أوقات الدرس

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OL Academy

مدرس المقرر

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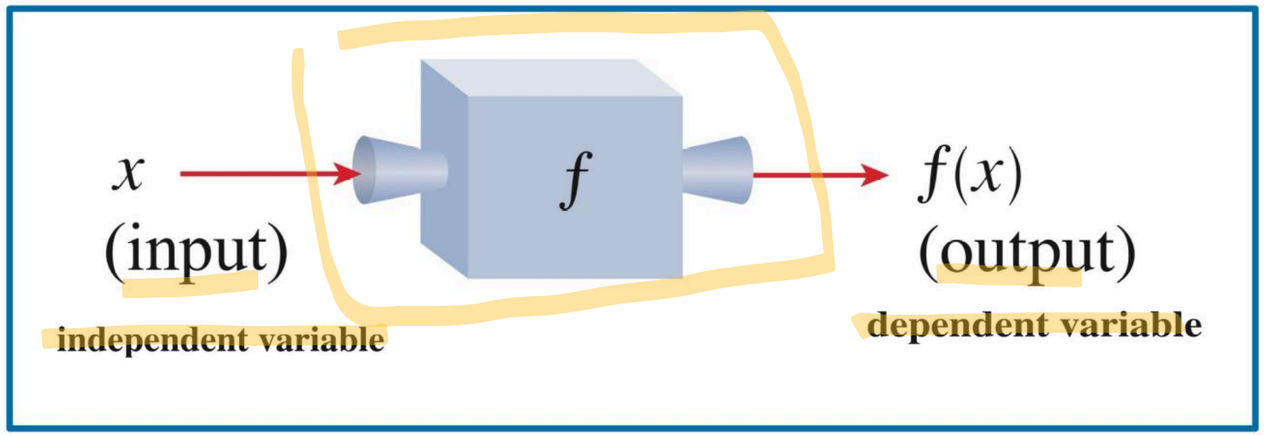
MATHS101

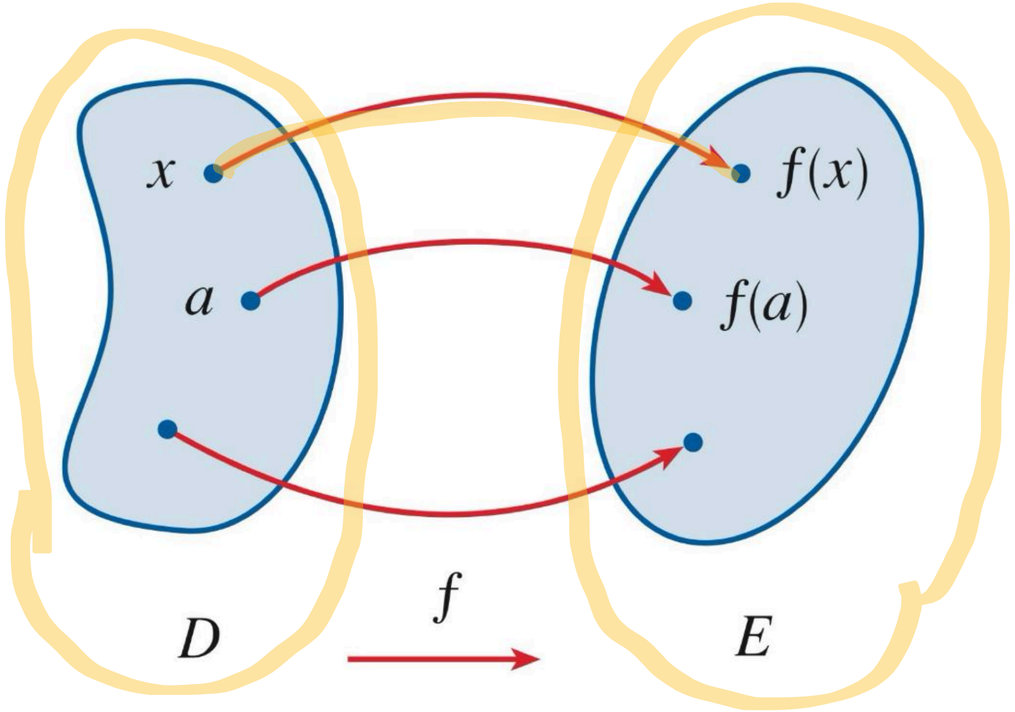
Lesson (1)

