

AM Objective #13: Find Composition of 2 functions

1. Given  $f(x) = \frac{x+4}{x}$  and  $g(x) = x^2 + 3$  find  $(g \circ f)(6)$ .

[A]  $\frac{52}{9}$

[B]  $\frac{84}{25}$

[C]  $\frac{43}{39}$

[D]  $\frac{14}{3}$

$$f(6) = \frac{6+4}{6} = \frac{10}{6} = \frac{5}{3}$$

$$\begin{aligned} g(f(6)) &= g\left(\frac{5}{3}\right) = \left(\frac{5}{3}\right)^2 + 3 \\ &= \frac{25}{9} + 3 \cdot \frac{9}{9} \\ &= \frac{25}{9} + \frac{27}{9} \\ &= \frac{52}{9} \end{aligned}$$

2. Given  $f(x) = x^5$  and  $g(x) = -5 + x$ , find  $(f \circ g)(x)$ .

[A]  $(-5+x^5)^5$

[B]  $-5x^5 + x^6$

[C]  $(-5+x)^5$

[D] none of these

$$f(g(x)) = f(-5+x) = (-5+x)^5$$

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3. Given  $f(x) = -2x^2$ ,  $g(x) = -3x + 7$ , and  $h(x) = \sqrt{x}$ , find  $[(f + g) \circ h](x)$ .

[A]  $-2x - 3\sqrt{x} + 7$  [B]  $-2x^2 - 3\sqrt{x} + 7$  [C]  $6x + \sqrt{x} + 7$  [D]  $-2\sqrt{x} - 3x + 7$

$$\begin{aligned} (f+g)(x) &= f(x) + g(x) \\ &= -2x^2 + -3x + 7 \\ &= -2x^2 - 3x + 7 \end{aligned}$$

$$\begin{aligned} [(f+g) \circ h](x) &= (f+g)(h(x)) = (f+g)(\sqrt{x}) \\ &= -2(\sqrt{x})^2 - 3(\sqrt{x}) + 7 \\ &= -2x - 3\sqrt{x} + 7 \end{aligned}$$

4. If  $g(x) = 5x^2$  and  $f(x) = 5x + 3$ , find  $(g \circ f)(-3)$  and  $(f \circ g)(4)$ .

$$\begin{aligned} f(-3) &= 5(-3) + 3 \\ &= -15 + 3 \\ &= -12 \end{aligned}$$

$$\begin{aligned} g(f(-3)) &= g(-12) = 5(-12)^2 \\ &= 5 \cdot 144 \\ &= 720 \end{aligned}$$

$$\begin{aligned} g(4) &= 5(4)^2 \\ &= 5 \cdot 16 \\ &= 80 \end{aligned}$$

$$\begin{aligned} f(g(4)) &= f(80) = 5(80) + 3 \\ &= 400 + 3 \\ &= 403 \end{aligned}$$