Math 65 / Notes & Practice #1 / 20 points / Due ________. / Name:__________________________

Home Work Practice: Simplify the following expressions by reducing the fractions:

$\frac{16}{40} =$ $\frac{-4}{32} =$ $\frac{8xy}{38x} =$ $\frac{?}{64} = \frac{9}{16}$

Solve the following equations for *x*:

$-11x + 8 = -25$ $7 = -5x - 19$

For today: 2.5 (Review) and …

- Solve equations of the form ax+b=cx+d
- Understand the terms conditional equations, identities, and contradictions

Type of Equation	Number of Solutions
Conditional	Finite number of solutions
Identity	Infinite number of solutions
Contradiction	No solution

General Procedure for Solving Linear Equations that Simplify to the Form $ax + b = cx + d$

1. Simplify by removing any grouping symbols and combining like terms on each side of the equation.
2. Use the **addition principle of equality** and add the opposite of a constant term and/or variable term to both sides so that variables are on one side and constants are on the other side.
3. Use the **multiplication** (or **division**) **principle of equality** to multiply both sides by the reciprocal of the coefficient of the variable (or divide both sides by the coefficient itself). The coefficient of the variable will become $+1$.
4. Check your answer by substituting it for the variable in the original equation.

4.4a (also review) Objectives:

- Determine if two lines are parallel, perpendicular, or neither
- Find the equation of a line given its slope and one point on the line
- Find the equation of a line given two points on the line
- Graph a line given in point-slope form
- Graph a line given its slope and one point on the line

Form	Name	When do I use…
$Ax + By = C$	Standard Form	Graph using intercepts
$m = \frac{y_2 - y_1}{x_2 - x_1}$	Slope of a line	Given two points
$y = mx+b$	Slope-intercept form	Given slope m, and y-intercept (0,b)
$y - y_1 = m(x - x_1)$	Point-slope form	Given 2 pts or m and pt, NOT y-inter
$y = b$	Horizontal line, slope 0	(0,b)
$x = a$	Vertical line, undefined slope	(a,0)

Examples: Solve the following for *x*

1) $7(3x - 4) = 8(x - 2) - 14$

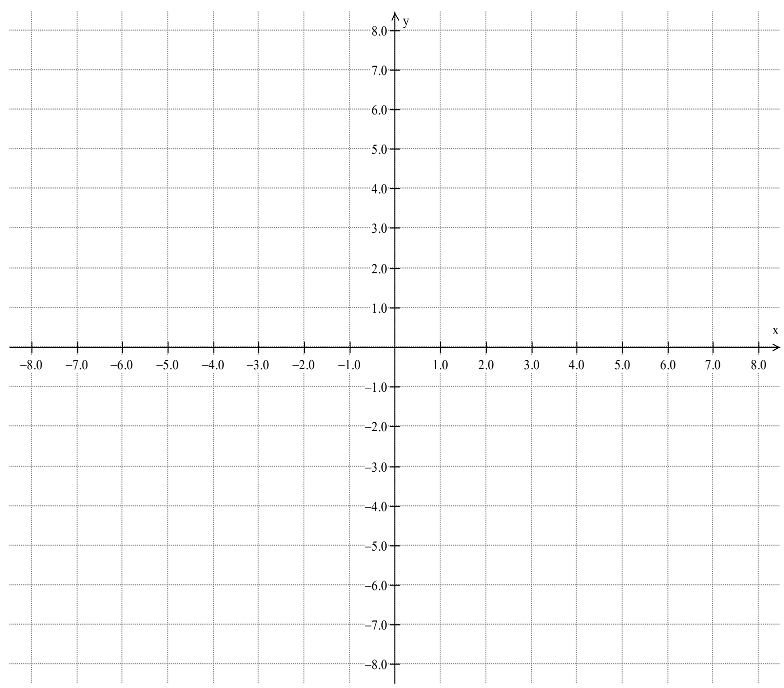
2) $\frac{2x}{3} + \frac{x}{3} = -\frac{3}{4} + \frac{x}{2}$

3) $3(x - 2) = 4(7 - 2x) + 11x$

4) $3(x + 6) = 2(9 - 2x) + 7x$

5) **Find the equation of the line determined by the pair of given points**

(-5, 2); (3, 6): (plot the points and draw the line through the points)



1st: $slope = \frac{rise}{run} = m = \frac{y_2 - y_1}{x_2 - x_1} =$

2nd: Fill in what you know:

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

3rd: $y =$

6) Graph the following equation by plotting two points: $y + 4 = -2(x - 6)$

7) Find the equation of the line determined by the pair of given points: (-3, 4) & (-3, 1)
Plot the points and draw the line.

