Section 3.1 Exponential Functions (key)

Warm Up: Evaluate (no calculator)

1) $\sqrt[3]{\frac{125}{8}} = \frac{\sqrt[3]{125}}{\sqrt[3]{8}} = \boxed{\frac{5}{2}}$

2) $27^{2/3} = \left(\sqrt[3]{27}\right)^2 = (3)^2 = \boxed{9}$

3) $4^{5/2} = \left(\sqrt{4}\right)^5 = \sqrt{4}^5 = 2^5 = \boxed{32}$

1) $y = x^8$ not exponential (power fnc.)
2) $y = 3^x$ exponential I.V. = 1 Base = 3
3) $y = 5^x$ exponential I.V. = 1 Base = 5
4) $y = 4^2$ not exponential (constant fnc.)
5) $y = x^{\sqrt{x}}$ not exponential (variable base)
6) $y = x^{1.3}$ not exponential (power fnc.)

7) $f(0) = 3 \cdot 5^0 = 3 \cdot 1 = \boxed{3}$

8) $f(x) = 6 \cdot 3^x$
$f(-2) = 6 \cdot 3^{-2} = 6 \cdot \frac{1}{3^2} = \frac{6}{9} = \boxed{\frac{2}{3}}$

9) $f(\frac{1}{3}) = -2 \cdot 3^{1/3}$
$\boxed{-2\sqrt[3]{3}}$

10) $f(-\frac{3}{2}) = 8 \cdot 4^{-3/2} = 8 \cdot \frac{1}{\left(\sqrt{4}\right)^3} = 8 \cdot \frac{1}{\sqrt{4}^3} = 8 \cdot \frac{1}{8} = \boxed{1}$

tbl 3.6

	f(x)	
-2	6	× $\frac{1}{2}$
-1	3	× $\frac{1}{2}$
0	$\frac{3}{2}$	× $\frac{1}{2}$
1	$\frac{3}{4}$	× $\frac{1}{2}$
2	$\frac{3}{8}$	× $\frac{1}{2}$

BASE = $\frac{1}{2}$

IV : $\frac{3}{2}$ since $f(0) = \frac{3}{2}$

11)

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

table 3.6

	g(x)	
-2	108	× $\frac{1}{3}$
-1	36	× $\frac{1}{3}$
0	12	× $\frac{1}{3}$
1	4	× $\frac{1}{3}$
2	$\frac{4}{3}$	× $\frac{1}{3}$

12)

Base = $\frac{1}{3}$

IV = 12

since $g(0) = 12$

$$g(x) = 12\left(\frac{1}{3}\right)^x$$

Graph the function and analyze it for domain, range, increasing or decreasing behavior, boundedness, extrema, asymptotes and end behavior.

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

DO NOT USE A CALCULATOR FOR THIS PROBLEM!

x	-3	-2	-1	0	1	2
f(x)	192	48	12	3	3/4	3/16

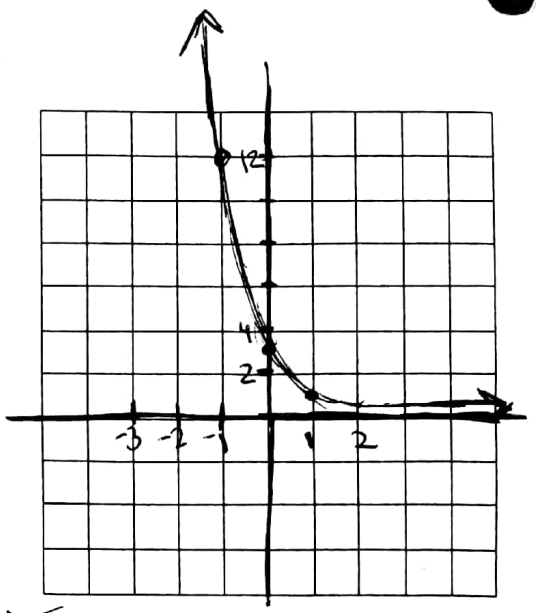
$3\left(\frac{1}{4}\right)^{-3}$ $3\left(\frac{1}{4}\right)^{-2}$ $3\left(\frac{1}{4}\right)^{-1}$ $3\left(\frac{1}{4}\right)^{0}$

$3(4)^3$ $3(4)^2$ $3(4)$ $3 \cdot 1$

$3(64)$ $3(16)$

$3\left(\frac{1}{4}\right)^{1}$ $3\left(\frac{1}{4}\right)^{2}$

$3/4$ $3/16$



Domain $(-\infty, \infty)$
Range $(0, \infty)$
Decr. fnc.
Bounded Below
no extrema
H.A. $y = 0$
$\lim_{x \to -\infty} f(x) = \infty$ $\lim_{x \to \infty} f(x) = 0$

EXPLORATION 1 Graphs of Exponential Functions

1. Graph each function in the viewing window $[-2, 2]$ by $[-1, 6]$.

(a) $y_1 = 2^x$ **(b)** $y_2 = 3^x$ **(c)** $y_3 = 4^x$ **(d)** $y_4 = 5^x$

- Which point is common to all four graphs? y-int $(0,1)$ b/c $2^0 = 1$ $3^0 = 1$ $4^0 = 1$ $5^0 = 1$
- Analyze the functions for domain, range, continuity, increasing or decreasing behavior, symmetry, boundedness, extrema, asymptotes, and end behavior.

continuous

incr. bounded below no extrema

Domain $(-\infty, \infty)$
Range $(0, \infty)$
HA $y = 0$
$\lim_{x \to -\infty} f(x) = 0$ $\lim_{x \to \infty} f(x) = \infty$

2. Graph each function in the viewing window $[-2, 2]$ by $[-1, 6]$.

(a) $y_1 = \left(\frac{1}{2}\right)^x$ **(b)** $y_2 = \left(\frac{1}{3}\right)^x$

(c) $y_3 = \left(\frac{1}{4}\right)^x$ **(d)** $y_4 = \left(\frac{1}{5}\right)^x$

- Which point is common to all four graphs? y-int
- Analyze the functions for domain, range, continuity, increasing or decreasing behavior, symmetry, boundedness, extrema, asymptotes, and end behavior.

Same as #1
except
decreasing fnc. and
$\lim_{x \to -\infty} f(x) = \infty$ $\lim_{x \to +\infty} f(x) = 0$