2A.3. Composition of Functions

- $f(g(x))$ ≡ f of g of x ≡ f composed with g
- $g(f(x))$ ≡ g of f of x ≡ g composed with f

Example #1. For $f(x) = x^2 + 3x - 8$ and $g(x) = 4x - 7$, calculate

(a) $f(g(x))$ (b) $g(f(x))$ (c) $f(g(2))$ (d) $g(f(2))$

SOLUTION:

(a) $f(g(x)) = f(g) = g^2 + 3g - 8 = (4x-7)^2 + 3(4x-7) - 8 =$

$= (16x^2 - 56x + 49) + (12x - 21) - 8 = 16x^2 - 44x + 20$ ◄

(b) $g(f(x)) = 4f - 7 = 4(x^2 + 3x - 8) - 7 = 4x^2 + 12x - 32 - 8 =$

$= 4x^2 + 12x - 40$ ◄

(c) $g(2) = 1$, $f(g(2)) = f(1) = -4$ ◄

(d) $f(2) = 2$, $g(f(2)) = g(2) = 1$ ◄

Example #2. Let x ≡ list price of an item for sale.

(a) Write a function $f(x)$ which means \$10 off

(b) Write a function $g(x)$ which means 20% discount.

(c) Calculate $f(g(x))$ and state its meaning.

(d) Calculate $g(f(x))$ and state its meaning.

(e) Which is best for the customer, $f(g(x))$ or $g(f(x))$?

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SOLUTION:

(a) $f(x) = x - 10$ ◄ (b) $g(x) = 0.8x$ ◄

(c) $f(g(x)) = f(g) = g - 10 = 0.8x - 10$ ◄

Take the 20% discount, then take $10.00 off ◄

(d) $g(f(x)) = 0.8f = 0.8(x - 10) = 0.8x - 8$ ◄

Take $10.00 off, then take the 20% discount.

(e) $f(g(x))$ is better ◄