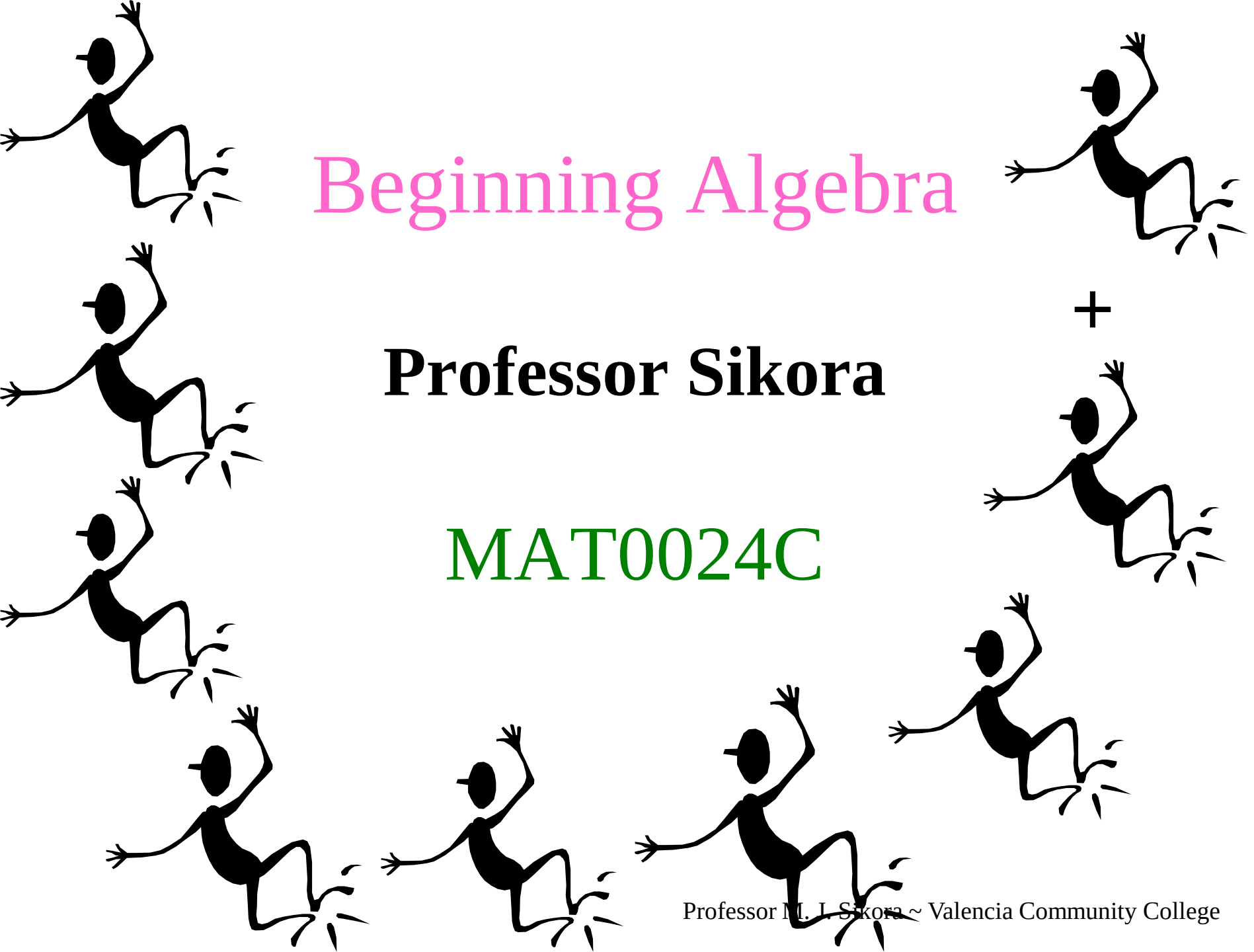


Beginning Algebra

+

Professor Sikora

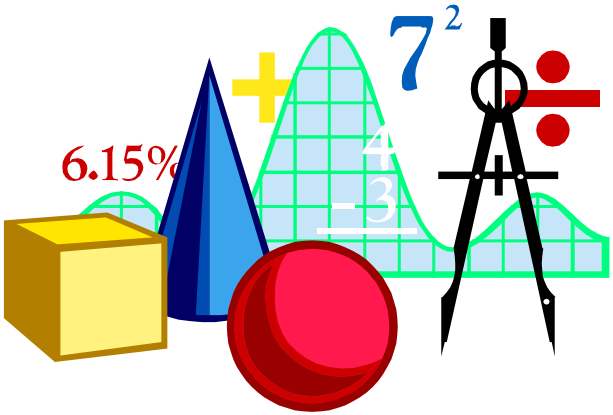
MAT0024C

CHAPTER 8 & 9

RATIONAL ¾ &

RADICAL √

EXPRESSIONS



Professor M. J. Sikora ~ Valencia Community College

9.1 Square Roots

Squares: the square of 5 is 25 ‘cuz $5^2 = 25$

and the square of -5 is 25 ‘cuz $(-5)^2 = 25$

Square Roots: 5 is the square root of 25

‘cuz $5^2 = 25$

and -5 is the square root of 25

‘cuz $(-5)^2 = 25$

b is square root of a if $b^2 = a$

All positive #s have 2 sq. roots. It’s pos. sq. root = **principal square root**

9.1 Square Roots

Square Root of a => $\pm\sqrt{a}$ **[a = positive real #]**

Also: $\sqrt{a} \cdot \sqrt{a} = (\sqrt{a})^2 = a$ and $\sqrt{0} = 0$

Note: $\sqrt{a}$ = represents the POSITIVE sq. root of a

Ex: $-\sqrt{225} =$

Ex: $\sqrt{\frac{9}{16}} =$

Ex: $-\sqrt{36x^8} =$

Ex: $\sqrt{\frac{m^6}{49u^4}} =$

9.1 Square Roots

Note: If **a** = POSITIVE # that is NOT a perfect sq., then $\sqrt{a}$ is **IRRATIONAL** *and* If **a** = NEGATIVE #, then $\sqrt{a}$ is **NOT REAL or Imaginary**

Identify as Rational, Irrational, or Imaginary:

Ex: $\sqrt{72}$ Ex: $\sqrt{\frac{9}{16}}$ Ex: $\sqrt{-16}$

9.2 Mult.& Simplifying Radical Expressions

Product Rule for Radicals: [a & b ε nonneg. Reals]

