Math Refresher

In the algebraic rules presented below, the variables represented by small latters (x, y, a, b, c, etc.) are all real numbers.

1. \((x^a)^b = x^{ab}\)
2. \(x^a x^b = x^{a+b}\)
3. \(x^{-a} = \frac{1}{x^a}\)
4. \(c(x + y) = cx + cy\)
5. \((x + y)^a \neq x^a + y^b\). Note that this implies that \(\sqrt{x+y} \neq \sqrt{x} + \sqrt{y}\)
6. \(\frac{x}{y} = \frac{z}{w} \Rightarrow xw = yz\)
7. \(cx + a = b \Rightarrow x = \frac{b - a}{c}\)
8. \(x_1 + x_2 + \cdots + x_n = \sum_{i=1}^{n} x_i\)
9. \(cx_1 + cx_2 + \cdots + cx_n = c\sum_{i=1}^{n} x_i\)
10. \(x_1 + x_2 + \cdots + x_n + y_1 + y_2 + \cdots + y_n = \sum_{i=1}^{n} (x_i + y_i) = \sum_{i=1}^{n} x_i + \sum_{i=1}^{n} y_i\)
11. \(cx_1 + cx_2 + \cdots + cx_n + dy_1 + dy_2 + \cdots + dy_n = \sum_{i=1}^{n} (cx_i + dy_i) = c\sum_{i=1}^{n} x_i + d\sum_{i=1}^{n} y_i\)
12. \(\ln(xy) = \ln x + \ln y\). Here, \(\ln\) is the natural logarithm (log base \(e\)).
13. \(\ln\frac{x}{y} = \ln x - \ln y\)
14. \(\ln x^y = y \ln x\)
15. \((x + y)^2 = x^2 + 2xy + y^2\)

16. Special mathematical constant: \(e = 2.718281828459\ldots\). \(e\) is the base of the natural logarithm.

\[\ln e = 1, \ln e^x = x\text{ (from rule 14)}, e^{-x} = \frac{1}{e^x}\text{ (from rule 3)}, e^{-(x+y)} = e^{-x}e^{-y}\text{ (from rule 2)}\]

17. \(x > y \Rightarrow -x < -y\), \(x < y \Rightarrow -x > -y\), \(x \geq y \Rightarrow -x \leq -y\), \(x \leq y \Rightarrow -x \geq -y\)