NAME Student AMDG

Ms. Kresovic

Adv Geo – 1 9.1Review of Radicals and Quadratic Equations Monday 24 February 2014

Objectives

- Simplify radicals
- Solve Quadratic Equations
  - Method 1: Solve for x
  - Method 2: Factoring
  - Method 3: Factoring by grouping
  - Method 4: Area model
- Review of Pythagorean Theorem and radicals (below)

## Class Examples

**Problem 1** *Simplify* $\sqrt{48}$.

**Solution**

$$\begin{aligned}\sqrt{48} &= \sqrt{16 \cdot 3} \quad \text{(16 is a perfect square.)} \\ &= \sqrt{16} \cdot \sqrt{3} \\ &= 4\sqrt{3}\end{aligned}$$

$\sqrt{4 \cdot 4 \cdot 3}$

**Problem 2** *Simplify* $\sqrt{18} + \sqrt{32} + \sqrt{75}$.

**Solution**

$$\begin{aligned}\sqrt{18} + \sqrt{32} + \sqrt{75} &= \sqrt{9 \cdot 2} + \sqrt{16 \cdot 2} + \sqrt{25 \cdot 3} \\ &= 3\sqrt{2} + 4\sqrt{2} + 5\sqrt{3} \\ &= 5\sqrt{3} + 7\sqrt{2}\end{aligned}$$

**Problem 3** *Simplify* $\sqrt{\frac{5}{3}}$.

**Solution**

$$\begin{aligned}\sqrt{\frac{5}{3}} &= \frac{\sqrt{5}}{\sqrt{3}} \\ &= \frac{\sqrt{5}}{\sqrt{3}} \cdot \boxed{\frac{\sqrt{3}}{\sqrt{3}}} \quad \text{rationalize the denominator} \\ &= \frac{\sqrt{15}}{3} \text{ or } \frac{1}{3}\sqrt{15} \quad \text{(The two answers are equivalent simplifications.)}\end{aligned}$$

$\frac{1}{3}\sqrt{16} = \frac{4}{3}$

**Problem 4.** Simplify $\sqrt{98}$ $= \sqrt{49} \cdot \sqrt{2} = \pm 7\sqrt{2}$

**Problem 5.** Simplify $\sqrt{200}$ $= \sqrt{25}\sqrt{8} = 5\sqrt{8} \rightarrow 5\sqrt{4} \cdot \sqrt{2} = \pm 10\sqrt{2}$