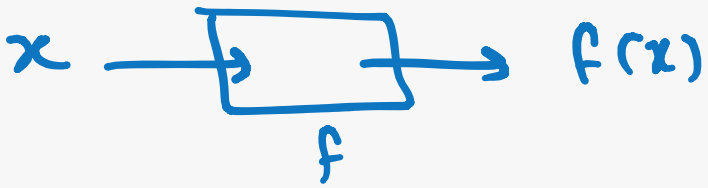
1.4 Exponential Functions

Functions

A **function** f is a rule that assigns to each element x in a set D exactly one element, called $f(x)$, in a set E.





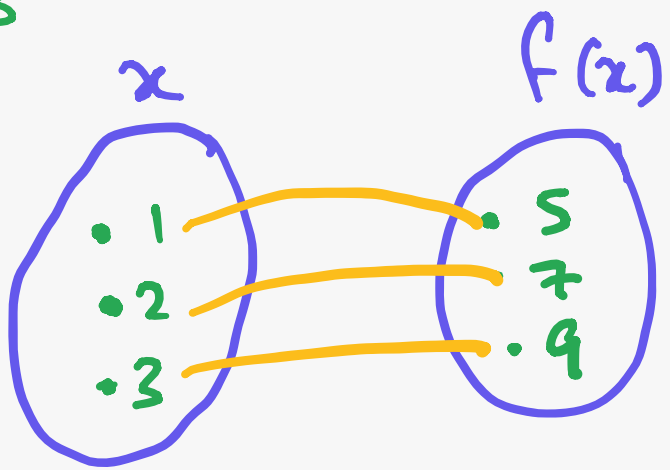


$f(x) = 2x + 3$, $x = 1, 2, 3$

$f(1) = 2(1) + 3 \Rightarrow f(1) = 5$

$f(2) = 2(2) + 3 \Rightarrow f(2) = 7$

$f(3) = 2(3) + 3 \Rightarrow f(3) = 9$



Algebraic Formulas

$(a-b)^2 = a^2 - 2ab + b^2$
$(a+b)^2 = a^2 + 2ab + b^2$
$a^2 - b^2 = (a+b)(a-b)$
$(a-b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$
$(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$
$a^3 - b^3 = (a-b)(a^2 + ab + b^2)$
$a^3 + b^3 = (a-b)(a^2 - ab + b^2)$
$(a+b+c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ac$

a^2+b^2+2ab

A

$$(3x+5)^2$$

$(a+b)^2 = a^2 + 2ab + b^2$

$= (3x)^2 + 2(3x)(5) + (5)^2$

$= 3^2 \cdot x^2 + 30x + 5^2$

$= 9x^2 + 30x + 25$

B

$$(x^2 - 25)$$ $\rightarrow 5^2 = 25$

$(a^2 - b^2) = (a+b)(a-b)$

$(x^2 - 5^2)$

$= (x+5)(x-5)$

$= x^2 - 5x + 5x - 25$

$= x^2 - 25$

C

$$x^2 - 9$$

$(a^2 - b^2) = (a+b)(a-b)$

$(x^2 - 3^2) = (x+3)(x-3)$

$(x^3 - 27)$

$(a^3 - b^3) = (a-b)(a^2 - ab + b^2)$

$(x^3 - 3^3) = (x-3)(x^2 + 3x + 3^2)$

$= (x-3)(x^2 + 3x + 9)$

D

$$x^4 - 16$$

$(a^2 - b^2) = (a+b)(a-b)$

$\left((x^2)^2 - (4)^2\right)$

$a \quad b$

$= (x^2+4)(x^2-4)$ → $\left((x)^2 - (2)^2\right)$

$a \quad b$

$= (x^2+4)(x+2)(x-2)$

Find the value of x:

