Contents

1 algebra

1.1 wallace

1.1.1 distributive property

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

1.1.2 slope

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

1.1.3 properties of exponents

$$a^m a^n = a^{m+n} \quad (ab)^m = a^m b^m \quad \frac{a^m}{a^n} = a^{m-n}$$

$$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m} \qquad a^{-m} = \frac{1}{a^m} \qquad \frac{1}{a^{-m}} = a^m$$

$$(a^m)^n = a^{mn} \qquad a^0 = 1 \qquad \left(\frac{a}{b}\right)^{-m} = \frac{b^m}{a^m}$$

1.1.4 scientific notation

$$a \times 10^b \text{ where } 1 \leqslant a < 10$$

1.1.5 ways to factor

- GCF
- Grouping
- Trinomials where $a = 1$
  - multiply to $a \times c$
  - add to b
- Trinomials where $a \neq 1$
- Factoring Special Products

1.1.6 factoring special products

$$\begin{aligned}
\text{difference of square} \quad & a^2 - b^2 = (a-b)(a+b) \\
\text{sum of squares} \quad & a^2 + b^2 = \text{Prime} \\
\text{perfect square} \quad & a^2 + 2ab + b^2 = (a+b)^2 \\
\text{sum of cubes} \quad & a^3 + b^3 = (a+b)(a^2 - ab + b^2) \\
\text{difference of cubes} \quad & a^3 - b^3 = (a-b)(a^2 + ab + b^2)
\end{aligned}$$

1.1.7 factoring strategy

- **GCF FIRST**
- **2 terms**: sum of diffs of squares or cubes

- **3 terms**: ac method, watch for perfect squares
- **4 terms**: grouping

1.1.8 cross product

$$\text{if } \frac{a}{b} = \frac{c}{d}, \text{ then } ad = bc$$

1.1.9 definition of radicals

$$\sqrt[m]{a} = b, \text{ if } b^m = a$$

1.1.10 properties of radicals

$$a^m a^n = a^{m+n} \quad (ab)^m = a^m b^m \quad a^{-m} = \tfrac{1}{a^m}$$

$$\tfrac{a^m}{a^n} = a^{m-n} \quad \left(\frac{a}{b}\right)^m = \frac{a^m}{b^m} \quad \tfrac{1}{a^{-m}} = a^m$$

$$(a^m)^n = a^{mn} \quad a^0 = 1 \quad \left(\tfrac{a}{b}\right)^{-m} = \tfrac{b^m}{a^m}$$

always rationalize denominator

1.1.11 radicals of mixed index

1.1.12 definition of rational exponents

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

1.1.13 definition of imaginary numbers

$$i^2 = -1 \left(\text{thus } i = \sqrt{-1}\right)$$

1.1.14 cyclic property of powers of i

$$\begin{aligned} i^0 &= 1 \\ i &= i \\ i^2 &= -1 \\ i^3 &= -i \end{aligned}$$

Example

i^{35}	divide exponent by 4
$8R3$	use remainder as exp of i
i^3	simplify
$-i$	solution

when solving a radical problem with an even index: check answers

1.1.15 odd root property

if $a^n = b$, then $a = \sqrt[n]{b}$ when n is odd

1.1.16 even root property

if $a^n = b$, then $a = \pm\sqrt[n]{b}$ when n is even

1.1.17 completing the square

$3x^2 + 18x - 6 = 0$	problem
$3x^2 + 18x = 6$	separate consts from vars
$x^2 + 6x = 2$	divide each term by a
$\left(\frac{1}{2} \cdot 6\right)^2 = 3^2 = 9$	find value to complete sq.
$x^2 + 6x + 6 = 2 + 6$	add it to both sides of equation
$(x + 3)^2 = 11$	factor

1.1.18 quadratic formula

$$
\begin{aligned}
ax^2 + bx + c = 0 &\quad \text{separate consts from vars} \\
ax^2 + bx = -c &\quad \text{divide each term b } a \\
x^2 + \frac{b}{a}x = \frac{-c}{a} &\quad \text{find num to complete the square} a \\
\left(\frac{1}{2} \cdot \frac{b}{a}\right)^2 = \frac{b^2}{4a^2} &\quad \text{add it to both sides} \\
x^2 + \frac{b}{a}x + \frac{b^2}{4a^2} = \frac{-c}{a} + \frac{b^2}{4a^2} &\quad \text{factor} \\
\left(x^2 + \frac{b}{2a}\right)^2 = \frac{b^2 - 4ac}{4a^2} &\quad \text{solve} \\
\mathbf{x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}} &\quad \text{solution}
\end{aligned}
$$

2 geometry