$\sqrt{100} \cdot \sqrt{2} = \pm 10\sqrt{2}$

**Problem 6.** Simplify $\sqrt{4 + 9} = \pm\sqrt{13}$

**Problem 7.** Simplify $\sqrt{4 \cdot 9}$ $= 2 \cdot 3 = \pm 6$

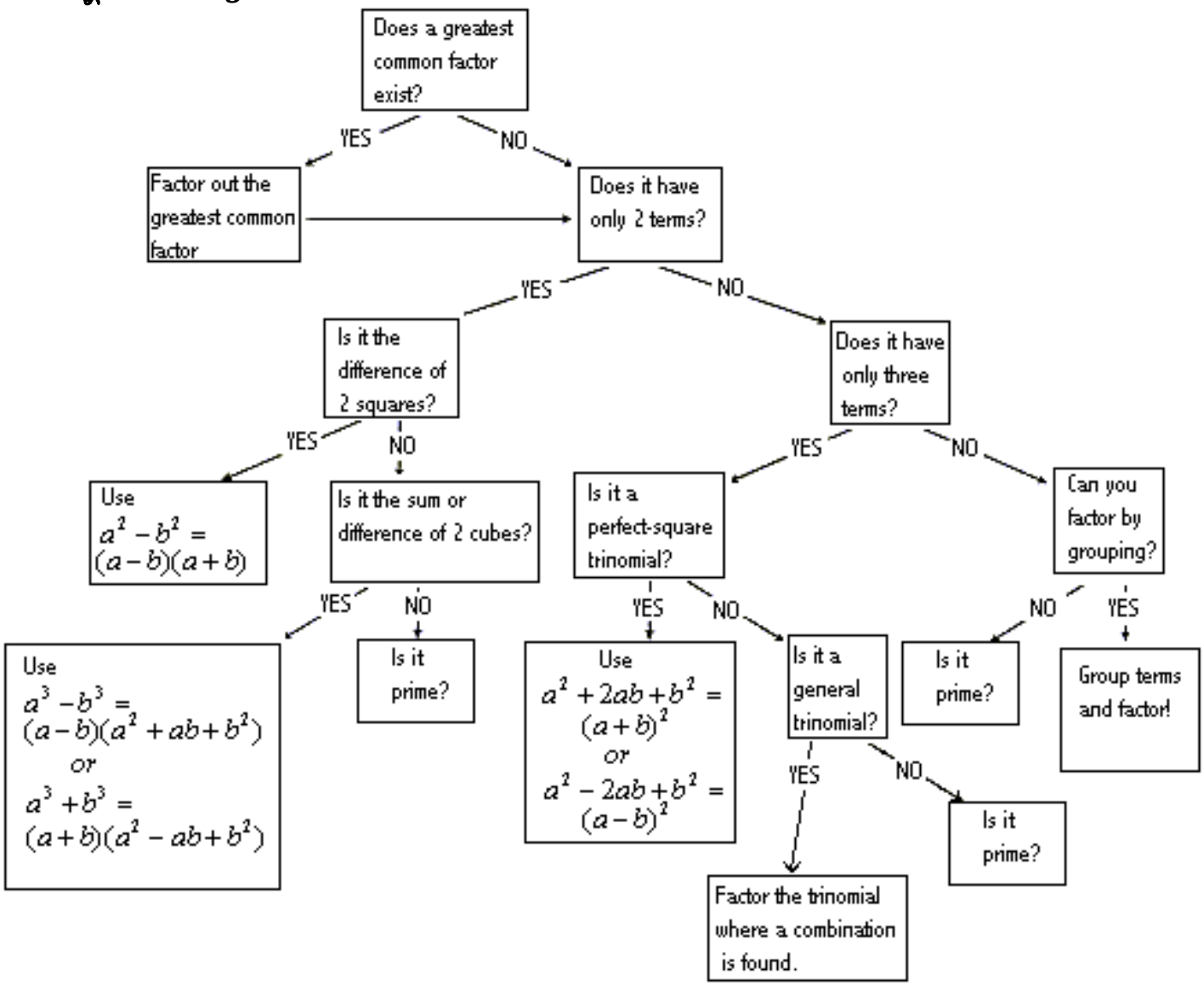
**Problem 8.** Simplify $\sqrt{3^2 + 4^2} = \sqrt{9 + 16} = \sqrt{25} = \pm 5$

DON'T: $3 + 4 = 7$

**Problem 9.** Simplify $\frac{\frac{9}{\sqrt{3}}\sqrt{3}}{\sqrt{3}} = \frac{9\sqrt{3}}{3} = 3\sqrt{3}$

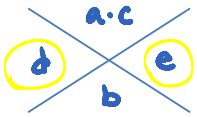
**Problem 10.** Simplify $7\sqrt{5} + \sqrt{7} + 6\sqrt{5} + \sqrt{7}$ $= 13\sqrt{5} + 2\sqrt{7}$

## Method 3: Factoring Flowchart




## Method 4: An area model

$0 = ax^2 + bx + c$




| | |
|---|---|
| $ax^2$ | d |
| e | c |

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*Solving Quadratics:*

You may use any method that you are comfortable with, and that allows you to be successful.

You are in a unique position as I will survey you at the end of this class and after your homework about these methods. This information will be shared with the department at our meeting this Thursday.

