Some algebra you may need to review

1. Factoring

Example 1.1. *Factor* $6x^3 - 2x^7$

Example 1.2. *Factor* $\frac{4}{3}x^{1/3} - 2x^{-2/3}$

Example 1.3. *Factor* $4(x-3)^3(2x-1)^3 + (x-3)^4 \cdot 3(2x-1)^2 \cdot 2$

2. Quadratic Equation

The solutions for x to the quadratic equation $0 = ax^2 + bx + c$ are

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

3. Equations of a Line

Horizontal Line: through (a, b) has equation $y = b$. A line is horizontal if and only of the slope is 0.

Vertical Line: through (a, b) has equation $x = a$. A line is vertical if and only of the slope is undefined.

General or Standard Form: $Ax + By = C$ or $Ax + By + C = 0$ where A, B, and C are real numbers.

Slope-Intercept Form: $y = mx + b$, where m is the slope and b is the y-intercept

Point-Slope Form: $y - y_1 = m(x - x_1)$ where m is the slope and (x_1, y_1) is a point on the line.

Parallel: If two lines are parallel then their slopes are the same

Perpendicular: If two lines are perpendicular then their slopes are the negative reciprocal of each other.

4. Logarithms

Definition 4.1. *The logarithm of x with respect to the base a is defined by*

$$y = \log_a x \text{ if and only if } x = a^y$$

Theorem 4.1 (Properties)**.**

(1) *Order of operations example:*

$$\begin{aligned} 4\log_2 4 \cdot 4/2 + 2 &= 4(\log_2(4 \cdot 4/2)) + 2 \\ &= 4(\log_2(8)) + 2 \\ &= 4(3) + 2 \\ &= 14 \end{aligned}$$

(2) (a) $\log_a 1 = 0$
(b) $\log_a a = 1$

(3) *Two special logarithms:*
(a) $\log x = \log_{10} x$
(b) $\ln x = \log_e x$

(4) *Since* $f(x) = a^x$ *and* $g(x) = \log_a x$ *are one-to-one:*
(a) $a^u = a^v$ *if and only if* $u = v$
(b) $\log_a u = \log_a v$ *if and only if* $u = v$.

(5) *Since* $f(x) = a^x$ *and* $g(x) = \log_a x$ *are inverses of each other:*
(a) $\log_a a^u = u$

(b) $a^{\log_a u} = u$

(6) *Operations:*
(a) $\log_a(mn) = \log_a m + \log_a n$

(b) $\log_a(m/n) = \log_a m - \log_a n$

(c) $\log_a(m^n) = n \log_a m$

(7) *Change of base formula: If* $b > 0$ *and* $b \neq 0$, *then* $\log_a x = \frac{\log_b x}{\log_b a}$. *In particular,*

$$\log_a x = \frac{\log x}{\log a} = \frac{\ln x}{\ln a}.$$

(8) *The domain of* $f(x) = \log_a x$ *is* $\{x | x > 0\}$.

For more detailed review of these topics and more see Chapters 1, 2 and Appendix A in the text. It is expected that you know the topics covered in these chapters and appendix.