Algebraic Properties

Where $\{a, c, b \in \mathbb{C}\}$

Commutative

$a + b = b + a$

$a \cdot b = b \cdot a$

Associative

$a + (b + c) = (a + b) + c$

$a \cdot (b \cdot c) = (a \cdot b) \cdot c$

Identity

$a + 0 = a$

$a \cdot 1 = a$

Inverse

$a + (-a) = 0$

$\frac{a}{b} \cdot \frac{b}{a} = 1;\ a, b \neq 0$

Zero-Product

$a \cdot 0 = 0$

$a \cdot b = 0$, then a or b equal 0

Distributive

$a(b + c) = ab + bc$

$a(b - c) = ab - bc$

Exponent Rules

Where $\{a, b, c \in \mathbb{Q}\}$ and $a \neq 0$

1) $a^b \cdot a^c = a^{b+c}$
2) $(a^b)^c = a^{b \cdot c}$
3) $(ab)^c = a^c b^c$
4) $a^b = \frac{1}{a^{-b}}$ or $a^{-b} = \frac{1}{a^b}$
5) $a^0 = 1$
6) $\left(\frac{a}{b}\right)^c = \frac{a^c}{b^c},\ b \neq 0$
7) $\frac{a^b}{a^c} = a^{b-c}$ or $\frac{1}{a^{c-b}}$
8) $a^{\frac{n}{d}} = \sqrt[d]{a^n},\ d \neq 0$

Properties of Equality

Where $\{a, c, b \in \mathbb{C}\}$

Addition Property of Equality

If $a = b$, then $a + c = b + c$

Multiplication Property of Equality

If $a = b$, then $ac = bc$

Symmetric

If $a = b$, then $b = a$

Reflexive

$a = a$

Substitution

If $a = b$, then b can replace a in expressions and equations.

The Imaginary Unit

$i = \sqrt{-1}$

$i^2 = -1$

$i^3 = -i$

$i^4 = 1$

Formulas

Midpoint

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

Distance

$$d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

Quadratic Formula

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

Radical expressions

For $\sqrt[d]{x^n}$ if	d is **odd**	d is **even**
$x < 0$	one negative root	no real root
$x = 0$	one root, zero	one root, zero
$x > 0$	one positive root	one positive root, one negative root

Parent Equations

Quadratic

$y = a(x-h)^2 + k$

Square Root

$y = a\sqrt{x-h} + k$

Absolute Value

$y = a|x-h| + k$

Cubic

$y = a(x-h)^3 + k$

Cube Root

$y = a\sqrt[3]{x-h} + k$

Floor

$y = \lfloor x \rfloor$

Reciprocal

$y = \dfrac{a}{x-h} + k$

Polynomial

$y = a_n x^n + a_{n-1} x^{n-1} + \ldots + a_1 x^1 + a_0 x^0$

Ceiling

$y = \lceil x \rceil$

Conics

Parabola (horizontal)

$x = a(y-k)^2 + h$

Circle

$(x-h)^2 + (y-k)^2 = r^2$

Ellipse

$$\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$$

Hyperbola

$$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$$

$$\frac{(y-h)^2}{a^2} - \frac{(x-k)^2}{b^2} = 1$$

Linear Equations

Slope Formula

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Slope-intercept form

$y = mx + b$

Point-slope form

$y - y_1 = m(x - x_1)$

Standard form

$Ax + By = C$

Geometry Formulas

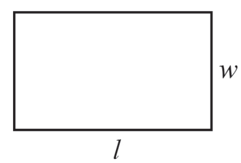
P: perimeter A: area

SA: surface area V: volume

Rectangle

$P = 2l + 2w$

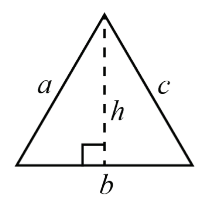
$A = lw$



Triangle

$P = a + b + c$

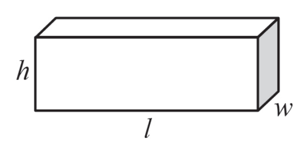
$A = \dfrac{1}{2}bh$



Rectangular Prism

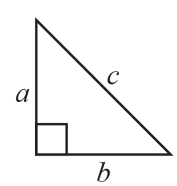
$SA = 2lw + 2lh + 2wh$

$V = lwh$



Pythagorean Theorem

$a^2 + b^2 = c^2$



Plan, Implement, Explain Method for Problem-Solving

Plan how you will approach the problem.

Implement your plan to complete the problem, and then **check** your work.

Explain why your answer makes sense for the given problem.