**Problem 11.** Solve $x^2 + 9 = 25$

① $x^2 + 9 = 25$

$-9 \quad -9$

$\sqrt{x^2} = \sqrt{16}$

$x = \pm 4$

② $x^2 + 9 = 25$

$-25 \quad -25$

$x^2 - 16 = 0$ see flowchart DOTS

$(x-4)(x+4) = 0$

$x = 4$ or $-4$

③ $x^2 + 9 = 25$

$x^2 - 16 = 0$

↑ Adds to $0x$ ↖ Mult to $-16x^2$

$x^2 + 4x - 4x - 16$

$x \qquad -4$

$x(x+4) - 4(x+4)$

$(x-4)(x+4)$

④ $x^2 + 9 = 25$

$x^2 - 16 = 0$

$x^2 + 0x - 16 = 0$

what mult to $-16x^2$

$-4x \quad 4x$

$0x$

adds to ↑

| | $x$ | $+4$ |
|---|---|---|
| $x$ | $x^2$ | $4x$ |
| $-4$ | $-4x$ | $-16$ |

$(x+4)(x-4) = 0$

$x+4=0 \qquad x-4=0$

$x=-4 \qquad x=4$

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**Problem 12.** $x^2 + 13x + 42$

① $x^2+13x+42$

no equals

② $x^2+13x+42$

add, mult

$(x+6)(x+7)$

③ $x^2+13x+42$

$x^2+6x \quad +7x+42$

$x \qquad\quad 7$

$x(x+6)+7(x+6)$

$(x+6)(x+7)$

④ $x^2+13x+42$

what mult to $42x^2$

$6x \quad 7x$

$13x$ adds to ↑

| | $x$ | $7$ |
|---|---|---|
| $x$ | $x^2$ | $7x$ |
| $6$ | $6x$ | $42$ |

$(x+6)(x+7)$

**Problem 13.** $y^2 - 15y + 54$

① $y^2 - 15y + 54$

no equal sign

② $y^2 - 15y + 54$

what mult to 54

adds to $-15$

$(x-9)(x-6)$

③ $y^2 - 15y + 54$

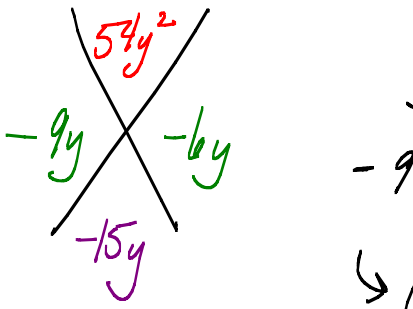
$y^2 - 9y - 6y + 54$

$y$ $-6$

$y(y-9) - 6(y-9)$

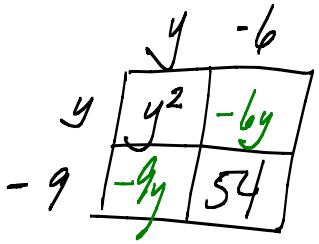
$(y-9)(y-6)$

④ $y^2 - 15y + 54$




What mult to $54y^2$

adds to $-15y$




$(y-6)(y-9)$

**Problem 14.** $z^2 - 3z - 28$

(1)

