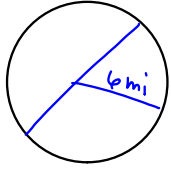


Calendar Math



Area:  $\pi r^2$   
 $\pi(6)^2 = 36\pi \text{ mi}^2 \approx 113.1 \text{ mi}^2$

Perimeter:  $2\pi r$   
 (Circumference)  $2\pi(6) = 12\pi \text{ mi} \approx 37.7 \text{ mi}$

Mar 22-7:49 AM

9.1 Combine and Evaluate functions

Combining functions using arithmetic operations

Let  $f$  and  $g$  be any two functions. A new function  $h$  can be created by performing any of the four basic operations on  $f$  and  $g$ .

Operation	Definition	Example: $f(x) = 5x^2 + 2x$ , $g(x) = -3x^2$
Addition	$h(x) = (f + g)(x)$	$h(x) = 5x^2 + 2x + (-3x^2) = 2x^2 + 2x$
Subtraction	$h(x) = (f - g)(x)$	$h(x) = 5x^2 + 2x - (-3x^2) = 8x^2 + 2x$
Multiplication	$h(x) = (fg)(x)$	$h(x) = (5x^2 + 2x)(-3x^2) = -15x^4 - 6x^3$
Division	$h(x) = \left(\frac{f}{g}\right)(x)$	$h(x) = \frac{5x^2 + 2x}{-3x^2} = \frac{5x + 2}{-3x}$

The domain of  $h$  consists of the  $x$ -values that are in the domains of both  $f$  and  $g$ . Additionally, the domain of a quotient does not include  $x$ -values for which  $g(x) = 0$ .

Let  $f(x) = x^2 + 1$  and  $g(x) = \sqrt{x+3} - 2$ .

Ex 1)  $h(x) = f(x) + g(x)$     Ex 2)  $h(x) = (f - g)(x)$     Ex 3)  $h(x) = (f/g)(x)$

$f(x) = x^2 + 1$      $g(x) = \sqrt{x+3} - 2$

$f(x) + g(x)$      $x \geq -3$

$x^2 + 1 + \sqrt{x+3} - 2$

$x^2 - 1 + \sqrt{x+3}$

D:  $[-3, \infty)$

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$f(x) - g(x)$

$x^2 + 1 - (\sqrt{x+3} - 2)$

$x^2 + 1 - \sqrt{x+3} + 2$

$x^2 + 3 - \sqrt{x+3}$

D:  $[-3, \infty)$

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Ex 3  $h(x) = \frac{f(x)}{g(x)}$

$\frac{x^2 + 1}{\sqrt{x+3} - 2}$

$x \neq 1$

D:  $[-3, 1) \cup (1, \infty)$

$\sqrt{x+3} - 2 = 0$   
 $\sqrt{x+3} = 2$   
 $x+3 = 4$   
 $x = 1$

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Ex 4.  $fg(x)$

$(x^2 + 1)(\sqrt{x+3} - 2)$

$x^2 + 1$	
$\sqrt{x+3}$	$x^2\sqrt{x+3} + \sqrt{x+3} - 2x^2 - 2$
$-2$	$-2x^2 - 2$

D:  $[-3, \infty)$

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Evaluating Combined Functions:

Let  $f(x) = \sqrt{x+2} - 2$  and  $g(x) = \frac{x-4}{x+3}$

Ex 5)  $2f(7) = g(3)$     Ex 6)  $g(4) = f(-2)$     Ex 7)  $\frac{f(3)}{g(1)}$

$f(7)$

$2f(7) + g(3)$

$2(\sqrt{7+2} - 2) + \frac{3-4}{3+3}$

$2(\sqrt{9} - 2) + \frac{-1}{6}$

$2(3-2) + \frac{-1}{6}$

$2 - \frac{1}{6}$

$\frac{12}{6} - \frac{1}{6} = \frac{11}{6}$

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Ex 6)  $g(4) \neq f(-2)$

$$\frac{4-4}{4+3} + \sqrt{2+2} - 2$$

$$0 + 0 - 2$$

$$\boxed{-2}$$

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Ex 7)  $-\frac{f(3)}{g(1)}$

$$-1 \cdot \frac{\sqrt{3+2} - 2}{\left(\frac{1-4}{1+3}\right) - 1(-3!5)}$$

$$\frac{\sqrt{5} - 2}{\left(-\frac{3}{4}\right)} \quad \boxed{.315}$$

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**Compositions:** Composing one function with another function is applying one function to the result of another function. The notation for composition is  $(f \circ g)(x)$  or  $f(g(x))$  and  $(g \circ f)(x)$  or  $g(f(x))$ . The inner function is always evaluated in the outer function.

Subbing one function in for x in another function.

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Find  $(f \circ g)(x)$  and its domain.

Ex 8)  $f(x) = x^2 + 2x + 1$  and  $g(x) = x + 5$

$$f \circ g(x)$$

$$x^2 + 2x + 1$$

$$\boxed{x+5}^2 + 2\boxed{x+5} + 1$$

$$x^2 + 10x + 25 + 2x + 10 + 1$$

$$\boxed{x^2 + 12x + 36}$$

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

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The domain of a composition:

1. Include the restrictions of the inside function (the one in the box)
2. Include the restrictions of the answer
3. Combine the restrictions together on one number line

Use the most restricted domain

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$f \circ g(x)$

Ex 9)  $f(x) = \frac{1}{x+1}$  and  $g(x) = \frac{x}{x-2}$

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

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

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

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$x \neq 2$   
 $x-2$   
 $\frac{x-2}{2x-2} \quad x \neq 1$       $2x-2=0$   
 $2x=2$   
 $x=1$   
 $D: (-\infty, 1) \cup (1, 2) \cup (2, \infty)$

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**Evaluating Composite Functions:**  
 Let  $f(x) = (x-1)^2 + 3$  and  $g(x) = -2|x+4| + 5$ . Evaluate.  
 Ex 10)  $(f \circ g)(-2)$      Ex 10)  $(g \circ f)(0)$      Ex 11)  $(f \circ f)(1)$      Ex 12)  $(g \circ g)(7)$   
 $f \circ g(-2)$   
 $g(-2)$   
 $-2|-2+4|+5$   
 $f(1)$   
 $(1-1)^2+3$   
 $0+3$   
 $3$

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Ex 10)  $(g \circ f)(0)$   
 $f(0)$   
 $(0-1)^2+3$   
 $(-1)^2+3$   
 $1+3$   
 $4$   
 $g(4)$   
 $-2|4+4|+5$   
 $-2|8|+5$   
 $-16+5$   
 $-11$

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5)  $d(\pi) + 3f(2)$   
 $2\cos\pi + 3\left(\frac{2}{2-4}\right)$   
 $2 \cdot -1$   
 $-2 + 3(-1)$   
 $-2-3$   
 $-5$

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17)  $f \circ g(6)$   
 $g(6)$   
 $\sqrt{6-2}$   
 $\sqrt{4}$   
 $2$   
 $f(2)$   
 $2(2)^2+1$   
 $9$

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29)  $f(x) = |x-5| - 2$       $g(x) = -2\sin x$   
 a)  $f \circ g(x)$   
 $| -2\sin x - 5 | - 2$      1.  $D: (-\infty, \infty)$   
 2.  $D: (-\infty, \infty)$   
 $| -2\sin x - 5 | - 2$       $D: (-\infty, \infty)$

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