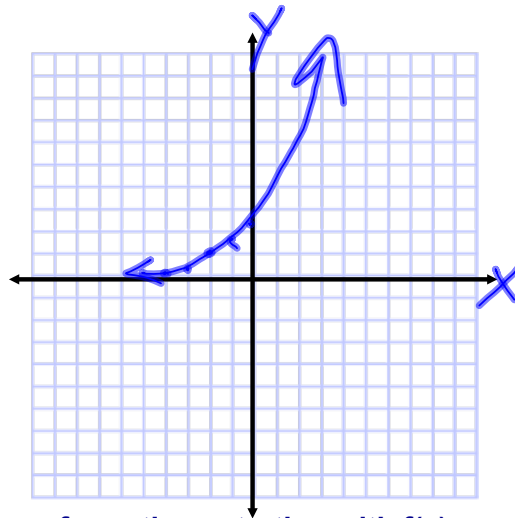
H.A.: $y = 0$
 Y-int: $(0, 1)$
 increasing

Ex 4) $g(x) = \left(\frac{3}{2}\right)^{x+2}$

X	Y
-4	$\frac{9}{16}$
-3	$\frac{3}{4}$
-2	$\frac{3}{2}$
-1	$\frac{9}{2}$
0	$\frac{9}{1}$

$$\left(\frac{3}{2}\right)^{-2} = \left(\frac{2}{3}\right)^2 = \frac{4}{9}$$

H.A.: $y=0$
 Y-int.: $(0, \frac{9}{4})$



III. Transformations: Describe the transformations starting with $f(x)$.

Ex 5) $f(x) = \left(\frac{3}{5}\right)^x$, $g(x) = -\left(\frac{3}{5}\right)^{x+4} + 2$

$x+4$: 4 units to the left
 $-$: reflect over x-axis
 $+2$: 2 units up

IV. Review of Exponents: Bottom of page 177

V. The Natural Base e--same characteristics as $f(x) = a^x$

(e is approximated from the expression $(1 + 1/x)^x$ for very large values of x.

Graph $y = 2^x$
 $y = e^x$
 $y = 3^x$

$e = 2.718281828$

Ex 6) Use a calculator to evaluate to three decimals.

$f(x) = 100e^{.001x}$ when $x = 12$. $f(x) \approx 101.707$