

Periodic Graphs Day 9:

- Function Compositions

Homework: Function Compositions
(not due the next time I see you,
but already on Canvas in case you
want to practice now. But you are
allowed to enjoy break and not
think about functions for the next
ten days)

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

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

Example 1: Evaluating

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

$$g(x) = \sqrt[3]{x}$$

A) $(n \circ g)(8)$

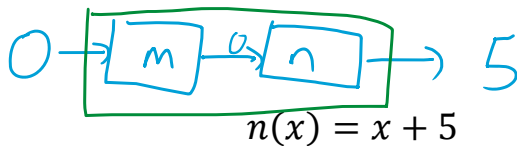
B) $(f \circ n)(4)$

$$h(x) = \frac{1}{x}$$

$$m(x) = x^2$$

C) $(n \circ m)(0)$

D) $(m \circ n)(0)$



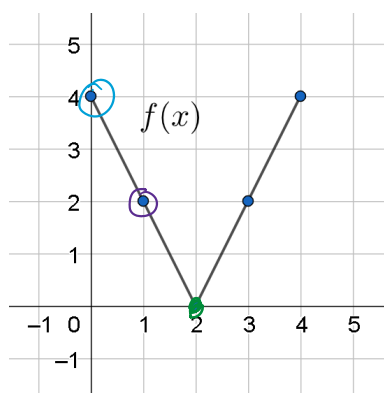
$$p(x) = x^2 - 10x + 25$$

$$p(4) = 16 - 40 + 25 = 1$$

E) $(f \circ p)(4)$

F) $(p \circ f)(4)$

Example 2: Evaluating



x	$g(x)$
0	3
1	4
2	2
3	0
4	1

A) $(f \circ g)(2)$

$$f(g(2))$$

$$f(2) = 0$$

B) $(g \circ f)(0)$

$$g(f(0))$$

$$g(4) = 1$$

C) $(f \circ f)(1)$

$$f(f(1))$$

$$f(2) = 0$$

Example 3: Evaluating

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

$$h(x) = \frac{1}{x}$$

$$n(x) = x + 5$$

$$g(x) = \sqrt[3]{x}$$

$$m(x) = x^2$$

$$p(x) = x^2 - 10x + 25$$

A) $(f \circ n)(-4)$

C) $(n \circ h)(-5)$

E) $(n \circ h)(0)$

B) $(n \circ f)(-4)$

D) $(h \circ n)(-5)$

F) $(h \circ n)(0)$

Domain

The domain of $f(g(x))$ is restricted to the elements of the domain of g for which $g(x)$ is in the domain of f .

So:

- Pay attention to domain of inside function
- Inside function has to be in the domain of outside function

Let $f(x) = \sqrt{x}$ and let $g(x) = \frac{1}{x-3}$.

Find an expression for $(f \circ g)(x)$

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

Example 4: Domain

So:

- Pay attention to domain of inside function
- Inside function has to be in the domain of outside function

Let $f(x) = \sqrt{x}$ and let $g(x) = \frac{1}{x-3}$.

Find an expression for $(g \circ f)(x) = g(f(x)) = g(\sqrt{x}) = \frac{1}{\sqrt{x}-3}$

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

Example 5: Domain

So:

- Pay attention to domain of inside function
- Inside function has to be in the domain of outside function

Let $f(x) = \sqrt{x}$ and let $g(x) = x^2 - 4$.

Find an expression for $(f \circ g)(x)$

Find an expression for $(g \circ f)(x)$

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

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

A special function for composing

Let $f(x) = \sqrt{x+2}$

Let $g(x) = x - 5$

Let $h(x) = x$

identity function

Find an expression for...

A) $(f \circ h)(x)$

$f(h(x))$
 $f(x) = \sqrt{x+2}$

B) $(g \circ h)(x)$

C) $(h \circ f)(x) = h(f(x))$
 $= h(\sqrt{x+2}) = \sqrt{x+2}$

D) $(h \circ g)(x)$

A special function for composing

- When we combine things with addition, we call 0 the "additive identity" since $0 + x = x$ and $x + 0 = x$
- When we combine things with multiplication, we call 1 the "multiplicative identity" since $1 \cdot x = x$ and $x \cdot 1 = x$
- When we combine functions with composition, we call $f(x) = x$ the "identity function" since $f(g(x)) = g(x)$ and $g(f(x)) = g(x)$.

tan
sec

$$y = 5 + \tan\left(2\left(x - \frac{\pi}{2}\right)\right) + 4$$

$$2\left(x - \frac{\pi}{2}\right) = \frac{\pi}{2} + \pi k$$

$$x - \frac{\pi}{2} = \frac{\pi}{4} + \frac{\pi}{2}k$$

$$x = \frac{3\pi}{4} + \frac{\pi}{2}k$$

