

Composition of functions

For two functions, f and g , to find $(f \circ g)(x) = \underline{\hspace{2cm}}$

Example: Let $f(x) = 3x + 4$ and let $g(x) = 2x^2 - 1$

$$\begin{aligned}\text{Find } (f \circ g)(5) &= f(g(5)) = f(2(5)^2 - 1) \\ &= f(49) = 3(49) + 4 \\ &= \boxed{151}\end{aligned}$$

$$\begin{aligned}\text{Find } (g \circ f)(-3) &= g(f(-3)) = g(3(-3) + 4) = g(-5) \\ &= 2(-5)^2 - 1 \\ &= 50 - 1 = \boxed{49}\end{aligned}$$

$$\begin{aligned}\text{Find } (g \circ f)(x) \\ g(f(x)) &= g(3x+4) = 2(3x+4)^2 - 1 = 2(9x^2 + 24x + 16) - 1 \\ &= \boxed{18x^2 + 48x + 31}\end{aligned}$$

$$\begin{aligned}\text{Find } (f \circ g)(m+2) &= f(g(m+2)) = f(2(m+2)^2 - 1) \\ &= f(2(m^2 + 4m + 4) - 1) \\ &= f(2m^2 + 8m + 7) \\ &= 3(2m^2 + 8m + 7) + 4 \\ &= \boxed{6m^2 + 24m + 25}\end{aligned}$$

Function Composition

Perform the indicated operation.

1) $g(x) = 2x + 4$

$h(x) = 4x - 2$

Find $g(h(-3))$

$$g(4(-3) - 2) = g(-14)$$

$$= 2(-14) + 4 = \boxed{-24}$$

2) $h(x) = x^3 + 3$

$g(x) = x + 1$

Find $(h \circ g)(-4) = h(g(-4))$

$$= h[-4 + 1] = h(-3) = (-3)^3 + 3$$

$$= \boxed{-24}$$

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

$h(x) = 3x + 1$

Find $(g \circ h)(2) = g(h(2))$

$$g[3(2) + 1] = g(7) = 3(7) + 2$$

$$= \boxed{23}$$

4) $h(x) = x - 5$

$g(x) = -2x^3 - 5x$

Find $(h \circ g)(-2) = h(g(-2))$

$$h[-2(-2)^3 - 5(-2)] = h[-2(-8) + 10]$$

$$= h(26) = 26 - 5 = \boxed{21}$$

5) $g(a) = 4a - 1$

$h(a) = 4a - 2$

Find $g(h(4y))$

$$g(4(4y) - 2) = g(16y - 2)$$

$$= 4(16y - 2) - 1 = 64y - 8 - 1$$

$$= \boxed{64y - 9}$$

6) $g(x) = 2x - 3$

$f(x) = 4x$

Find $g(f(-2x))$

$$g[4(-2x)] = g(-8x) = 2(-8x) - 3$$

$$= \boxed{-16x - 3}$$

7) $g(n) = 4n - 3$

$f(n) = -2n + 1$

Find $g(f(n^2))$

$$g(-2(n^2) + 1) = g(-2n^2 + 1)$$

$$= 4(-2n^2 + 1) - 3$$

$$= \boxed{-8n^2 + 1}$$

8) $g(x) = 4x + 4$

$f(x) = x^2 - 3x$

Find $(g \circ f)(x+3) = g(f(x+3))$

$$g[(x+3)^2 - 3(x+3)] = g[x^2 + 6x + 9 - 3x - 9]$$

$$= g[x^2 + 3x]$$

$$= 4(x^2 + 3x) + 4$$

$$= \boxed{4x^2 + 12x + 4}$$