

**a few more algebra reminders . . . .**

1. Find the domain. Write it in interval notation.

(a) Domain:  $(-\infty, -2) \cup (-2, 3) \cup (3, +\infty)$

$$f(x) = \frac{2}{(x+2)(x-3)}$$

(b) Domain:  $(-\infty, -2) \cup (-2, 3) \cup (3, +\infty)$

$$g(x) = \frac{x-1}{(x+2)(x-3)}$$

(c) Domain:  $(-\infty, +\infty)$

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

(d) Domain:  $(-\infty, +\infty)$

$$j(x) = 5$$

(e) Domain:  $(-\infty, 2]$

$$k(x) = \sqrt{2-x}$$

(f) Domain:  $(-\infty, 4) \cup (4, +\infty)$

$$l(x) = \frac{x}{\sqrt[3]{x-4}}$$

2. Let  $f(x) = x^2 + 1$  and  $g(x) = 2x + 3$ . Find . . .

(a)  $g \circ f = g(f(x)) = g(x^2 + 1) = 2(x^2 + 1) + 3 = 2x^2 + 5$

(b)  $f \circ g = f(g(x)) = f(2x + 3) = (2x + 3)^2 + 1 = 4x^2 + 12x + 10$

(c)  $g \circ g = g(g(x)) = g(2x + 3) = 2(2x + 3) + 3 = 4x + 9$

(d)  $f \circ f = f(f(x)) = f(x^2 + 1) = (x^2 + 1)^2 + 1 = x^4 + 2x^2 + 2$

3. For the given function, find (and simplify)

(i)  $f(x + h)$

(ii)  $f(x + h) - f(x)$

(iii)  $\frac{f(x+h)-f(x)}{h}$

(a)  $f(x) = 3x + 7$

$$f(x + h) = 3(x + h) + 7 = 3x + 3h + 7$$

$$f(x + h) - f(x) = (3x + 3h + 7) - (3x + 7) = 3h$$

$$\frac{f(x + h) - f(x)}{h} = \frac{3h}{h} = 3$$

(b)  $f(x) = x^2$

$$f(x + h) = (x + h)^2 = x^2 + 2xh + h^2$$

$$f(x + h) - f(x) = (x^2 + 2xh + h^2) - (x^2) = 2xh + h^2$$

$$\frac{f(x + h) - f(x)}{h} = \frac{2xh + h^2}{h} = \frac{h(2x + h)}{h} = 2x + h$$

(c)  $f(x) = \frac{1}{x+3}$

$$f(x + h) = \frac{1}{(x + h) + 3} = \frac{1}{x + h + 3}$$

$$\begin{aligned} f(x + h) - f(x) &= \frac{1}{x + h + 3} - \frac{1}{x + 3} = \frac{(x + 3)}{(x + h + 3)(x + 3)} - \frac{(x + h + 3)}{(x + h + 3)(x + 3)} \\ &= \frac{(x + 3) - (x + h + 3)}{(x + h + 3)(x + 3)} = \frac{-h}{(x + h + 3)(x + 3)} \end{aligned}$$

$$\begin{aligned} \frac{f(x + h) - f(x)}{h} &= \frac{\frac{-h}{(x+h+3)(x+3)}}{h} = \frac{\frac{-h}{(x+h+3)(x+3)}}{\frac{h}{1}} = \frac{-h}{(x + h + 3)(x + 3)} \cdot \frac{1}{h} \\ &= \frac{-1}{(x + h + 3)(x + 3)} \end{aligned}$$