

College Algebra Quick Reference

Factoring Formulas

- Difference of Squares:
 $a^2 - b^2 = (a + b)(a - b)$
 $16x^2 - 25 = (4x + 5)(4x - 5)$
- Perfect Square Trinomials:
 $a^2 + 2ab + b^2 = (a + b)^2$
 $a^2 - 2ab + b^2 = (a - b)^2$
 $x^2 + 6x + 9 = (x + 3)^2$
- Sum/Difference of Cubes:
 $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$
 $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$
 $8x^3 + 27 = (2x + 3)(4x^2 - 6x + 9)$

Rules of Exponents

For all $a, b \neq 0$ and any real numbers m, n :

- $a^m \cdot a^n = a^{m+n}$
 $x^3 \cdot x^4 = x^7$
- $\frac{a^m}{a^n} = a^{m-n}$
 $\frac{x^5}{x^2} = x^3$
- $(a^m)^n = a^{mn}$
 $(x^2)^3 = x^6$
- $(ab)^n = a^n b^n$
 $(2x)^3 = 8x^3$
- $a^0 = 1$ (if $a \neq 0$)
- $a^{-n} = \frac{1}{a^n}$
 $x^{-2} = \frac{1}{x^2}$

Rational Exponents

- $a^{\frac{m}{n}} = \sqrt[n]{a^m}$
 $8^{\frac{2}{3}} = \sqrt[3]{8^2} = \sqrt[3]{64}$

- $(a^{\frac{1}{n}})^n = a$
 $(x^{\frac{1}{3}})^3 = x$

Complex Fractions

Simplify by multiplying numerator and denominator by LCD:

$$\frac{\frac{a}{b}}{\frac{c}{d}} = \frac{a}{b} \cdot \frac{d}{c} = \frac{ad}{bc}$$

$$\frac{\frac{2}{x}}{\frac{3}{y}} = \frac{2y}{3x}$$

Operations with Fractions

- Addition/Subtraction:

$$\frac{a}{b} \pm \frac{c}{d} = \frac{ad \pm bc}{bd}$$
$$\frac{1}{2} + \frac{1}{3} = \frac{3+2}{6} = \frac{5}{6}$$

- Multiplication:

$$\frac{a}{b} \cdot \frac{c}{d} = \frac{ac}{bd}$$
$$\frac{1}{3} \cdot \frac{3}{4} = \frac{6}{12} = \frac{1}{2}$$

- Division:

$$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \cdot \frac{d}{c} = \frac{ad}{bc}$$
$$\frac{1}{2} \div \frac{1}{4} = \frac{1}{2} \cdot \frac{4}{1} = 2$$

Reducing Radicals

- Perfect square under radical:

$$\sqrt{a^2 b} = a\sqrt{b}$$
$$\sqrt{16x^2} = 4|x|$$

- Product rule:

$$\sqrt{ab} = \sqrt{a}\sqrt{b}$$
$$\sqrt{12} = \sqrt{4}\sqrt{3} = 2\sqrt{3}$$

- Quotient rule:

$$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$$
$$\sqrt{\frac{x^2}{y}} = \frac{|x|}{\sqrt{y}}$$