$$\sqrt{a} \bullet \sqrt{b} = \sqrt{a \bullet b}$$ **and visa versa**

Find: $\sqrt{6} \bullet \sqrt{11} =$

Simplify Radicals➔ *no* PERFECT SQUARE under the radical sign

Simplify: $\sqrt{60}$

Find Product & Simplify: $\sqrt{10} \bullet \sqrt{50} =$

$3\sqrt{20} \bullet 4\sqrt{5} =$

$3\sqrt{108} =$

9.2 Simplifying Radical Expressions

Simplify: $\sqrt{20} =$ $\sqrt{500} =$ $\sqrt{x^3} =$

$\sqrt{y^5} =$ $2\sqrt{18c^{10}} =$ $5q\sqrt{63p^5q^4} =$

Mult. & Simplify: $\left(-7\sqrt{2}\right)^2 =$

$3\sqrt{2w^3} \bullet 4\sqrt{8w} =$ $\left(2\sqrt{2x}\right)\left(-3\sqrt{3x}\right) =$

$4\sqrt{5yz^3} \bullet 2\sqrt{45yz} =$

9.3 & Simplify Radical Expressions

Quotient Rule for Radicals: [a & b ε nonneg. Reals]

$y \neq 0$

$$\frac{\sqrt{a}}{\sqrt{b}} = \sqrt{\frac{a}{b}}$$

and visa versa

Simplify: $\sqrt{\frac{10}{49}} =$

$\frac{8\sqrt{50}}{4\sqrt{5}} =$

$\sqrt{\frac{3}{8}} \bullet \sqrt{\frac{7}{2}} =$

$\sqrt{\frac{99b^3}{16a^2b}} =$

$\frac{\sqrt{30\,y^9}}{\sqrt{160\,y^5}} =$

$\frac{\sqrt{32}}{\sqrt{98x^2}} =$

9.4 + and - of Radical Expressions

Like Radicals: multiples of *same root* of the *same #* Ex: $2\sqrt{5}$ and $12\sqrt{5}$

Add or subtract *LIKE* radicals:

Add: $-4\sqrt{3}+9\sqrt{3}=$

Simplify 1st!

