

3.1a Exponential Functions and their graphs

An exponential function is a non-algebraic function, they are considered to be transcendental functions. These functions cannot be represented by polynomials or roots.

Definition

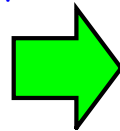
The exponential function f with base a is denoted by:

$$f(x) = a^x \quad \text{where } a > 0, a \neq 1, \text{ and } x \text{ is any real \#}$$

Ex 1: Evaluate each using your calculator:

- a. $g(x) = 2^x$ if $x = -3.1$ _____
- b. $b(x) = 2^{-x}$ if $x = \pi$ _____
- c. $h(x) = 0.6^x$ if $x = \frac{1}{2}$ _____
- d. $s(x) = 1.05^{2x}$ if $x = 12$ _____

★When working with exponential functions, its is important to remember how to evaluate especially when given rational exponents, try these!



Flashback:

$$\begin{array}{ll}
 a^x a^y = & (ab)^x = \\
 \frac{a^x}{a^y} = & (a^x)^y = \\
 a^{-x} = & \left(\frac{a}{b}\right)^x = \\
 a^0 = & |a|^2 =
 \end{array}$$

Ex 2: Evaluate:

a. 5^{-1}	b. 5^{-3}	c. 5^0	d. $5^{-(-2)}$
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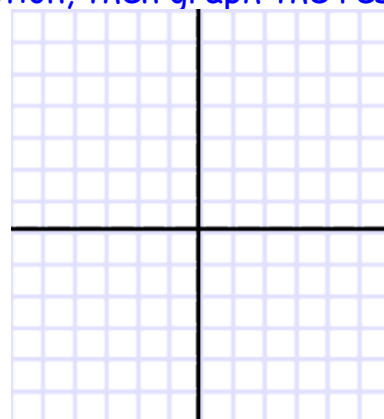
Ex 3: Fill in the chart for each function, then graph the results.

a. $f(x) = 2^x$

x	-3	-2	-1	0	1	2
f(x)						

b. $g(x) = 2^{-x}$

x	-3	-2	-1	0	1	2
g(x)						

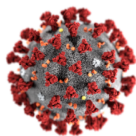


Parent Function FACTS!

$$f(x) = a^x, a > 0, a \neq 1$$

This function is different from all other parent functions studied so far because the variable x is an exponent. A distinguishing characteristic of an exponential function is its rapid increase as x increases (for $a > 1$). Many real-life phenomena with patterns of rapid growth (or decline) can be modeled by exponential functions.

Sound familiar?



$f(x) = a^x, a > 0, a \neq 1$ Domain: _____ Range: _____ Intercept: _____ Increasing: _____ Horizontal asymptote: _____ Continuous? _____		$f(x) = a^{-x}, a > 0, a \neq 1$ Domain: _____ Range: _____ Intercept: _____ Increasing: _____ Horizontal asymptote: _____ Continuous? _____
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Ex 4: Fill in the chart below, describe the transformation from $f(x) = 2^x$ then sketch the new graph.

Function	Transformation	Sketch
$g(x) = 2^{-x}$		
$w(x) = -2^x$		
$z(x) = 2^{x-5}$		
$h(x) = 2^{x+5}$		
$m(x) = 2^x - 5$		
$q(x) = 2^x + 5$		
$u(x) = -2^{x+2} - 3$		