5.5 - Performing Function Operations

Warmup

1. $\dfrac{1}{\sqrt{-5}}$ $\dfrac{-i\sqrt{5}}{5}$

2. $\dfrac{4}{\sqrt{-4}}$ $-2i$

3. $\dfrac{\sqrt{18}}{2i\sqrt{6}}$ $\dfrac{-i\sqrt{3}}{2}$

4. $\dfrac{\sqrt{28}}{4i\sqrt{7}}$ $\dfrac{-i}{2}$

5. $\dfrac{\sqrt{60}}{\sqrt{-15}}$ $-2i$

6. $\dfrac{-\sqrt{12}}{\sqrt{-18}}$ $\dfrac{i\sqrt{6}}{3}$

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Functions

1. Domain vs. Range

   given $y = 2x - 3$

   if $x = \{1,3,6\}$ what is y?

   $y = \{-1,3,9\}$

2. g(x)

   pronounced “g of x”

   $g(x) = 2x - 2$

   $x = \{-1,2\}$

   $g(x) = \{-4,2\}$

Find the range

a. $f(x) = -2x + 1$

domain = { -3, 0, 2 }

range = { 7, 1, -3 }

b. $k(y) = y^2 - 3$

domain = { -1, 0, 3 }

range = { -2, -3, 6 }

5.5 - Performing Function Operations

Functions

$g(x) = 2x - 2$

$g(-3) = 2(-3) - 2 = -8$

Practice

$f(x) = 2x^2 - 5$ $\quad$ $k(x) = 3x + 2$

1. $f(2)$ — 3
2. $k(-2)$ — -4
3. $f(-3) + k(-2)$ — 9
4. $f(k(-2))$ — 27

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Recursive Functions

$f(1) = -1$

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

What is $f(4)$? $f(4) = 13$

$f(1) = -4$

$f(2) = 3$

$f(x) = f(x-1) \cdot f(x-2)$

What is $f(5)$? $f(5) = 432$

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More Functions

Definition of a Function:

A function is a relation in which different ordered pairs have different first coordinates.

Example 1: (2, 4)
(3, 4)
(-3, 2)
(5, -2)

Function

Example 2: (2, 4)
(2, 5)
(-3, 3)
(-3, -2)

Not a Function

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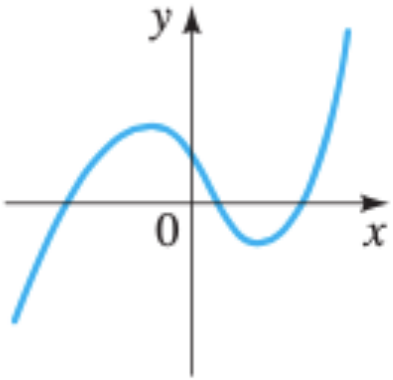
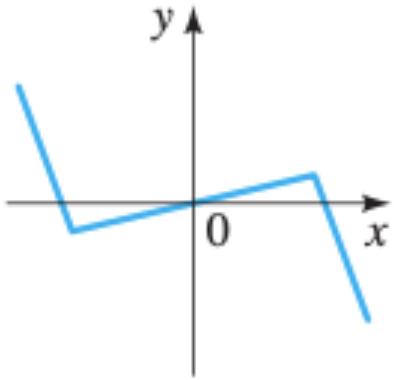
More Functions

How can you tell graphically?

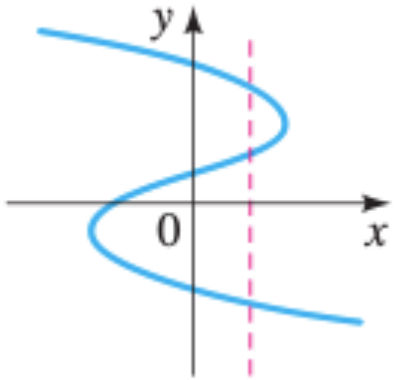
Vertical Line Test - A relation is a function if and only if no vertical line intersects its graph more than once.



Function



Function



Not a Function

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Composite Functions

$f(x) = 2x + 7$

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

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

$(f - g)(1) = 6$

$(f \div g)(x) = \dfrac{2x + 7}{x^2 - x + 3}$

$(f \div g)(1) = \dfrac{9}{3} = 3$

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1. $(f + g)(x) = x^2 + x + 10$

   $(f + g)(-3) = 16$

2. $(f(g(x)) = 2x^2 - 2x + 13$

   $(f(g(2)) = 17$

5.5 - Performing Function Operations

Composite Functions

$f(x) = x + 1$

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

$k(x) = 2x + 3$

1. $(f \cdot k \div g)(x) = \dfrac{(x+1)(2x+3)}{2x^2 - x + 3}$

$(f \cdot k \div g)(2) = \dfrac{3 \cdot 7}{8 - 2 + 3} = \dfrac{21}{9} = \dfrac{7}{3}$

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Domain of Composites

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

$$g(x) = \sqrt{x}$$

$$(f \circ g)(x) = f(g(x))$$

$$(f \circ g)(x) = \frac{1}{2\sqrt{x} - 1}$$

Domain of g(x)?

$$x \geq 0$$

Domain of $(f \circ g)(x)$?

$$2\sqrt{x} - 1 \neq 0$$

$$2\sqrt{x} \neq 1$$

$$\sqrt{x} \neq \frac{1}{2}$$

$$x \neq \frac{1}{4}$$

Final Domain

$$0 \leq x < \frac{1}{4} \text{ or } x > \frac{1}{4}$$

5.5 - Performing Function Operations

Domain of Composites

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

$$g(x) = \sqrt{x + 2}$$

Find domain of $(f \circ g)(x)$

Domain of g(x)? $x \geq -2$

Domain of $(f \circ g)(x)$

$$2\sqrt{x + 2} - 1 \neq 0$$

$$x \neq -\frac{7}{4}$$

Final Domain

$$-2 \leq x < -\frac{7}{4} \text{ or } x > -\frac{7}{4}$$

5.5 - Performing Function Operations

Domain of Composites

Find domain of $(f \circ g \circ k)(x)$?

$$f(x) = \sqrt{\frac{1}{-x} + 6}$$

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

$$k(x) = \sqrt{2x + 1}$$

Domain of k(x)? $x \geq -\frac{1}{2}$

Domain of $(g \circ k)(x)$

$$2x + 3 \neq 0$$

$$x \neq -\frac{3}{2}$$

Domain of $(f \circ g \circ k)(x)$

$$-2x + 3 \geq 0$$

$$x \leq \frac{3}{2}$$

Final Domain

$$-\frac{1}{2} \leq x \leq \frac{3}{2}$$