1

$$7 - 4x = 3$$

$-4x = 3 - 7$

$\frac{-4x}{-4} = \frac{-4}{-4}$

$x = 1$

Constant Function: f(x)= C

Linear Function: f(x)= aX+b

$f(x) = 3$

$f(x) = 2x^{1} + 3$

2 $\frac{6+3(x-5)}{2} = \frac{4x}{3}$ ×3 ×3

$= \frac{3}{2}(6+3(x-5)) = 4x \times 2$

$= 3(6+3(x-5)) = 8x$

$= 3(6+3x-15) = 8x$

$= 18+9x-45 = 8x$

$= 18-45 = 8x-9x$

$\frac{-27}{-1} = \frac{-x}{-1}$

$x = 27$

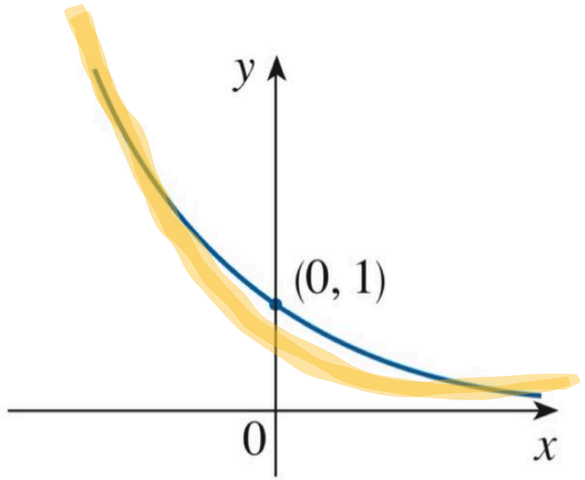
1.4 Exponential Functions

The function $f(x) = 2^x$ is called an *exponential function* because the variable, x, is the exponent.

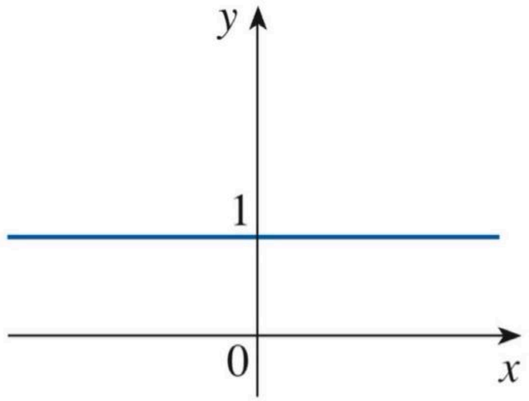
In general, an **exponential function** is a function of the form

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

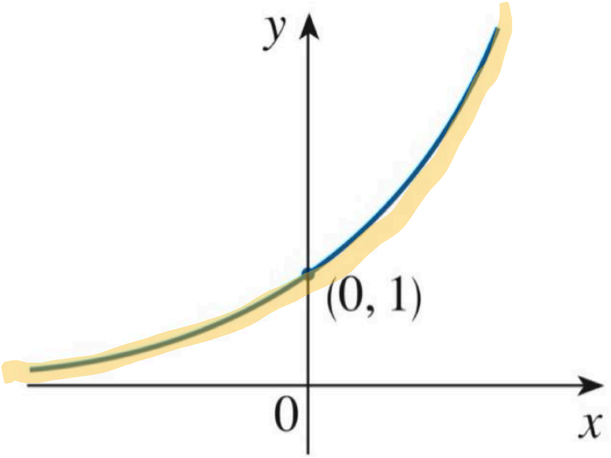
where b is a positive constant.



