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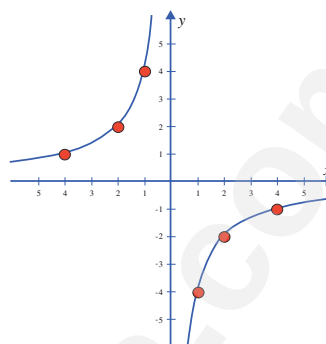
Functions



Lesson 1: Defining a function

1. No solution required
2. This relation is a function.

Domain		Range
-4	→	1
-2	→	2
-1	→	4
0	→	
1	→	-4
2	→	-2
3	→	1



Lesson 2: Vertical Translations of Functions

Translation of 3 units to the right:

Original point		Translated point		Original point		Translated point	
x	y	x	y	x	y	x	y
0	0	3	0	0	$f(0)$	3	$f(3-3)$
2	4	5	4	2	$f(2)$	5	$f(5-3)$
3	9	6	9	3	$f(3)$	6	$f(6-3)$
-2	4	1	4	-3	$f(-2)$	1	$f(1-3)$

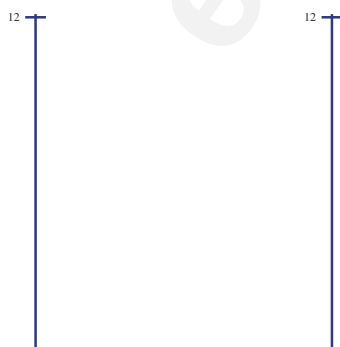
Therefore the equation is $g(x) = f(x-3)$

Translation of 3 units to the right:

Original point		Translated point		Original point		Translated point	
x	y	x	y	x	y	x	y
0	0	-3	0	0	$f(0)$	-3	$f(-3+3)$
2	4	-1	4	2	$f(2)$	-1	$f(-1+3)$
3	9	0	9	3	$f(3)$	0	$f(0+3)$
-2	4	-5	4	-3	$f(-2)$	-5	$f(-5+3)$

Therefore the equation is $g(x) = f(x+3)$

The graphs for the two translations are given below:



Functions



Lesson 3: More Transformations of Functions

Original point		Translated point		Original point		Translated point	
x	y	x	y	x	y	x	y
2	8	2	-4	2	$f(2)$	2	$f(-2)$
1	5	1	-1	1	$f(1)$	1	$f(-1)$
-1	-1	-1	5	-1	$f(-1)$	-1	$f(1)$
-2	-4	-2	8	-2	$f(-2)$	-2	$f(2)$

From this we can see that $g(x) = f(-x) = -3x + 2$

Lesson 4: Stretching of Functions

- The function $g(x) = f(x) + a$ is a vertical translation of the function $f(x)$ by a units. The translation is up for $a > 0$ and down for $a < 0$
- The function $g(x) = f(x + a)$ is a horizontal translation of the function $f(x)$ by a units. The translation is left for $a > 0$ and right for $a < 0$
- The function $g(x) = a \times f(x)$ is a vertical dilation of the function $f(x)$ with a scale factor of a . The dilation is an enlargement or stretch for $a > 1$ and a compression or reduction for $0 < a < 1$
- The function $g(x) = f(a \times x)$ is a horizontal dilation of the function $f(x)$ with a scale factor of a . The dilation is an enlargement or stretch for $0 < a < 1$ and a compression or reduction for $a > 1$

Lesson 5: Applications of Transformations.

$$g(x) = -(x-2-5)(x-8-5) + 11$$

$$g(x) = -x^2 + 20x - 80$$

Lesson 6: Introducing Inverse Functions

Multiply by 3 and then add 1.

Lesson 7: The Inverse of Linear Functions

Find the equation of the inverse of a general linear function,

$f(x) = ax + q$, by swapping the x - and y - values of the function.

$$f(x): y = ax + q.$$

$$f^{-1}(x): x = ay + q. \quad (x\text{- and }y\text{- values have just been interchanged})$$

$$-ay = -x + q$$

$$y = \frac{-x}{-a} + \frac{q}{-a}$$

$$y = \frac{1}{a}x - \frac{q}{a}$$

Functions



Lesson 8: The Inverse of Exponential Functions

Find the equation of the inverse of a general linear function,

$f(x) = ax^2$, by swapping the x - and y - values of the function.

$$f(x): y = ax^2$$

$$f^{-1}(x): x = ay^2 \quad (x\text{- and }y\text{- values have just been interchanged})$$

$$-ay^2 = -x$$

$$y^2 = -x/a$$

$$y = \pm \sqrt{\frac{-x}{a}}$$

Lesson 9: The inverse of Quadratic Functions

$$1. \text{ Equation: } f^{-1}(x): y = \sqrt{x}$$

$$2. \text{ Equation: } g^{-1}(x): y = \sqrt[3]{x}$$