(2) $z^2 - 3z - 28$

$(z-7)(z+4)$

(3) $z^2 - 3z - 28$

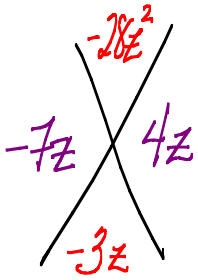
$z^2 - 7z + 4z - 28$

$z$ $\quad$ $4$

$z(z-7)$ $\quad$ $4(z-7)$

$(z-7)(z+4)$

(4) $z^2 - 3z - 28$



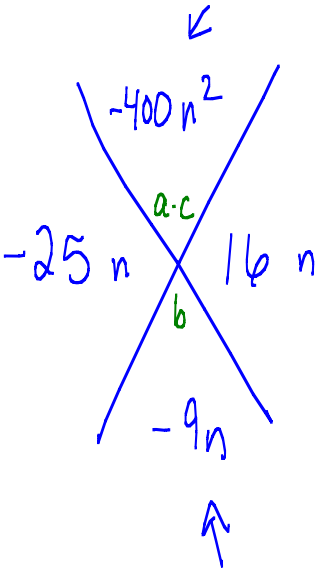

| | $z$ | $4$ |
|---|---|---|
| $z$ | $z^2$ | $4z$ |
| $-7$ | $-7z$ | $-28$ |

$(z+4)(z-7)$

Do 1-5 for homework

**Problem 15.** $-20n^2 + 9n + 20$

$-1(20n^2 - 9n - 20) = -1(5n+4)(4n-5)$




| | 5n | 4 |
|---|---|---|
| 4n | $20n^2$ | 16n |
| -5 | -25n | -20 |

---

Grouping $-1(20n^2 - 9n - 20)$

$-1(20n^2 - 25n + 16n - 20)$

$5n \qquad 4$

$-1[5n(4n-5) + 4(4n-5)]$

$-1(5n+4)(4n-5)$

**Problem 16.** *Solve* $(3\sqrt{5})^2 + (3\sqrt{2})^2 = x^2$ *for* x.

$3\sqrt{5} \cdot 3\sqrt{5} +$

$9\sqrt{25} +$

$9 \cdot 5 + 9 \cdot 2$

$45 + 18 = x^2$

$63 = x^2$

$9 \cdot 7 = x^2$

$\pm 3\sqrt{7} = x$

$9(5+2) = x^2$

$\pm 3\sqrt{7} = x^2$

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**Problem 17.** *Solve for x.* **a** $x^2 - 10x = -16$ **b** $x^2 + 5x = 0$

FTA ⇒ degree poly is exact number solutions. (x intercepts & imaginary numbers)

$+16$

$x^2 - 10x + 16 = 0$

$\frac{x^2 - 8x}{x} \quad \frac{-2x + 16}{-2} = 0$

$x(x-8) - 2(x-8) = 0$

$(x-8)(x-2) = 0$

$x - 8 = 0 \qquad x - 2 = 0$

$x = 8 \qquad x = 2$

$x(x+5) = 0$

$x = 0 \qquad x + 5 = 0$

$-5 \quad -5$

$x = -5$

$x = 0 \text{ & } -5$

# Homework

**1** Simplify. Expression (NOT an equation)

**a** $\sqrt{4}$ 2 **b** $\sqrt{27}$ $3\sqrt{3}$ **c** $\sqrt{72}$ $6\sqrt{2}$ **d** $\sqrt{32}$ $4\sqrt{2}$ **e** $\sqrt{98}$ $7\sqrt{2}$ **f** $\sqrt{200}$ $10\sqrt{2}$ **g** $\sqrt{20}$ $2\sqrt{5}$ **h** $\sqrt{24}$ $2\sqrt{6}$

$\sqrt{49}\cdot\sqrt{2}$

**2** Simplify.

**a** $5\sqrt{18}$ $15\sqrt{2}$ **b** $\sqrt{4+9}$ $\sqrt{13}$ **c** $\sqrt{3^2+4^2}$ $\sqrt{9+16}=\sqrt{25}=5$ **d** $\sqrt{5^2+12^2}$ 13 **e** $\frac{1}{6}\sqrt{48}$ $\frac{\sqrt{16\cdot3}}{6}=\frac{4}{6}\sqrt{3}=\frac{2}{3}\sqrt{3}$ **f** $\sqrt{49\cdot3}$ $7\sqrt{3}$

**3** Simplify.

**a** $\frac{1}{\sqrt{2}}\frac{\sqrt{2}}{\sqrt{2}}=\frac{\sqrt{2}}{2}$ **b** $\frac{1}{\sqrt{5}}\frac{\sqrt{5}}{\sqrt{5}}=\frac{\sqrt{5}}{5}$ **c** $\frac{4}{\sqrt{2}}\frac{\sqrt{2}}{\sqrt{2}}=2\sqrt{2}$ **d** $\frac{6}{\sqrt{3}}\frac{\sqrt{3}}{\sqrt{3}}=\frac{6\sqrt{3}}{3}=2\sqrt{3}$