8) Find the equation (in slope-intercept form) of the line with the given slope that passes through the point with the given coordinates: m = 0 & the point (3, 4). Plot the point and use the slope to draw the line.

Math 65 / Notes & Practice #2 / 20 points / Due ________. / Name:________________________

Home Work Practice: Simplify the following and how correct use of the equal sign:

1) $\frac{-7}{36x} \cdot \frac{20x}{3y}$

2) $\frac{-6}{11b} \cdot \frac{11a}{2b} \cdot \frac{7b}{9}$

3) $\frac{-6b}{5} \div \frac{7}{6b}$

4) $\frac{-4a}{3b} \cdot \frac{3ab}{8b} \div \frac{3ab}{5b}$

5) If you go on a motorcycle trip of 150 miles in the mountains and 2/5 of the trip is uphill, how many miles of the trip are not uphill? Reduce to the lowest terms.

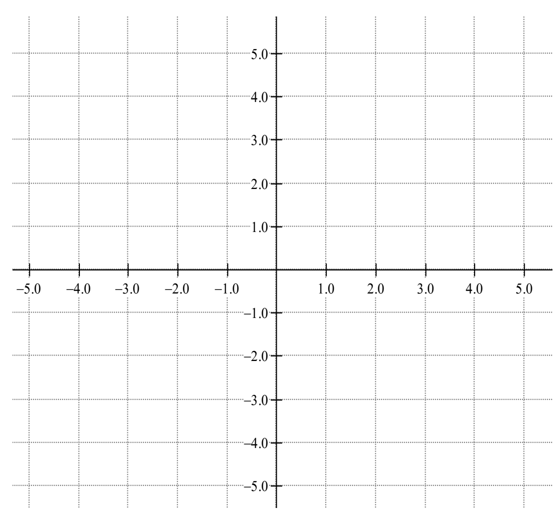
Solve the following equations for *y*:

6) $-\frac{3}{8}(y-5) = -\frac{2}{3}(y+2)$

7) $y - 2.3y + 2.3 = -1.8(y+1.5)$

8) Solve the following systems of equations by graphing. First, graph each line. Second, identify where the lines intersect as an ordered pair. That's the solution to the system!

$$\begin{cases} y = 3x - 1 \\ y = -2x + 4 \end{cases}$$



For today:

5.1 Simplifying Integer Exponents & 5.2a Simplifying Integer Exponents II

Objectives:
- Simplify expressions by using properties of integer exponents

Summary of the Rules for Exponents

For any nonzero real number a and integers m and n :

1. The exponent 1: $a = a^1$
2. The exponent 0: $a^0 = 1$
3. The product rule: $a^m \cdot a^n = a^{m+n}$
4. The quotient rule: $\frac{a^m}{a^n} = a^{m? - ?n}$
5. Negative exponents: $a^{-n} = \frac{1}{a^n}$
6. Power rule: $(a^m)^n = a^{mn}$
7. Power of a product: $(ab)^n = a^n b^n$
8. Power of a quotient: $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$

Examples for 5.1 & 5.2a: Simplify the expression using the properties of exponents. Expand any numerical portion of your answer and only include positive exponents. *Show correct use of the equal sign.*

a) $x^6 \cdot x^{-4}$

b) $\frac{x^8}{x^5}$

c) 9^{-2}

d) $(-6)^4$

e) $4 \cdot 3^3$

f) $(3a^0 b^5)(2a^0 b^{-1})$

g) $(2x^{-5} y^{-1})(8x^3 y)$

h) $\frac{-4y^5}{-2y^4}$

Examples 5.2a:

1) $-3\left(2ab^{2}\right)^{0}$

2) $5\left(-6m^{3}\right)^{3}$

3) $2\left(xy^{-2}\right)$

4) $\left(\frac{-3x}{y^{-2}}\right)^{2}$

5) $\left(\frac{4x^{2}y^{2}}{y}\right)^{4}$

6) $\left(\frac{3}{ab^{3}}\right)^{-3}$

7) $\left(\frac{2x^{3}y^{-1}}{y^{3}}\right)^{2}$

8) $\frac{\left(4x^{2}y^{-2}\right)^{-2}}{\left(3x^{-1}y\right)^{-3}}$

9) $\frac{\left(3a^{2}\right)\left(4a^{-1}\right)^{2}}{\left(19b^{2}\right)\left(3b^{-1}\right)}$

10) $\frac{12a^{-2} \bullet 18a^{4}}{36a^{2}b^{-5}}$

11) $3x(2x^{-2}y^{3})^{-3}$

12) $\frac{(7x^{-2})(6x^{5})}{(9x^{3}y^{4})^{0}(2y^{-1})}$

Math 65 / Notes & Practice #3 / 20 points / Due ________. / Name:________________________

Home Work Practice: Simplify the following expressions by adding/subtracting the fractions. Use your equal signs correctly!

