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COLLEGE ALGEBRA

NAME: Jeffrey Aybar

GPS # 25 | 3.1 | EXPONENTIAL FUNCTIONS I | Class Time: 11:30 | Date: 3/4/08

Useful Guidelines:

* An **exponential function:** $f(x) = a^x$, where $a > 0$ and $a \neq 1$. The domain of f is the set of all real numbers. [Note that the base is a constant and the exponent is a variable.] $e = 2.718281828...$
* Properties of the Exponential Function $f(x) = a^x$ (where $a > 0$ and $a \neq 1$):
  (1) Domain: the interval $(-\infty, \infty)$; Range: the interval $(0, \infty)$;
  (2) x-intercepts: none; y-intercept: 1;
  (3) Horizontal asymptote: $y = 0$ as $x \to \infty$;
  (4) $f(x) = a^x, a > 1$, is an increasing, one-to-one, smooth and continuous function;
  $f(x) = a^x, 0 < a < 1$, is a decreasing, one-to-one, smooth and continuous function;
  (5) The points $(0,1), (1,a)$, and $(-1, \frac{1}{a})$ are always on the graph of f.

20/20 $a > 1$ ✓ Good

$a < 1$ ✗

1. Evaluate $f(x) = 3^x$ at $x = -2, -1, 0, 1, 2$, and 3. Graph the exponential function.

$f(x) = 3^x$

$3^{-2} = \frac{1}{3^2} = \frac{1}{9}$ $(-2, \frac{1}{9})$

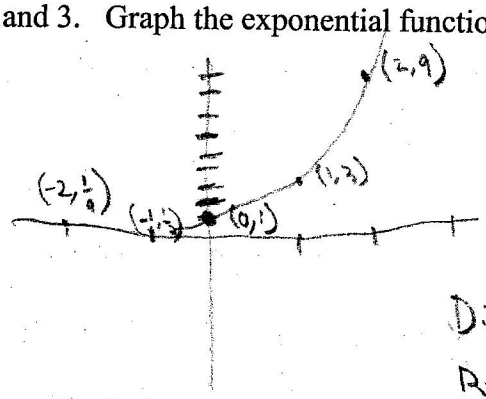
$3^{-1} = \frac{1}{3}$ $(-1, \frac{1}{3})$

$3^0 = 1$ $(0,1)$

$3^1 = 3$ $(1,3)$

$3^2 = 9$ $(2,9)$

$3^3 = 27$



H.A $y = 0$

D: $(-\infty, \infty)$

R: $(0, \infty)$

2. Evaluate $g(x) = \left(\frac{1}{3}\right)^x$ at $x = -2, -1, 0, 1, 2$, and 3. Graph the exponential function.

$g(x) = \left(\frac{1}{3}\right)^x = \left(\frac{1}{3}\right)^{-2} = 9$

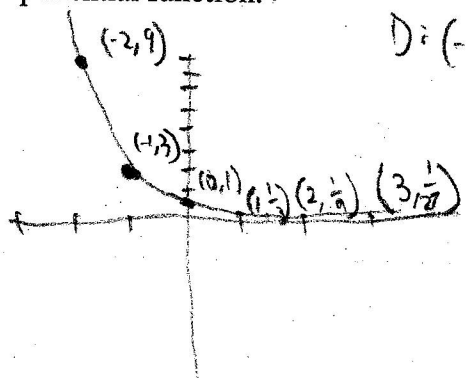
$\left(\frac{1}{3}\right)^{-1} = 3$

$\left(\frac{1}{3}\right)^0 = 1$

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

$\left(\frac{1}{3}\right)^2 = \frac{1}{9}$

$\left(\frac{1}{3}\right)^3 = \frac{1}{27}$



D: $(-\infty, \infty)$

R: $(0, \infty)$

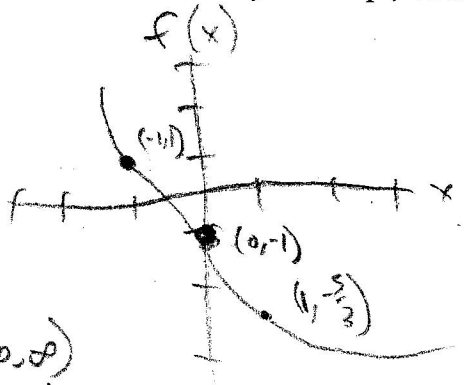
3. Graph each function and determine the y-intercept, domain, range, and horizontal asymptote of f.

(a) $f(x) = 3^{-x} - 2$

$= \frac{1}{3^x} - 2$

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

x	$f(x)$
-1	1
0	-1
1	$-\frac{5}{3}$



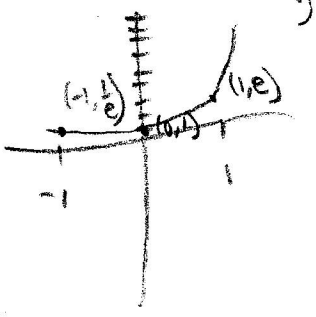
D: $(-\infty, \infty)$

R: $(-2, \infty)$

(b) $f(x) = e^x$

$e = 2.718281828 = 2.718$

x	$f(x)$
-1	$\frac{1}{e}$
0	1
1	e



D: $(-\infty, \infty)$

R: $(0, \infty)$

$y = 0$ H.A