**4** Simplify.

**a** $4\sqrt{3}+7\sqrt{3}=11\sqrt{3}$

**b** $7\sqrt{2}+\sqrt{3}+6\sqrt{3}+\sqrt{2}$

$8\sqrt{2}+7\sqrt{3}$

$5\sqrt{3}$

$2\sqrt{3}+3\sqrt{3}$

$\sqrt{4}\cdot\sqrt{3}+\sqrt{9}\cdot\sqrt{3}$

**c** $\sqrt{12}+\sqrt{27}$

**d** $\sqrt{72}+\sqrt{75}-\sqrt{48}$

$\sqrt{36\cdot2}+\sqrt{25\cdot3}-\sqrt{16\cdot3}$

$6\sqrt{2}+5\sqrt{3}-4\sqrt{3}$

$6\sqrt{2}+\sqrt{3}$

↗ Equations → $\pm\sqrt{\ldots}$

**5** Solve for x.

**a** $x^2 = 25$, $x = \pm 5$

**b** $x^2 = 144$ $x = \pm 12$

**c** $x^2 = 169$ $x = \pm 13$

**d** $x^2 = \frac{1}{4}$ $x = \pm \frac{1}{2}$

**e** $x^2 = 12$ $x = \pm 2\sqrt{3}$

**f** $x^2 = 18$ $x = \pm 3\sqrt{2}$

**6** Solve for x.

**a** $x^2 + 16 = 25$ (−16 −16)

**b** $x^2 + 6^2 = 100$ (−36 −36)

**a** $x^2 = 9$, $x = \pm 3$ **b** $x^2 = 64$, $x = \pm 8$

$x = \pm 5$, $x^2 = 25$, $144 + x^2 = 169$

**c** $12^2 + x^2 = 13^2$

**d** $x^2 + (3\sqrt{3})^2 = 36$, $3 \cdot 3\sqrt{3} \cdot \sqrt{3}$, $9\sqrt{9}$

$x^2 + 27 = 36$ (−27 −27)

