STUDENT SUCCESS CENTER
THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

ALGEBRA REVIEW

Quadratic Formula

The roots of $ax^2 + bx + c = 0$

(if $a \neq 0$) are:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Example

The roots of $x^2 + 3x - 1 = 0$ are $x = \frac{-3 \pm \sqrt{13}}{2}$.

Special Factors

$x^2 - a^2 = (x + a)(x - a)$

$x^3 - a^3 = (x - a)(x^2 + ax + a^2)$

$x^3 + a^3 = (x + a)(x^2 - ax + a^2)$

Examples

$(x^2 - 9) = (x + 3)(x - 3)$

$(x^3 - 8) = (x - 2)(x^2 + 2x + 4)$

$(x^3 - 4) = (x - \sqrt[3]{4})(x^2 + \sqrt[3]{4}x + \sqrt[3]{16})$

Exponents and Radicals

$a^0 = 1, a \neq 0$

$\frac{a^x}{a^y} = a^{x-y}$

$\left(\frac{a}{b}\right)^x = \frac{a^x}{b^x}$

$\sqrt[n]{a^m} = a^{\frac{m}{n}} = \left(\sqrt[n]{a}\right)^m$

$a^{-x} = \frac{1}{a^x}$

$(a^x)^y = a^{xy}$

$\sqrt{a} = a^{1/2}$

$\sqrt[n]{ab} = \sqrt[n]{a}\,\sqrt[n]{b}$

$a^x a^y = a^{x+y}$

$(ab)^x = a^x b^x$

$\sqrt[n]{a} = a^{1/n}$

$\sqrt[n]{\left(\frac{a}{b}\right)} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}$

Algebraic Errors to Avoid

$\frac{a}{x+b} \neq \frac{a}{x} + \frac{a}{b}$
To see this error, let $a = b = x = 1$.

$\sqrt{x^2 + a^2} \neq x + a$
$a - b(x - 1) \neq a - bx - b$
To see this error, let $x = 3$ and $a = 4$.
Remember to distribute the negative sign.
This should be:
$a - b(x - 1) = a - bx + b$

$\frac{\left(\frac{x}{a}\right)}{b} \neq \frac{bx}{a}$
To divide fractions, invert and multiply. This should be:
$\frac{\left(\frac{x}{a}\right)}{b} = \frac{\left(\frac{x}{a}\right)}{\frac{b}{1}} = \frac{x}{a} \cdot \frac{1}{b} = \frac{x}{ab}$

$\sqrt{-x^2 + a^2} \neq -\sqrt{x^2 - a^2}$
We can't factor a negative sign out of the square root.

$\frac{a + bx}{a} \neq 1 + bx$
We can only cancel factors of the entire numerator with factors in the denominator.
This one should be:
$\frac{a + bx}{a} = \frac{a}{a} + \frac{bx}{a} = 1 + \frac{bx}{a}$

$(x^2)^3 \neq x^5$
The equation should be:
$(x^2)^3 = x^2 x^2 x^2 = x^6$

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