(a) $y = b^x$, $0 < b < 1$



(b) $y = 1^x$, $b = 1$



(c) $y = b^x$, $b > 1$

$(a \cdot b)^2 = a^2 \cdot b^2$

Laws of Exponents If a and b are positive numbers and x and y are any real numbers, then

$(x^2)^3 = x^{2 \cdot 3} = x^6$ $\qquad$ $(3x)^2 = 3^2 x^2$

1. $b^{x+y} = b^x b^y$
2. $b^{x-y} = \dfrac{b^x}{b^y}$
3. $(b^x)^y = b^{xy}$
4. $(ab)^x = a^x b^x$

1–2 Use the Laws of Exponents to rewrite and simplify each expression.

$x^0 = 1$

$x^{1/a} \Leftrightarrow \sqrt[a]{x}$

1 $\dfrac{-2^6}{4^3}$

$= \dfrac{-2^6}{(2^2)^3}$

$= -\dfrac{2^6}{2^{2\cdot 3}} = -\dfrac{2^6}{2^6}$

$= -2^{6-6} = -2^0 = -1$

2 $\dfrac{(-3)^6}{9^6}$

$\left(\dfrac{-3}{9}\right)^6 = \left(\dfrac{-1}{3}\right)^6$

$= \dfrac{(-1)^6}{(3)^6} = \dfrac{1}{729}$

$(-x)^{\text{even}} = x$

$(-x)^{\text{odd}} = -x$

3 $\dfrac{1}{\sqrt[4]{x^5}} = \dfrac{1}{\sqrt[4]{x^{4+1}}}$

$= \dfrac{1}{\sqrt[4]{x^4 \cdot x}} = \dfrac{1}{(x^4 \cdot x)^{1/4}}$

$= \dfrac{1}{x^{4/4} \cdot x^{1/4}}$

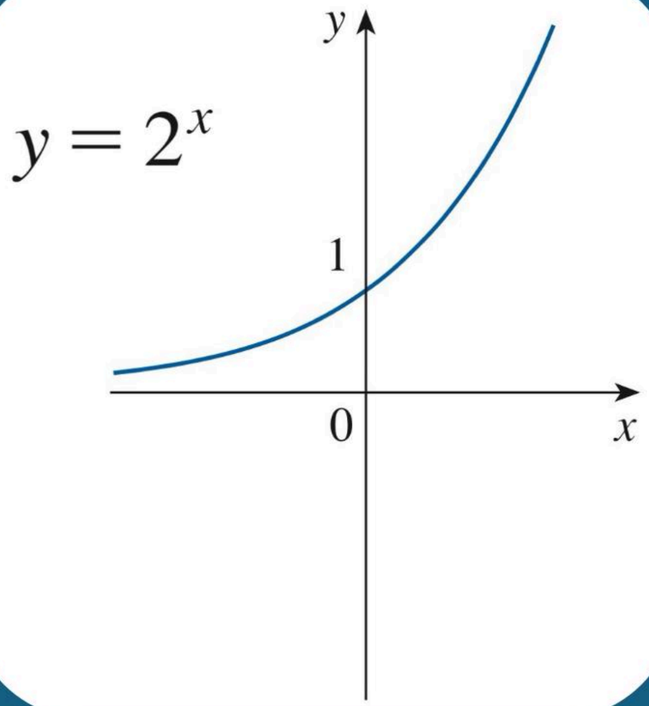
$= \dfrac{1}{x \cdot x^{1/4}} = \dfrac{1}{x\sqrt[4]{x}}$

4 $\dfrac{x^3 \cdot x^n}{x^{n+1}}$

5 $b^3(3b^{-1})^{-2}$

6 $\dfrac{2x^2y}{(3x^{-2}y)^2}$

Exponential Function graphing:



$Domain\ is\ always\ (-\infty, \infty)$
$Rang\ is\ (0, \infty)$

+N : Draw the graph above the horizontal asymptote.

-N : Draw the graph below the horizontal asymptote.

+b : Move the graph to the left.

-b : Move the graph to the right.

+a : Graph moves up.

-a : Graph moves down.

$$y = \pm N^{x \pm b} \pm a$$

Examples for graphing

1 $y = 3^{x+1} - 2$

2

$$y = 3 - e^{x-2}$$