

Lesson 2.1 - Exponential Functions and their graphs

Practice

State the domain and range of the following exponential functions:

(a) $f(x) = 2^x$ domain: $(-\infty, \infty)$
range: $(0, \infty)$

(b) $g(x) = \left(\frac{1}{2}\right)^x$ domain: $(-\infty, \infty)$
range: $(0, \infty)$

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

4. $f(x) = -(3^x)$

5. $f(x) = 3^{-x}$

6. $f(x) = \left(\frac{1}{3}\right)^x$

domain: $(-\infty, \infty)$

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range: $(0, \infty)$

range: $(0, -\infty)$

range: $(0, \infty)$

range: $(0, \infty)$

Identify each transformation from the parent function of $f(x) = B^x$. Tell if the function is a decay or growth function.

1. $g(x) = 3^{x-2}$

right 2 - growth

2. $g(x) = \frac{1}{2}^x + 3$

up 3 - decay

3. $g(x) = -4^x - 6$

down 6 - decay

4. $g(x) = -\frac{2^{x-5}}{3} + 4$

up 4, right 5 - growth

5. $g(x) = 2^{x-7} + 5$

up 5, right 7 - growth

6. $g(x) = 3(2^{x+1}) + 2$

left 1, up 2 growth

Write the function for each graph described below.

7. the graph of $f(x) = 2^x$, reflected across the x axis.

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

8. The graph of $f(x) = \frac{1}{3}^x$, translated up 5 units.

$f(x) = \left(\frac{1}{3}\right)^x + 5$

9. The graph of $f(x) = 3^x$, left 2 units, and down 3.

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

10. The graph of $f(x) = \frac{1}{2}^x$ translated down 2 units

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

11. The graph of $f(x) = 4^x$, stretched horizontally by a factor of 3

$f(x) = 4^{\frac{1}{3}x}$

12. The graph of $f(x) = 2^x$, up 4 units, right 3

$f(x) = 2^{x-3} + 4$

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Practice

1) Describe the transformations that map the function $y = 2^x$ onto each of the following functions...

a) $y = 2^x - 2$

down 2

b) $y = 2^{x+3}$

right 3

c) $y = 4^x$

vert stretch by 2

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

vert stretch by 3
right 1
up 1

3) Write the equation for the function that results from each transformation applied to the base function $y = 5^x$.

a) translate down 3 units

$$y = 5^x - 3$$

b) shift right 2 units

$$y = 5^{x+2}$$

c) translate left $\frac{1}{2}$ unit

$$y = 5^{x+\frac{1}{2}}$$

d) shift up 1 unit and left 2.5 units

$$y = 5^{x+2.5} + 1$$

4) Write the equation for the function that results from each transformation applied to the base function

$$f(x) = \left(\frac{1}{3}\right)^x$$

a) reflect in the x-axis (vertical reflection)

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

b) stretch vertically by a factor of 3

$$f(x) = 3\left(\frac{1}{3}\right)^x$$

c) stretch horizontally by a factor of 2.4

$$f(x) = \left(\frac{1}{3}\right)^{2.4x}$$

d) reflect horizontally, stretch vertically by factor of 4

$$f(x) = 4\left(\frac{1}{3}\right)^{-x}$$

Without a calculator, match each function with its graph.

B 1) $f(x) = 5^x$

E 2) $f(x) = -5^{-x}$

C 3) $f(x) = -5^{x-1}$

F 4) $f(x) = 5^{-x} + 1$

D 5) $f(x) = 5^{x+1}$

A 6) $f(x) = -5^x - 1$

