

**Worksheet 3**

1. Suppose that  $f(x) = x^2 - 2x$ . Evaluate the following:

$$\frac{f(a+h) - f(a)}{h}$$

Simplify your answer as much as possible.

2. Suppose that  $g(x) = \sqrt{x}$ . Evaluate the following:

$$\frac{g(a+h) - g(a)}{h}$$

Rationalize the numerator of your answer, and then simplify as much as possible.

3. Suppose that  $f(x) = x^2 + 3x$  and  $g(x) = \sqrt{x}$ .

(a) What is  $f(g(x))$ ?

(b) What is  $g(f(x))$ ?

4. For each of the following functions  $h(x)$ , find functions  $f(x)$  and  $g(x)$  so that

$$f(g(x)) = h(x)$$

(a)  $h(x) = \sqrt{x^2 + 1}$

(b)  $h(x) = \sin(3x^2)$

5. Simplify:

(a)  $\frac{x^3y^2}{xy}$

(b)  $\frac{x^{4/5}}{x^{1/3}}$

(c)  $\frac{(x^2y^4)^3}{x^3y^5}$

(d)  $\frac{\sqrt{x^2y^3}}{x^{1/3}y^{-2}}$

6. Evaluate each of the following:

(a)  $(\sqrt[3]{64})^2$

(b)  $\sqrt[5]{32}$

(c)  $81^{3/4}$

(d)  $\sqrt{27^{2/3}}$

7. Solve the following equations:

(a)  $x^{-2} = \frac{1}{4}$

(b)  $x^{3/2} = 27$

(c)  $x^{-1/2} = 3$

(d)  $\frac{9}{\sqrt{x^3}} = \frac{1}{\sqrt{x}}$

8. Find all solutions to the following equation:

$$x^{2/5} - 5x^{1/5} + 6 = 0$$

*Hint:* First, let  $a = x^{1/5}$ , and solve for  $a$ .

9. Evaluate each of the following:

(a)  $\log_{10}(1,000,000)$

(b)  $\ln(e^5)$

(c)  $\log_3(9)$

(d)  $\log_b(b^3)$  for  $b > 0$

10. Expand the following expressions:

(a)  $\log_{10}\left(\frac{xy}{z}\right)$

(b)  $\log_3\left(\sqrt[3]{\frac{x^2y}{z}}\right)$

(c)  $\ln\left(\frac{x-2}{x+3}\right)$

11. Solve the following equations:

(a)  $2^x = 32$

(b)  $3^t = 5$

(c)  $2 = 3^{5x-6}$

(d)  $10 = 2e^{5t}$

(e)  $\log_3(x) = 4$

(f)  $\ln(3x) = 5$

(g)  $\log_3(x-2) + \log_3(x+2) = 4$

(h)  $\ln(\ln x) = 1$