Subtract: $5\sqrt{200}-6\sqrt{18}=$

Simplify: $\sqrt{3r}\bullet\sqrt{6}+\sqrt{8r}=$

9.4 + and - of Radical Expressions

Simplify: $\sqrt{12xy^2} + 27\sqrt{xy^2} =$

$\sqrt{20mn^2} - \sqrt{80m^3} =$

$\sqrt{32x} - \sqrt{5y} - \sqrt{200x} + \sqrt{125y} =$

9.4 • then + or - Radical Expressions

Use Distributive Arrows:

$$\sqrt{3}\left(3\sqrt{6}-\sqrt{3}\right)=$$

Use FOIL:

$$\left(\sqrt{5}+\sqrt{3}\right)\left(\sqrt{5}-\sqrt{3}\right)=$$

$$\left(\sqrt{3x}+1\right)\left(\sqrt{3x}+2\right)=$$

Mini-Quiz 9.1 ➔ 9.4 Simplify:

1) $\sqrt{\frac{9w^2}{36w^6}}$

2) $-\sqrt{\frac{49w^5}{81h^{10}}}$

3) $\sqrt{6}-\sqrt{24}$

4) $\sqrt{2}-\sqrt{18}$

5) $3\sqrt{6}\left(2\sqrt{3}-4\sqrt{6}\right)$

6) $\left(\sqrt{5}-\sqrt{2}\right)\left(\sqrt{5}+\sqrt{2}\right)$

7) $\left(2\sqrt{5}-4\right)^2$

8) $\sqrt{45}+\sqrt{20}-\sqrt{125}$

9) $\sqrt{200r^6s^9}$

10) $-5\sqrt{32y}+3\sqrt{50y}-\sqrt{18y}$

8.1 Simplifying Rational Expressions

Review

Write in Lowest Terms [Factor & Slash]: Exs:

$$\frac{a^2+a-2}{a-1}$$

$$\frac{a^2-b^2}{a^2+2ab+b^2}$$

$$\frac{x(x+2)-2(x-1)}{x^2+2}$$

$$\frac{x^2-5}{5-x^2}$$

$$\frac{6x+12}{7x+14}$$

$$\frac{3x^2-9x-12}{6x^2+30x+24}$$

8.2 Mult. [•] & ÷ of Rational Expressions

Mult. [•] of Rational Expressions:

$$\frac{P}{Q} \bullet \frac{R}{S} = \frac{PR}{QS}$$

Ex: $\frac{8p^2q}{3} \bullet \frac{9}{pq^2}$

Ans. in lowest terms!

Ex: $\frac{3(p-q)}{p} \bullet \frac{q}{2(p-q)}$

Ex: $\frac{x^2+7x+10}{3x+6} \bullet \frac{6x-6}{x^2+2x-15}$

8.2 Mult. [•] & ÷ of Rational Expressions

÷ Rational Expressions:

$$\frac{P}{Q} \div \frac{R}{S} = \frac{P}{Q} \bullet \frac{S}{R} = \frac{PS}{QR}$$

Keep
Change
Flip

$\neq 0$

Ans. in lowest terms!

Ex: $\frac{5}{8} \div \frac{15}{16}$

Ex: $\frac{9p^2}{3p+4} \div \frac{6p^3}{3p+4}$

Ex: $\frac{5a^2b}{2} \div \frac{10ab^2}{8}$

8.2 Mult. [•] & ÷ of Rational Expressions

÷ Rational Expressions:

Ans. in lowest terms!

Ex: $\dfrac{4x(x+3)}{2x+1} \div \dfrac{-x^2(x+3)}{4x^2-1}$

Ex: $\dfrac{ab-a^2}{a^2-1} \div \dfrac{a-b}{a^2+2a+1}$

8.2 Combining Operations

Ex: $\dfrac{a^2+ab}{ab-b^2} \bullet \dfrac{a^2-b^2}{a^2+ab} \div \dfrac{a+b}{b}$

Ans. in lowest terms!

Ex: $\dfrac{x^2-2x}{x^2+6x+9} \div \left(\dfrac{x^2-4}{x^2+3x} \bullet \dfrac{x}{x+2} \right)$

8.3 + & - of Rational Expressions~Like Denom.

