Quick Reference 1 **Fundamental Concepts**

Commutative properties: $a+b=b+a$ $ab=ba$

Associative properties: $a+(b+c)=(a+b)+c$ $a(bc)=(ab)c$

Distributive properties: $a(b+c)=ab+ac$ $(a+b)c=ac+bc$

Identities: $a+0=0+a=a$ $a\cdot 1=1\cdot a=a$

Inverses: $a+(-a)=(-a)+a=0$ $a\left(\frac{1}{a}\right)=\left(\frac{1}{a}\right)a=a$

Absolute value: $|a|=|-a|$ for every real number a

Operations with real numbers

Subtract real numbers: $a-b=a+(-b)$

Multiply real numbers: $a\times b=a\cdot b=ab$ $a\times 0=0$

Divide real numbers: $\frac{a}{b}=a\div b$ $\frac{a}{-b}=\frac{-a}{b}=-\frac{a}{b}$ $\frac{0}{a}=0$ $\frac{a}{0}=$ undefined

Multiplication signs: $(+)(+)=(+)$ $(-)(-)=(+)$ $(+)(-)=(-)$ $(-)(+)=(-)$

Division signs: $\frac{(+)}{(+)}=(+)$ $\frac{(-)}{(-)}=(+)$ $\frac{(+)}{(-)}=(-)$ $\frac{(-)}{(+)}=(-)$

Note: $(+)$ is a positive number. $(-)$ is a negative number.

Operations with Fractions

(All denominators are nonzero real numbers.)

Fractions with same denominators: $\frac{a}{b}+\frac{c}{b}=\frac{a+c}{b}$ $\frac{a}{b}-\frac{c}{b}=\frac{a-c}{b}$

Add fractions (find a common denominator): $\frac{a}{b}+\frac{c}{d}=\frac{ad+bc}{bd}$

Subtract fractions (find a common denominator): $\frac{a}{b}-\frac{c}{d}=\frac{ad-bc}{bd}$

Multiply fractions: $\left(\frac{a}{b}\right)\cdot\left(\frac{c}{d}\right)=\frac{ac}{bd}$

Divide fractions: $\left(\frac{a}{b}\right)\div\left(\frac{c}{d}\right)=\left(\frac{a}{b}\right)\cdot\left(\frac{d}{c}\right)=\frac{ad}{bc}$

Cancel common factor: $\frac{ab}{ac}=\frac{b}{c}$ $\frac{ab+ac}{ad}=\frac{a(b+c)}{ad}=\frac{b+c}{d}$