

Section 5 – 2D: Translating Functions

The six general translations functions

Translation 1

Compared to $f(x)$

$$f(x - h)$$

moves the graph
h units to the RIGHT

subtracting h from the x
inside a bracket moves
the graph h units to the RIGHT

Translation 2

Compared to $f(x)$

$$f(x + h)$$

moves the graph
h units to the LEFT

adding h to the x
inside a bracket moves
the graph h units to the LEFT

Translation 3

Compared to $f(x)$

$$f(x) + h$$

moves the graph
up h units

adding h to $f(x)$
at the end of the equation
moves the graph UP h units

Translation 3

Compared to $f(x)$

$$f(x) - h$$

moves the graph
DOWN h units

subtracting h from $f(x)$
at the end of the equation
moves the graph DOWN h units

Translation 4

Compared to $f(x)$

$$-f(x)$$

flips the graph
about the x axis

multiplying $f(x)$ by -1
has the effect of negating the y values
and flips the graph about the x axis

Translation 5

Compared to $f(-x)$

$$f(-x)$$

flips the graph
about the y axis

multiplying the x in $f(x)$ by -1
has the effect of negating the x values
and flips the graph about the y axis

Translations of the **increasing** exponential functions

Translation 1

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

is equivalent to

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

subtracting 3 from the x
inside a bracket moves
the graph of $y = 2^{(x-3)}$
3 units to the RIGHT
compared to the graph $y = 2^x$

Translation 2

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

is equivalent to

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

adding 5 to the x
inside a bracket moves
the graph of $y = 2^{x+5}$
5 units to the LEFT
compared to the graph $y = 2^x$

Translation 3

$$y = 2^x + 5$$

adding 5 to the 2^x
at the end of the equation
moves the graph UP 5 units
compared to $y = 2^x$

Translation 4

$$y = 2^x - 4$$

subtracting 4 to the 2^x
at the end of the equation
moves the graph DOWN 4 units
compared to $y = 2^x$

Translation 5

$$y = -2^x$$

is equivalent to

$$y = -1(2^x)$$

multiplying (2^x) by -1
has the effect of negating the y values
and flips the graph about the x axis
compared to $y = 2^x$

Translation 6

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

is equivalent to

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

multiplying the x by -1
has the effect of negating the x values
and flips the graph about the y axis
compared to $y = 2^x$

Translations of the **decreasing** exponential functions

Translation 1

$$y = (1/2)^{x-5}$$

is equivalent to

$$y = (1/2)^{(x-5)}$$

subtracting 5 from the x
inside a bracket moves
the graph of $y = (1/2)^{(x-5)}$

5 units to the RIGHT

compared to the graph $y = (1/2)^x$

Translation 2

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

is equivalent to

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

adding 3 to the x
inside a bracket moves
the graph of $y = (1/2)^{x+3}$

3 units to the LEFT

compared to the graph $y = (1/2)^x$

Translation 3

$$y = (1/2)^x + 7$$

adding 7 to the $(1/2)^x$
at the end of the equation
moves the graph UP 7 units
compared to $y = (1/2)^x$

Translation 4

$$y = (1/2)^x - 3$$

subtracting 3 to the $(1/2)^x$
at the end of the equation
moves the graph DOWN 3 units
compared to $y = (1/2)^x$

Translation 5

$$y = -(1/2)^x$$

is equivalent to

$$y = -1(1/2)^x$$

multiplying $(1/2)^x$ by -1
has the effect of negating the y values
and flips the graph about the x axis

compared to $y = (1/2)^x$

Translation 6

$$y = (1/2)^{-x}$$

is equivalent to

$$y = (1/2)^{(-1x)}$$

multiplying the x by -1
has the effect of negating the x values
and flips the graph about the y axis

compared to $y = (1/2)^{x^x}$