

MAT1375, Classwork13, Fall2026

Ch13. Exponential and Logarithmic Functions I

1. Definition of the Exponential Function:

A function f is called an Exponential function with base b for any real number x if

$$f(x) = c \cdot b^x,$$

for some real number c and positive real number b which is called the base

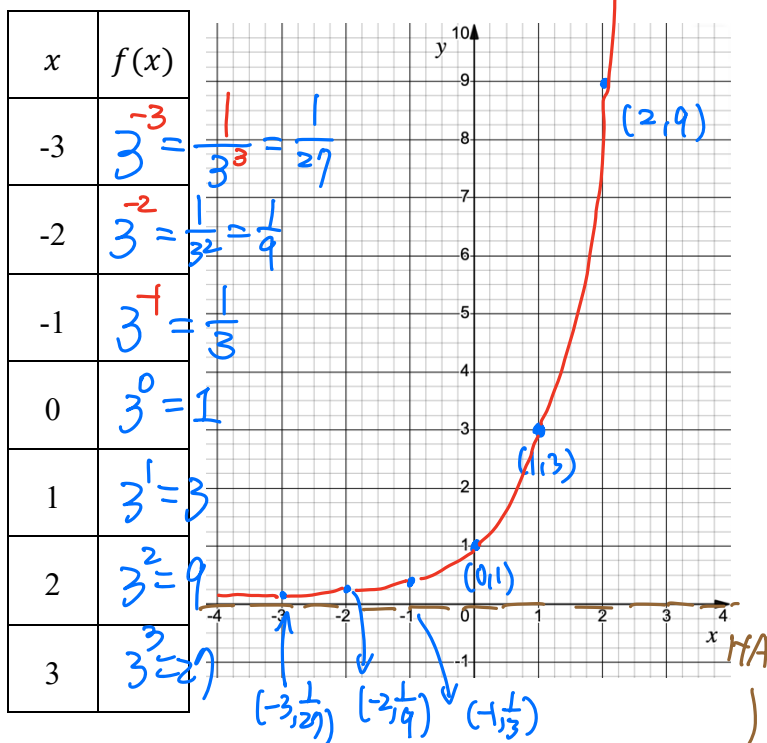
2. Please circle the given function if it is an exponential function:

- (1) $f(x) = 2^x$. (2) $g(x) = 3^{x+1}$. (3) $h(x) = e^x$. (4) $k(x) = \left(\frac{1}{5}\right)^x$. (5) $l(x) = x^2$.
~~(6) $m(x) = (-1)^x$. (7) $n(x) = x^x$.~~
 base = $-1 < 0$ both base and exponent are unknown

Euler's number $e = 2.71828182 \dots \Rightarrow$ irrational number, and a real number

3. Graph the given functions:

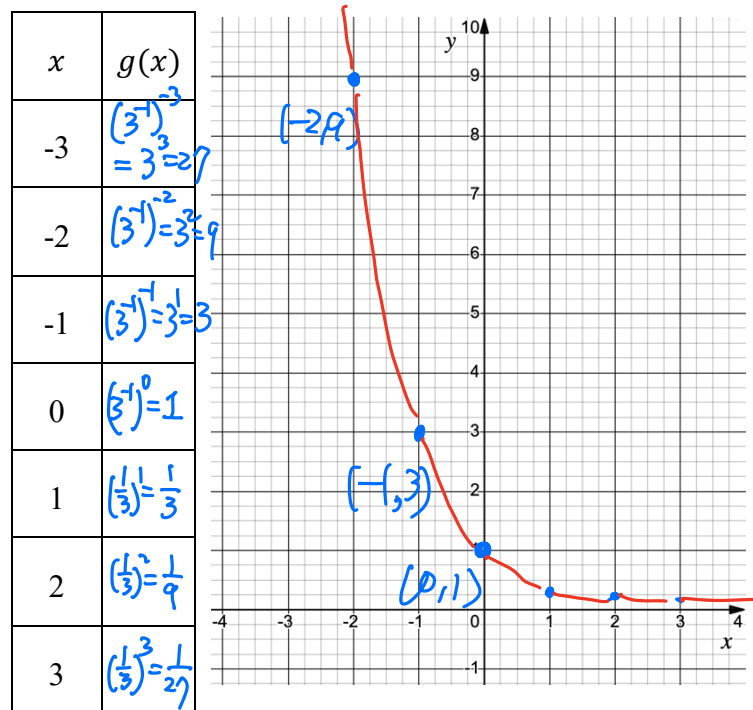
(a) $f(x) = 3^x$.