1) $\frac{3}{16} - \frac{9}{16}$

2) $\frac{1}{6} - \frac{2}{18}$

3) $\frac{1}{6} + \frac{1}{10} + \frac{7}{12}$

4) $\frac{1}{12} + \frac{2}{9} - \frac{1}{4}$

5) Solve for *t* : $t + \frac{5}{6}t - \frac{1}{6} = \frac{3}{8}(t + \frac{2}{3})$

For today:

5.2b Scientific Notation - Objectives:

- Perform operations with decimal numbers by using scientific notation
- Write decimal numbers in scientific notation
- Write numbers in scientific notation as decimal numbers

- **Concept check on page 3 of web version**

Scientific Notation

If N is a decimal number, then in **scientific notation**

$N = a \times 10^n$ where $1 \le a < 10$ and n is an integer.

5.3-Identifying and Evaluating Polynomials

- Classify a polynomial as a monomial, binomial, trinomial, or a polynomial with more than three terms
- Define a polynomial
- Evaluate a polynomial for given values of a variable

5.3 Terminology:

A **term** is an expression that involves only multiplication and/or division with constants and/or variables.

Examples:

Define:

Numerical coefficient (or **coefficient**):

Constant (or constant term):

A **monomial in *x*:**

A **polynomial** is:

Degree of a polynomial:

Leading coefficient:

Examples 5.2b:

1) Write 5.544×10^{-5} in decimal form.

2) Write $1{,}770{,}000$ in scientific notation.

3) Write 0.000516 in scientific notation.

4) Write 2.188×10^{6} in decimal form.

5) Simplify the expression $\frac{2100}{0.0001}$ using scientific notation and express your answer in scientific notation.

6) Simplify the expression $1{,}000{,}000 \times 0.0004$ using scientific notation and express your answer in scientific notation.

7) Simplify the expression $\frac{0.084 \times 0.0085}{0.51 \times 0.070}$ using scientific notation and express your answer in scientific notation.

8) Simplify the expression $\frac{3.6 \times 0.008 \times 70}{50 \times 0.0015 \times 700}$ using scientific notation and express your answer in scientific notation.

9) An atom of gold has a mass of approximately 3.25×10^{-22} grams.
What is the mass of 2000 atoms of gold? Express your answer in scientific notation.

10) Simplify the expression $\frac{\left(8 \times 10^{-5}\right) \times 189}{\left(3.6 \times 10^{4}\right) \times \left(1.4 \times 10^{7}\right)}$ using scientific notation and express your answer in scientific notation. Round your answer to the nearest thousandth.

Special Terminology for Polynomials		
Term	Definition	Examples
Monomial:	polynomial with one term	$-2x^3$ and $4a^5$
Binomial:	polynomial with two terms	$3x+5$ and a^2+3
Trinomial:	polynomial with three terms	x^2+6x-7 and a^3-8a^2+12a
Polynomials with four or more terms are simply referred to as **polynomials**.		

Degree of each polynomial in the box?

Leading coefficients?

More Examples:

To simplify a polynomial, gather any like terms:

$$5x^3 - 4x^2 + x - 2x^3 - 6x + 7x^2 + 5 =$$

To **evaluate** a polynomial: Given $g(x) = 4x - 15$ find $g(3)$ and find $g(3a+9)$

Math 65 / Notes & Practice #4 / 20 points / Due ________. / Name:________________________

Home Work Practice: Simplify or solve where appropriate. Use your equal signs correctly!

