Algebra Formulas

Log Formulas:

\[
\log_n(ab) = \log_n a + \log_n b
\]

\[
\log_n \left(\frac{a}{b}\right) = \log_n a - \log_n b
\]

\[
\log_n(a^b) = b \cdot \log_n a
\]

\[
\log_n n = 1 \quad \ln e = 1
\]

\[
\log_n 1 = 0
\]

\[
\log_n a = b \Rightarrow n^b = a
\]

\[
\log_n a = \frac{\log a}{\log n} = \frac{\ln a}{\ln n}
\]

Interest Formulas:

\[A = Pe^{rt}\] Complied Continuously

\[A = P\left(1 + \frac{r}{n}\right)^{nt}\] Complied n times per year

\[I = Prt\] Simple Interest

Linear Formulas:

\[\text{slope} = \frac{y_2 - y_1}{x_2 - x_1}\]

\[y = mx + b\] Slope-Intercept Form

\[y - y_1 = m(x - x_1)\] Point-Slope Form

**Perpendicular Lines = opposite reciprocal slopes. Ex: \(m_1 = \frac{3}{4}\) Perp. slope = \(-\frac{4}{3}\)

**Parallel Lines = same exact slope
Ex: \(m_1 = \frac{3}{4}\) Parallel slope = \(\frac{3}{4}\)

Quadratic Equations:

General Form: \(y = ax^2 + bx + c\)

Vertex: \(x = -\frac{b}{2a}\) Substitute x into original equation to find y-value

X-intercept: Solve quadratic Formula:

\[x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}\] Written as: \((x, 0)\)

Y-intercept: always c-value if in general form
Written as: \((0, y)\)

Standard Form: \(y - k = a(x - h)^2\)

Vertex: \((h, k)\)

X-intercept: Substitute 0 for y and solve for x
Written as: \((x, 0)\)

Y-intercept: Substitute 0 for x and solve for y
Written as: \((0, y)\)

Sequences and Series:

Arithmetic Sequences

\[a_n = a_1 + (n - 1) \cdot d\]

To Sum an arithmetic Sequence:

\[s_n = \frac{n}{2}(a_1 + a_n)\] Or \[s_n = \frac{n}{2}(2a_1 + (n - 1) \cdot d)\]

Geometric Sequences

\[a_n = a_1 \cdot r^{n-1}\]

To Sum a geometric Sequence:

\[s_n = \frac{a_1(r^n - 1)}{r - 1}\] Or \[s_{\text{infinite}} = \frac{a_1}{1 - r}\]
Rational Equations

Ex. \( y = \frac{2x+5}{x^2-4} \)

**Vertical Asymptote:**
- set denominator = 0 and solve for \( x \)

**Horizontal Asymptote:**
- Degree of numerator > degree of denominator
  - **No Horizontal Asymptote**
- Degree of numerator < degree of denominator
  - \( y = 0 \)
- Degree of numerator = degree of denominator
  - \( y = \text{Ratio of Num. to Den.} \)

**Domain:**
- Opposite of the Vertical Asymptote

Ex. VA: \( x=4 \)  Dom.: \( x \neq 4 \) or All real numbers except when \( x=4 \)

**Range:**
- Look on the graph, the range are the \( y \)-values that the graph includes

**X-Intercept:**
- Set \( y=0 \) and solve for \( x \)

**Y-Intercept:**
- Set \( x=0 \) and solve for \( y \)

Box Word Problems

\[ \text{Volume} = (\text{Length}-2x)(\text{Width}-2x)(x) \]
\[ \text{Area}_{\text{box}} = (\text{Length}-2x)(\text{Width}-2x) \]
\[ \text{Area}_{\text{material}} = (\text{Length})(\text{Width}) \]

Working Together Word Problems

\[ \frac{1}{\text{Time for person 1}} + \frac{1}{\text{Time for person 2}} = \frac{1}{\text{Time for working together}} \]

*multiply by common denominator to get rid of fractions.

Distance / Traveling Word Problems

\[ \text{Distance} = \text{rate} \times \text{time} \]

Profit Revenue Cost Problems

**Revenue** = (Price)(Quantity)

**Cost** = (Variable Cost)(Quantity) + Fixed Costs

**Profit** = Revenue – Cost

**To Find Break-Even Amount**
- Set Profit = 0 (solve for \( x \))
- or

Revenue = Cost (solve for \( x \))