

Composition of Function Notes

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

* inside \rightarrow out

Find the rule given the functions:

$$f(x) = x^2 - 7$$

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

$$h(x) = \sqrt{x+1}$$

$$\begin{aligned} 1. f(-3) &\quad x = -3 \\ &= (-3)^2 - 7 \\ &= 9 - 7 \\ &= \boxed{2} \end{aligned}$$

$$\begin{aligned} 2. h(8) &\quad x = 8 \\ &= \sqrt{8+1} \\ &= \sqrt{9} \\ &= \boxed{3} \end{aligned}$$

$$3. (f+g)(x) = f(x) + g(x)$$

$$(x^2 - 7) + (3x + 2)$$

$$\begin{aligned} &x^2 - 7 + 3x + 2 \\ &\boxed{x^2 + 3x - 5} \end{aligned}$$

$$\begin{aligned} 4. (fg)(x) &= f(x) \cdot g(x) \\ &(x^2 - 7)(3x + 2) \end{aligned}$$

$$\boxed{3x^3 + 2x^2 - 21x - 14}$$

$$\begin{aligned} 5. (f-g)(x) &= f(x) - g(x) \\ &(x^2 - 7) - (3x + 2) \end{aligned}$$

$$\begin{aligned} &x^2 - 7 - 3x - 2 \\ &\boxed{x^2 - 3x - 9} \end{aligned}$$

$$6. (f/g)(x) = \frac{f(x)}{g(x)}$$

$$\begin{aligned} &\frac{x^2 - 7}{3x + 2} \end{aligned}$$

$$\begin{aligned} 7. g(f(12)) &\quad \downarrow \\ &f(12) = 12^2 - 7 = 137 \end{aligned}$$

$$\begin{aligned} 8. f(g(7)) &\quad \downarrow \\ &g(7) = 3(7) + 2 = 23 \end{aligned}$$

$$9. f(g(x)) \quad \downarrow$$

$$f(3x+2)$$

$$g(137) = 3(137) + 2 = 413$$

$$\boxed{413}$$

$$\begin{aligned} f(23) &= 23^2 - 7 \\ &= 522 \end{aligned}$$

$$\boxed{522}$$

$$= (3x+2)^2 - 7$$

$$\begin{aligned} &= 9x^2 + 6x + 4 - 7 \\ &= \boxed{9x^2 + 12x - 3} \end{aligned}$$

$$\begin{aligned} 10. (f+g)(2) &\quad f(2) + g(2) \\ &\quad \downarrow \\ &= 2^2 - 7 = 3(2) + 2 \\ &= 4 - 7 = 8 \\ &= -3 \end{aligned}$$

$$-3 + 8 = \boxed{5}$$

$$11. g(f(x)) \quad \downarrow$$

$$\begin{aligned} g(x^2 - 7) &= 3(x^2 - 7) + 2 \\ &= 3x^2 - 21 + 2 \\ &= \boxed{3x^2 - 19} \end{aligned}$$

$$12. (f \circ h)(x) = f(h(x))$$

$$\begin{aligned} &f(\sqrt{x+1}) \quad \uparrow \\ &= (\sqrt{x+1})^2 - 7 \quad \sqrt{x+1} \\ &= x+1 - 7 \\ &= \boxed{x-6} \end{aligned}$$

13. Find the domain restrictions for #6.
(the denom $\neq 0$)

$$\begin{aligned} 3x+2 &= 0 \\ x &= -\frac{2}{3} \end{aligned} \rightarrow \boxed{x \neq -\frac{2}{3}}$$

$$14. (f-g)(4) = f(4) - g(4)$$

$$f(4) = 4^2 - 7 = 16 - 7 = 9$$

$$g(4) = 3(4) + 2 = 12 + 2 = 14$$

$$9 - 14 = \boxed{-5}$$