

Exponential Functions

Section 1.4

Exponential Functions

An exponential function is a function of the form

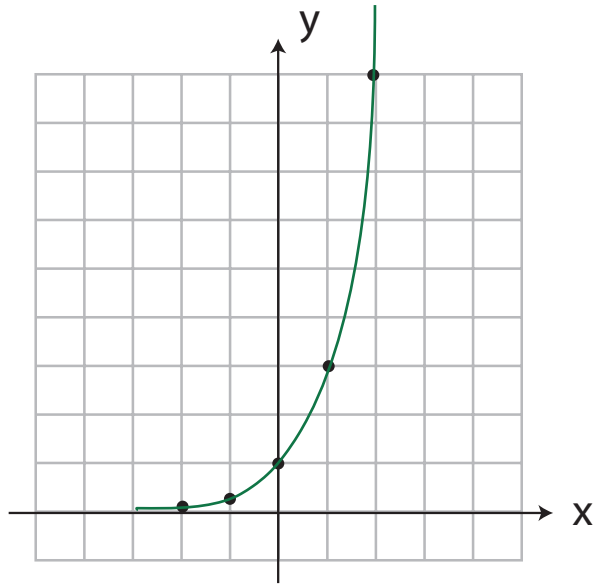
$$f(x) = b^x$$

where b is a positive real number called the base and x is a variable called the exponent.

Domain: $x \in R$

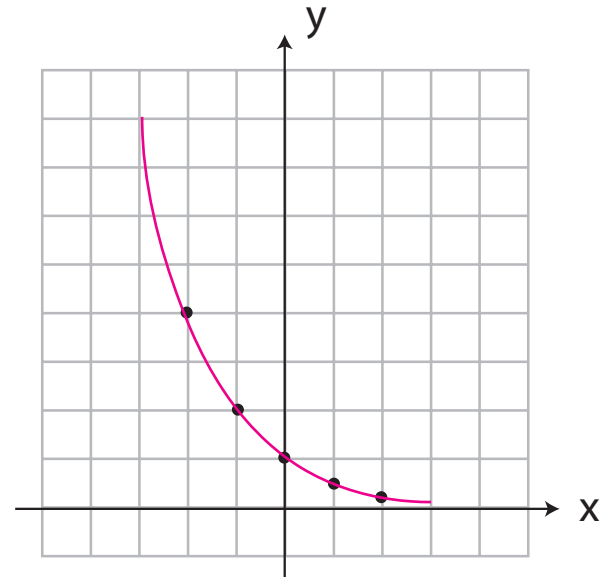
Range: $y > 0$

Graphs of Exponential Functions



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

When $b > 1$, the function is increasing.



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

When $0 < b < 1$, the function is decreasing.

$y=0$ is a horizontal asymptote

Transformation of an Exponential Function

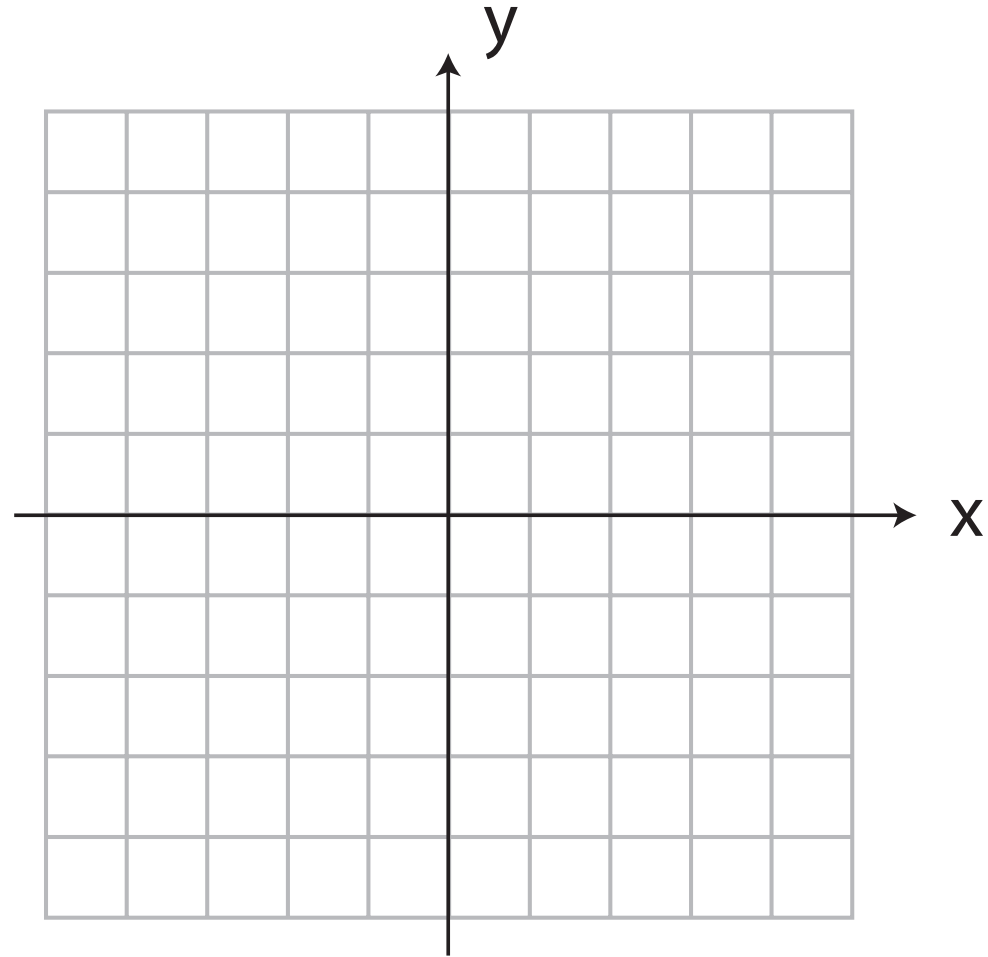
Graph $f(x) = -e^{2x} - 1$.

Recall:

e is a special irrational number between 2 and 3 that is commonly used in calculus

Approximation:

$$e \approx 2.718$$



Laws of Exponents

$$1. a^x \cdot a^y = a^{x+y}$$

$$2. \frac{a^x}{a^y} = a^{x-y}$$

$$3. (a^x)^y = a^{xy}$$

$$4. (ab)^x = a^x b^x$$

$$a^{-x} = \frac{1}{a^x}$$

$$a^{\frac{x}{y}} = \sqrt[y]{a^x} = (\sqrt[y]{a})^x$$

$$a^1 = a$$

$$a^0 = 1$$

Examples: