Discontinuous Piecewise

$$f(x) = \begin{cases} |x+2| & \text{if } x \leq 3 \\ 2\ln(x) & \text{if } x > 3 \end{cases}$$

$$g(x) = \begin{cases} 2\cos(x) & \text{if } x < -3 \\ e^x + 3 & \text{if } x \geq -3 \end{cases}$$

$$h(x) = \begin{cases} -x^2 + 3 & \text{if } x \leq 2 \\ -x & \text{if } x > 2 \end{cases}$$

1.4 Combining Functions

Part A

$f(x) = x^2 - 2x \quad g(x) = x + 3$

addition

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

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

$= x^2 - x + 3$

Domain

$(-\infty, \infty)$

subtraction

$$(f-g)(x) = f(x) - g(x)$$

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

$$= x^2 - 2x - x - 3$$

$$= x^2 - 3x - 3$$

Domain

$(-\infty, \infty)$

Multiplication

$$(fg)(x) = f(x)\,g(x)$$

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

$$= x^3 + 3x^2 - 2x^2 - 6x$$

$$= x^3 + x^2 - 6x$$

Domain $(-\infty, \infty)$

Division

$$(f/g)(x) = \frac{f(x)}{g(x)} \quad g(x) \neq 0$$

$$= \frac{x^2 - 2x}{x+3}$$

$x + 3 \neq 0$

$x \neq -3$

Domain $(-\infty, -3) \cup (-3, \infty)$

$$(g/f)(x) = \frac{g(x)}{f(x)} \quad f(x) \neq 0$$

$$= \frac{x+3}{x^2-2x}$$

$$x^2 - 2x = 0$$

$$x(x-2) = 0$$

$$x \neq 0 \quad x \neq 2$$

$$(-\infty, 0) \cup (0, 2) \cup (2, \infty)$$

$f(x) = |x|$ $\quad g(x) = \sqrt{x-2}$

-5 $\quad \sqrt{-5-2}$

$(f+g) = |x| + \sqrt{x-2}$

$|x|$ domain $(-\infty, \infty)$

$x-2 \geq 0$

$x \geq 2$

domain $[2, \infty)$

$(f-g) = |x| - \sqrt{x-2}$

domain $[2, \infty)$

domain will be smaller of 2 individual domains

$(fg) = |x|\sqrt{x-2}$

domain $[2, \infty)$

$\left(\frac{f}{g}\right) = \frac{|x|}{\sqrt{x-2}}$

$x - 2 > 0$

$x > 2$ $\quad (2, \infty)$

Composition of functions

$f(x) = x^2 - 2x \qquad g(x) = x + 3$

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

$f \circ f, \; g \circ f, \; x$

$f(x) = x^2 - 2x \qquad g(x) = x + 3$

$(f \circ g)(2) = f(g(2))$

$2 + 3$

5

$= f(5)$

$= (5)^2 - 2(5)$

$= 15$

$(g \circ f)(3) = g(f(3))$

$g(3)$

$x + 3$

$3 + 3$

6

$x^2 - 2x$

$(3)^2 - 2(3)$

$9 - 6$

3

$f(x) = \sin(x) \quad g(x) = e^x$

$(f \circ g)(1) = f(g(1))$ $\quad e^1 = 2.7$

$f(2.7)$

$\sin(2.7) = 0.43$

$(g \circ f)(1) = g(f(1))$

$= g(.84)$

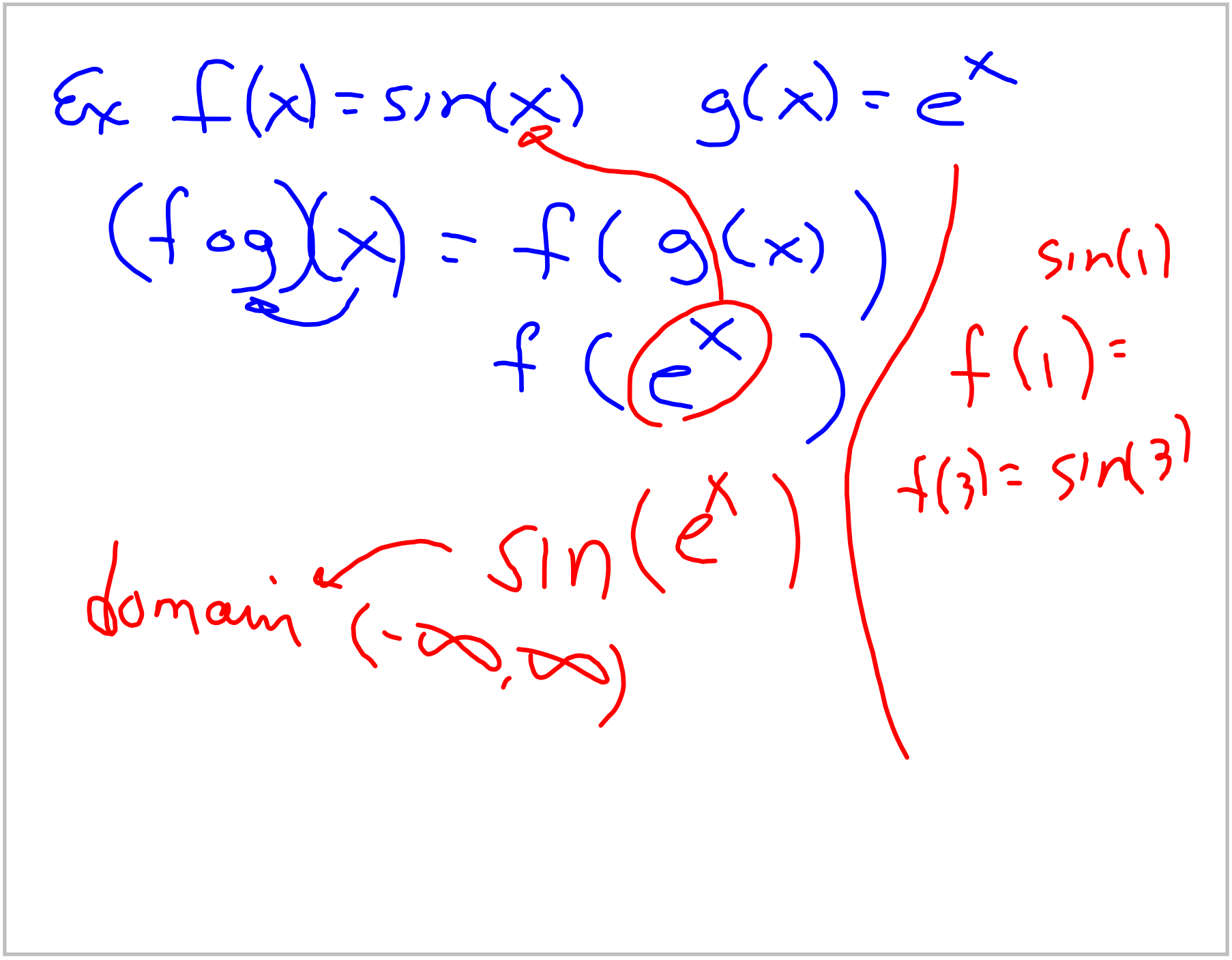
$f(1) = \sin(1)$

$= .84$

$e^{.84} = 2.32$

$g(x) = e^{.84}$

$g(.84) = e$


Ex f(x) = sin(x) g(x) = e^x
(f ∘ g)(x) = f(g(x))
f (e^x)
sin(e^x)
domain (-∞, ∞)
sin(1)
f(1) =
f(3) = sin(3)

$f(x) = \sin(x)$ $\quad g(x) = e^x$

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

$= g(\sin(x))$

$e^{\sin x}$

domain $(-\infty, \infty)$

$f(x) = x^2$ $\quad g(x) = x+5$

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

$= f(x+5)$

$= (x+5)^2$

$= (x+5)(x+5)$

$= x^2 + 10x + 25$

domain

$(-\infty, \infty)$

$(g \circ f)(x)$

domain

$(-\infty, \infty)$

$= g(f(x))$

$= g(x^2)$

$\boxed{= x^2 + 5}$