Domain: $(-\infty, \infty)$; Range: $(0, \infty)$

Asymptote: Horizontal Asymptote $y=0$

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

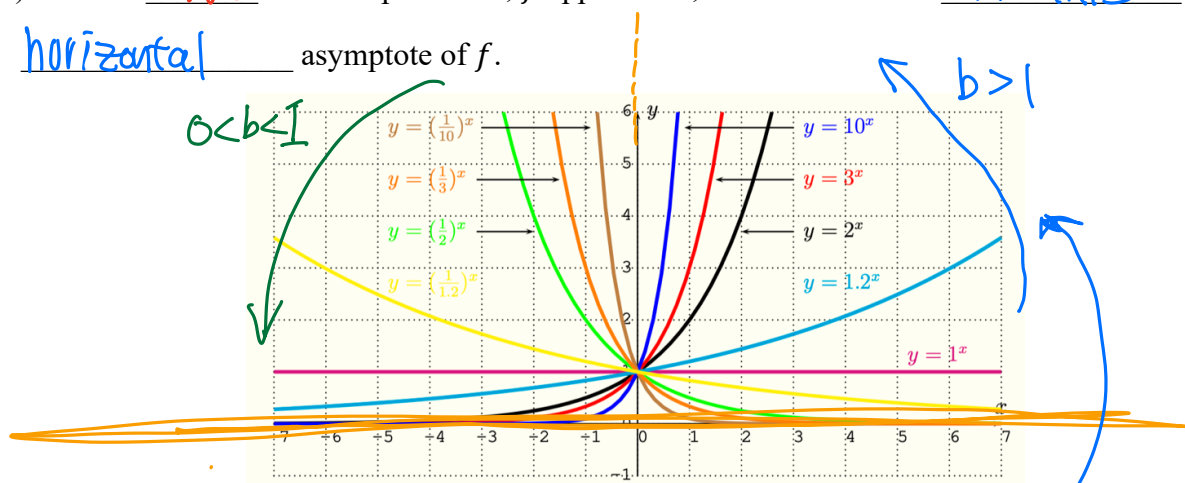


Domain: $(-\infty, \infty)$; Range: $(0, \infty)$

Asymptote: H.A.: $y=0$

4. Characteristics of Exponential Function of $f(x) = b^x$.

- (a) The domain of f : All real numbers $(-\infty, \infty)$; The Range of f : $(0, \infty)$.
- (b) There is NO x -intercept. In fact, f approaches, but never touches x -axis which is a horizontal asymptote of f .



- (c) Its y -intercept is 1 or $(0, 1)$
- (d) For $b > 1$, $f(x) \rightarrow \infty$ as $x \rightarrow \infty$, $f(x) \rightarrow 0^+$ as $x \rightarrow -\infty$.
- (e) For $0 < b < 1$, $f(x) \rightarrow 0^+$ as $x \rightarrow \infty$, $f(x) \rightarrow \infty$ as $x \rightarrow -\infty$.
- (f) f is one-to-one and has an inverse function.

6. What is the 4-steps strategy to find the inverse of a given function? Can it be used to find the inverse function of $f(x) = b^x$?

Step 1 replace f by y : $y = b^x$
Step 2 switch x and y : $x = b^y$
Step 3 solve for y : $y = ?$

7. Definition of **Logarithmic Function**:

For $x > 0$ and $b > 0, b \neq 1$, the logarithmic of x with base b is defined by the equivalence

$$x = b^y \Leftrightarrow y = \log_b(x).$$

This computes the inverse of the exponential function $y = b^x$ with base b . (We exchange x and y to get $x = b^y$ and solve for y).

8. Rewrite the equation as a logarithmic equation.

a) $3^4 = x$ b) $e^x = 17$ c) $2^{7a} = 53$ d) $b^3 = 8$

$4 = \log_3(x)$ $x = \log_e(17)$ $7a = \log_2(53)$ $3 = \log_b 8$

① reorganize the base

② then move the base to the other side with $\log$

$$a = \frac{\log_2(53)}{7}$$