9 JUNE,2026

Tuesday, 9 June 2026 6:02 PM

Exponential function

(x)

$f(x) = a(b)^x$ → exponent

base.
$b > 0$ $b \neq 1$

Initial Value
$(a \neq 0)$

Example $f = 2(3)^x$.

$f(2)$ $f = 2(3)^2 = 2 \times 9$
$= 18$

Exponential Growth

Occurs when the growth factor is greater than 1.

$$y = a(1 + r)^t$$

where:

- a = initial amount
- r = growth rate
- t = time

$8\% = 0.08$

Example

A population of 500 grows by 8% annually. $1 + 0.08$

$$P = 500(1.08)^t$$

Find the population after 3 years. $t = 3$

$$P = 500(1.08)^3$$

$$P = 500(1.2597)$$

$$P \approx 630$$

Answer: 630 people

$P \approx 630$

Product Rule

$a^m \cdot a^n = a^{m+n}$

Example:

$$2^3 \cdot 2^4 = 2^7 = 128$$

Quotient Rule

$$\frac{a^m}{a^n} = a^{m-n}$$

Example:

$$\frac{5^6}{5^2} = 5^4 = 625$$

Power Rule

$$(a^m)^n = a^{mn}$$

Example:

$$(3^2)^4 = 3^8 = 6561$$

Zero Exponent

$$a^0 = 1$$

Example:

$$7^0 = 1$$

Negative Exponent

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

Example:

$\frac{1}{2^3}$ ← $2^{-3} = \frac{1}{8}$

$2^{-2} = \frac{1}{2^2} = \frac{1}{4}$

4. Introduction to Logarithms

Definition

A logarithm answers:

"To what exponent must the base be raised to obtain a given number?"

Exponential Form

$$2^3 = 8$$

Logarithmic Form

$\log_2(8) = 3$

because:

$$2^3 = 8$$

Conversion Formula

$$a^b = c$$

is equivalent to

$$\log_a(c) = b$$

Examples

Example 1

$\log_3(81)$

Ask:

"3 raised to what power equals 81?"

$3^4 = 81$

Therefore,

$\log_3(81) = 4$

Example

Solve:

$$3^x = 20$$

Taking log both sides.

$\log(3^x) = \log(20)$

$x \log 3 = \log(20)$ Power Property

$\log_b(M^n) = n \log_b(M)$

$\frac{x \log 3}{\log 3} = \frac{\log(20)}{\log 3}$

$x = \frac{\log 20}{\log 3} \approx 2.73$

Example 1

Solve:

$\log_2(x) = 5$

32

Example 2

Solve:

$\log_5(x - 1) = 2$

26

Table I contains outputs of the function $f(x) = b^x$ for some x values, and **Table II** contains outputs of the function $g(x) = \log_b(x)$ for some x values. In both functions, b is the same positive constant.

Fill in the missing values in the tables. If necessary, round your answer to three decimal places.

You do not need a calculator.

Table I

x	0.585		1	3	3.322
$f(x) = b^x$	1.5	2	8	10	

Table II

x	1.5	2	5	8
$g(x) = \log_b(x)$	0.585	1	2.322	3

Practice Question: Exponential and Logarithmic Functions

Table I contains outputs of the function $f(x) = b^x$ for some values of x, and Table II contains outputs of the function $g(x) = \log_b(x)$ for some values of x. In both functions, b is the same positive constant.

Fill in the missing values. You do **not** need a calculator.

Table I

x	1	2	4	?
$f(x) = b^x$	3	9	81	243

Table II

x	3	9	81	243
$g(x) = \log_b(x)$	1	2	4	5

Questions

1. What is the value of b? 3
2. What is the missing value of x in Table I? 5
3. What is the missing value of x in Table II? 81
4. What is the missing value of $g(243)$? 5

$g(x) = 4$

$\log_b(x) = 4$

$\log_3(x) = 4$

$x = 3^4 = 81$

9) $8 \cdot 13^{7x} = 73$

10) $-8 \cdot 9^{-5x} = -49$

11) $9 \cdot 9^{k+2} = 59$

12) $17^{k-10} + 4 = 66$

13) $5^{4x} + 5 = 91$

≈ 0.692

14) $10^{-9n} + 8 = 34$

15) $e^{r+4} + 6 = 29$

16) $-10 \cdot 8^{-5n} = -81$

$\frac{8}{8} \cdot 13^{7x} = \frac{73}{8}$

$13^{7x} = \frac{73}{8}$

$\frac{7x \log(13)}{\log(13)} = \frac{\log\left(\frac{73}{8}\right)}{\log(13)}$

$x = \frac{\log\left(\frac{73}{8}\right)}{7\log(13)}$

$= \frac{0.960}{7.798}$

≈ 0.123

10) $-8 \cdot 9^{-5x} = -49$

Step 1: Divide by -8

$$9^{-5x} = \frac{49}{8}$$

Step 2: Take log of both sides

$$-5x \log(9) = \log\left(\frac{49}{8}\right)$$

Step 3: Solve for x

$$x = -\frac{\log(49/8)}{5\log(9)}$$

$$\boxed{x \approx -0.164}$$

11) $9 \cdot 9^{k+2} = 59$

Step 1: Combine powers

$$9^1 \cdot 9^{k+2} = 9^{k+3}$$

$$9^{k+3} = 59$$

Step 2: Take log

$$(k+3)\log(9) = \log(59)$$

Step 3: Solve

$$k = \frac{\log(59)}{\log(9)} - 3$$

$$\boxed{k \approx -1.143}$$

12) $17^{k-10} + 4 = 66$

Step 1: Isolate the exponential term

$$17^{k-10} = 62$$

Step 2: Take log

$$(k-10)\log(17) = \log(62)$$

Step 3: Solve