$x^2 = 9$, $x = \pm 3$

**e** $(\sqrt{5})^2 + (\sqrt{11})^2 = x^2$ $5 + 11 = x^2 \rightarrow 16 = x^2 \rightarrow \pm 4 = x$

**f** $x^2 = (5\sqrt{3})^2 + (\sqrt{5})^2$

$x^2 = 75 + 5$

$x^2 = 80$

$x^2 = 16 \cdot 5$

$x = \pm 4\sqrt{5}$

**7** Solve for x.

**a** $x^2 - 5x - 6 = 0$

**b** $x^2 + 4x - 12 = 0$

**c** $x^2 - 8x + 15 = 0$

**d** $x^2 - 18 - 3x = 0$

**e** $x^2 - 36 = 9x$

**f** $-x^2 + 5x + 36 = 0$

a) $x = 6$ & $-1$

b) $x = 2$ & $-6$

c) $x = 5$ & $3$

d) $x = 6$ & $-3$

e) $x = 12$ & $-3$

f) $x = 9$ & $-4$

$-1(x^2 - 5x - 36) = 0$

$-1(x-9)(x+4) = 0$

$-1 \cdot a \cdot b = 0$

then &

$x - 9 = 0$ $x + 4 = 0$

$x = 9$ $x = -4$

**8** Solve for x. Set = 0 first

**a** $x^2 - 4x = 0$, $x(x-4) = 0$

**b** $x^2 = 10x$

**c** $x^2 - 2x = 11x$

**d** $5x = x^2 - 3x$

a) $x = 0$ & $4$

b) $x = 0$ & $10$

c) $x = 0$ & $13$

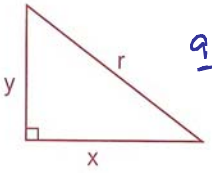
d) $x = 0$ & $8$

**9** If, in the given figure, $x^2 + y^2 = r^2$,

**a** Find x if y = 21 and r = 29 20

**b** Find y, in simplified radical form, if x = 2 and r = 4

**c** Find r to the nearest tenth if x = 4.1 & y = 7.1.




9b] $2^2 + y^2 = 4^2$

$y^2 = 16 - 4$

$y = \sqrt{12} = 2\sqrt{3}$ length ∴ only positive

9c] $4.1^2 + 7.1^2 = r^2$

$16.8 + 50.4 \approx r^2$

$67.2 \approx r^2$

$8.2 \approx r$

**10** Solve for x. $-x^2 - 8x - 28$

**a** $3x^2 + 5x - 7 = x^2 + 8x + 28$

**b** $12x^2 - 15 = -11x$

**c** $8x^2 - 7x + 9 = 2x^2 + 6x + 7$

**10a** $2x^2 - 3x - 35 = 0$

$-70x^2$, $-10x$, $7x$, $-3x$

| | $2x$ | $7$ |
|---|---|---|
| $x$ | $2x^2$ | $7x$ |
| $-5$ | $-10x$ | $-35$ |

then $(2x+7)(x-5)$

$x = -\frac{7}{2}$ & $5$

**10b** $12x^2 + 11x - 15 = 0$

$-180x^2$, $20x$, $-9x$, $+11x$

| | $4x$ | $-3$ |
|---|---|---|
| $3x$ | $12x^2$ | $-9x$ |
| $5$ | $20x$ | $-15$ |

$(4x-3)(3x+5) = 0$

$4x - 3 = 0$

$x = \frac{3}{4}$ & $x = \frac{-5}{3}$

**11** Solve $\frac{7}{x+1} = \frac{2x+4}{3x-3}$ for x.

$21x - 21 = 2x^2 + 4x + 2x + 4$

$21x - 21 = 2x^2 + 6x + 4$

$-21x + 21 \qquad -21x + 21$

$0 = 2x^2 - 15x + 25$ → $0 = \frac{2x^2 - 10x}{2x} - \frac{5x + 25}{-5}$

$0 = (2x-5)(x-5)$

$0 = 2x(x-5) - 5(x-5)$

$0 = (x-5)(2x-5)$

$x = \frac{5}{2}$ & $5$

$50x^2$, $-10x$, $-5x$, $-15x$

| | $2x$ | $-5$ |
|---|---|---|
| $x$ | $2x^2$ | $-5x$ |
| $-5$ | $-10x$ | $25$ |

**10c** $6x^2 - 13x + 2 = 0$

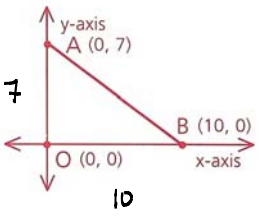
$12x^2$, $-12x$, $-1x$, $-13x$

| | $6x$ | $-1$ |
|---|---|---|
| $x$ | $6x^2$ | $-1x$ |
| $-2$ | $-12x$ | $2$ |

$(x-2)(6x-1) = 0$

$x = 2$ & $\frac{1}{6}$

**12** Find AB




Pyth Thm: In a rt Δ, $leg^2 + leg^2 = hyp^2$

$7^2 + 10^2 = AB^2$

$149 = AB^2$

$\sqrt{149} = AB$ EXACT

challenge

**13** Simplify.

**a** $\sqrt{(h)^2}$, if h represents a negative number

**b** $\sqrt[2]{(x-3)^2}$, if $x < 3$

**c** $\sqrt{p^2q^2}$, if p and q both represent negative numbers

**d** $\sqrt{x^3y^2}$, if $x \geq 0$ and $y < 0$

$\sqrt[3]{27} = 27^{1/3} = (3^3)^{1/3} = 3$