Adding Rational Expressions:

$$\frac{P}{Q}+\frac{R}{Q}=\frac{P+R}{Q}$$

Same Denominator →

Ex: $\frac{2x}{15}+\frac{4x}{15}$

Ex: $\frac{x}{x+y}+\frac{1}{x+y}$

8.3 + & - of Rational Expressions~Like Denom.

Subtracting Rational Expressions:

$$\frac{P}{Q} - \frac{R}{Q} = \frac{P - R}{Q}$$

Same Denominator →

Ex: $\dfrac{n-3}{n^2-16} - \dfrac{1}{n^2-16}$

Ex: $\dfrac{x^2+3x}{x-1} - \dfrac{5x-1}{x-1}$

8.4 LCD ~ Least Common Denominator

LCD = Least expression all denominators ÷into w/out remainder

To find LCD: 1) **FACTOR** each denom.

2) **LIST** factors using greatest # of times anywhere

3) **MULTIPLY** factors in 2) for LCD

Ex: Find LCD for $\frac{9}{8m^4}$ *and* $\frac{11}{12m^6}$

Ex: for $\frac{6}{x^2-4x}$ *and* $\frac{3x-1}{x^2-16}$

8.4 LCD ~ Least Common Denominator

Write equivalent fractions over an LCD

Ex: Rewrite over new denominator: $\frac{7k}{5} = \frac{\quad}{30}$

Ex: $\frac{5k+1}{k^2+2k} = \frac{\quad}{k(k+2)(k-1)}$

FACTOR!

8.4 + & - of Rational Expressions

Adding Rational Expressions: **Different Denominators:**

1) **Find LCD**

2) **Rewrite Fractions** over this LCD

3) **Add** numerators & put over this LCD

4) Ans. in **Lowest Terms**

Ex: $\frac{m}{3n} + \frac{2}{7n}$

Ex: $\frac{-2}{p+1} + \frac{4p}{p^2-1}$

8.4 + & - of Rational Expressions

Adding Rational Expressions: **Different Denominators:**

Ex: $\dfrac{2k}{k^2-5k+4}+\dfrac{3}{k^2-1}$

Ex: $\dfrac{m}{2m-3n}+\dfrac{n}{3n-2m}$

8.4 + & - of Rational Expressions

Subtracting Rational Expressions:

$$\frac{P}{Q} - \frac{R}{Q} = \frac{P-R}{Q}$$

Review: **Same Denominator** →

Ex: $\frac{5x}{x-1} - \frac{5}{x-1}$

Different Denominators

Ex: $\frac{6}{a+2} - \frac{1}{a-3}$

LCD →

Ex: $\frac{4x}{x-1} - \frac{-3x-1}{1-x}$

LCD →

8.4 + & - of Rational Expressions

Different Denominators

Ex: $\dfrac{3r}{r^2-5r} - \dfrac{4}{r^2-10r+25}$ _____

LCD →

Ex:

$$\frac{a}{a^2-2a+1} - \frac{1}{6a-6}$$

8.4 + & - of Rational Expressions

Ex: $\dfrac{2}{x^2+x} - \dfrac{x-4}{x^2-1}$

Ex: $\dfrac{7y}{2y-3} - \dfrac{4}{3-2y}$

Mini-Quiz 8.1 ➔ 8.4 Perform operation & simplify:

1) $-\frac{9}{4xy^2} \bullet -\frac{20xz}{15y}$

2) $-\frac{9y-3}{y^2+3y} \bullet \frac{2y+6}{2-6y}$

3) $\frac{6x-xy}{z^3} \div \frac{xy-6x}{z^2}$

4)&5) Find the LCD

4) $\frac{9}{x^6y^3}, \frac{2}{x^2y^5}$

5) $\frac{2x}{x^2-10x+25}, \frac{5}{x^2-25}$

6) $\frac{3k}{3k+5} + \frac{6k}{3k+5}$

7) $\frac{b}{b^2-25} - \frac{5}{b^2-25}$

8) $\frac{4}{x-2} + \frac{3}{x+3}$

9) $\frac{c}{4c+32} - \frac{16}{c^2+8c}$

10) Were Mini-Quizzes helpful? Y or N