Absolute Value  Defn: The absolute value of a real \( z \) is

\[
|z| = \begin{cases} 
  z & \text{if } z \geq 0 \\
  -z & \text{if } z < 0 
\end{cases}
\]

Rule: \( \sqrt{z^2} = |z| \)

Proportionality
Defn I) Quantity \( A \) is directly proportional to quantity \( B \) if \( A = k \cdot B \) for some constant \( k \).

II) Quantity \( A \) is inversely proportional to quantity \( B \) if \( A = k \cdot \frac{1}{B} \) for some constant \( k \).

Note: \( k \) is sometimes referred to as a proportionality constant.

Lines
Defn: The slope of the line passing through points \( (x_1, y_1) \) & \( (x_2, y_2) \) is

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\Delta y}{\Delta x} = \frac{\text{rise}}{\text{run}}
\]

Slope-Intercept Form: \( y = mx + b \) is line with slope \( m \) & \( y \)-intercept \( b \).

Point-Slope Form \( y - y_1 = m(x - x_1) \) is line with slope \( m \) & passing through point \( (x_1, y_1) \).

Parallel Lines
Same slopes \( m_1 = m_2 \)

Perpendicular Lines
Slopes are negative reciprocals
\( m_1 \cdot m_2 = -1 \) or \( m_1 = -\frac{1}{m_2} \)
Triangles

Similar Triangles
All angles match

$$\frac{A}{B} = \frac{a}{b}$$

Pythagorean Theorem
$$a^2 + b^2 = c^2$$ if & only if the triangle is right

Defn The distance between two points \((x_1, y_1) \& (x_2, y_2)\)
in the xy-plane
$$L = \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$$

Defn The midpoint of the line segment joining
points \((x_1, y_1) \& (x_2, y_2)\) is
$$mp = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

Circles
The circle w/ center \((h, k)\) & radius \(r\)
is given by
$$(x-h)^2 + (y-k)^2 = r^2$$

Exponent Rules
1) \((x^m)^n = x^{mn}\)
2) \(x^m \cdot x^n = x^{m+n}\)
3) \(\frac{x^m}{x^n} = x^{m-n}\)
4) \((xy)^m = x^m y^m\)
5) \((\frac{x}{y})^m = \frac{x^m}{y^m}\)
6) \(x^{-m} = \frac{1}{x^m}\)

Logarithms
Defn \(\log_b x = m\) means \(b^m = x\)

Rules 1) \(\log_b (mn) = \log_b m + \log_b n\)
2) \(\log_b \left(\frac{m}{n}\right) = \log_b m - \log_b n\)
3) \(\log_b m^n = n \log_b m\)
4) \(\log_b b^x = x\)
5) \(\log_b b \log_b x = x\)

Notation
1) \(\ln x = \log_e x\) with \(e \approx 2.71828\)
2) \(\log x = \log_{10} x\)

Complex Numbers
Defn I) \(i = \sqrt{-1}\)
II) \(a + bi\) is the general form of a complex number \((a, b)\) are real #s
Note: \(i^2 = -1\), \(i^3 = -i\), \(i^4 = 1\), \(i^5 = i\), ...