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1 algebra

1.1 wallace

1.1.1 distributive property

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

1.1.2 slope

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

1.1.3 properties of exponents

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

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

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

1.1.4 scientific notation

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

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

$$\text{difference of square} \quad a^2 - b^2 = (a - b)(a + b)$$

$$\text{sum of squares} \quad a^2 + b^2 = \text{Prime}$$

$$\text{perfect square} \quad a^2 + 2ab + b^2 = (a + b)^2$$

$$\text{sum of cubes} \quad a^3 + b^3 = (a + b)(a^2 - ab + b^2)$$

$$\text{difference of cubes} \quad a^3 - b^3 = (a - b)(a^2 + ab + b^2)$$

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

$$\begin{aligned} a^m a^n &= a^{m+n} & (ab)^m &= a^m b^m & a^{-m} &= \frac{1}{a^m} \\ \frac{a^m}{a^n} &= a^{m-n} & \left(\frac{a}{b}\right)^m &= \frac{a^m}{b^m} & \frac{1}{a^{-m}} &= a^m \\ (a^m)^n &= a^{mn} & a^0 &= 1 & \left(\frac{a}{b}\right)^{-m} &= \frac{b^m}{a^m} \end{aligned}$$

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

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

1.1.14 cyclic property of powers of i

$$i^0 = 1$$

$$i^1 = i$$

$$i^2 = -1$$

$$i^3 = -i$$

Example

$$\begin{array}{ll} i^{35} & \text{divide exponent by 4} \\ 8R3 & \text{use remainder as exp of } i \\ i^3 & \text{simplify} \\ -i & \text{solution} \end{array}$$

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

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

1.1.18 quadratic formula

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

1.1.19 quadratic in form

$$0 = ax^m + bx^n + c, \text{ where } m = 2n$$

1.1.20 operations on functions

$$\begin{aligned} \text{addition} & \quad (f + g)(x) = f(x) + g(x) \\ \text{subtraction} & \quad (f - g)(x) = f(x) - g(x) \\ \text{multiplication} & \quad (f \cdot g)(x) = f(x) \cdot g(x) \\ \text{division} & \quad \left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)} \\ \text{composition} & \quad (f \circ g)(x) = f(g(x)) \end{aligned}$$

2 geometry