1) $-3\frac{2}{5} - 1\frac{7}{6} =$

2) $\frac{-3}{16} \times \frac{20}{39} \div \frac{15}{4} =$

3) $-3 \cdot 4^3$

4) $\left(2x^{-2}y^{-4}\right)\left(-6x^2y^{-2}\right)$

5) $16y + 23y - 3 = 16y - 2y + 2$

6) Find the equation of the line through the points (-2, 5) and (12, 12). (Show work)

- **For today:**

5.4 - Adding and Subtracting Polynomials & **5.5 - Multiplying Polynomials**

Objectives:

- Add polynomials
- Simplify expressions by removing grouping symbols and combining like terms
- Subtract polynomials

- Multiply a polynomial by a monomial
- Multiply two polynomials

Multiplication of polynomials is based on the distributive property:

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

$$\boxed{\cdot}\,(b + c) = \boxed{\cdot}\,b + \boxed{\cdot}\,c$$

Where $\boxed{\cdot}$ can be another polynomial.

Quick examples:

1) $x(x + 2) =$

2) $(x^2 + 3)(x + 2) =$

Adding and subtracting polynomials, examples, remember to use the = sign appropriately!

1) $\left(-2x^2-6\right)+\left(7x^2-x+2\right)$

2) $\left(-3x^2+9x\right)-\left(-2x^2+6x\right)$

3) $\left(a^2+12a-1\right)+\left(-3a^2-a+1\right)+(a+7)$

4) $\left(2x^2+8\right)-\left(6x^2-9x-2\right)$

5) $x(x+5)+[5x-x(9+5x)]$

More Examples: **Multiply the following pairs of polynomials:**

1) $\left(-3x^2\right)(-2x+2)$

2) $(-3y)\left(-2x^3+y^2+2\right)$

3) $\left(2x^2\right)\left(-6xy^4\right)$

4) $\left(x^2-1\right)(2x-2)$

5) $(x+6)(3x-1)$

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

7) $(x+2)\left(x^2+x-8\right)$

8) $(x-2)\left(x^2+2x+4\right)$

Math 65 / Notes & Practice #5 / 20 points / Due ________. / Name:________________________

Home Work Practice: *Simplify* or *solve* where appropriate. Use your equal signs correctly!

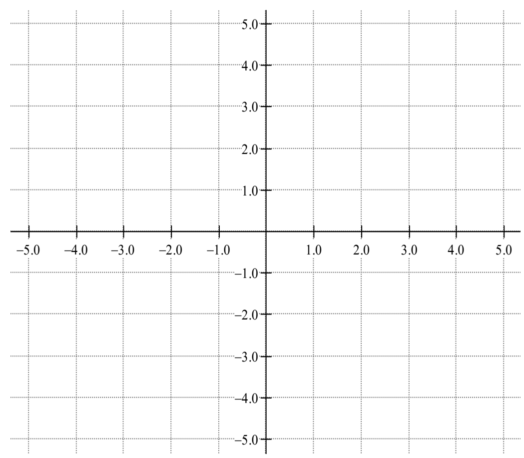
1) $\frac{1}{10} + \frac{2}{5} - \frac{4}{9}$

2) $7 - x = \frac{1}{2}(3 - x) - \frac{1}{5}(7x - 5)$

3) $\left(\frac{2m^2n^2}{n^3}\right)^3$

4) Simplify the expression $\frac{3600}{0.003}$ using scientific notation and express your answer in scientific notation.

5) Find the equation of the line, in slope-intercept form, passing through the points: (-2, -4) & (2, 2) Plot the points and draw the line that passes through them.



For today: 5.6a- The FOIL Method & 5.6b- Special Products

Objectives:

- Multiply **two binomials** using the FOIL method:
- "First Outer Inner Last"

- Multiply binomials, finding products that are the difference of squares
- Square binomials, finding products that are perfect square trinomials

Quick examples:

1) Multiply using the "FOIL" method:

$$(x^2 + 3)(x + 2) =$$

2) **Find the following products: NOTICE THE DIFFERENCE BETWEEN THE THREE!**

$$(a + b)(a - b) =$$

$$(a + b)^2 = (a + b)(a + b) =$$

$$(a - b)^2 = (a - b)(a - b) =$$

Examples:

1) $\left(x^2-1\right)(2x-2)$

2) $(3x+4)(3x+4)$

3) $(4x-y)^2$

4) $(3x+4y)(3x-4y)$

5) $(x+6)(3x-1)$

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

7) $(x+9)^2$

8) $(3a^2-3)(4a-5)$

9) $(8x+7y)(8x-7y)$

10) $\left(x^3+7\right)\left(2x^3-6\right)$

11) $(x-6)(2x+3)$

12) $(3a^2-3)(3a^2-3)$

13) $(3a^2-a+5)(a-2)$

Math 65 / Notes & Practice #6 / 20 points / Due ________. / Name:________________________

Home Work Practice: *Simplify* or *solve* where appropriate. Use your equal signs correctly!

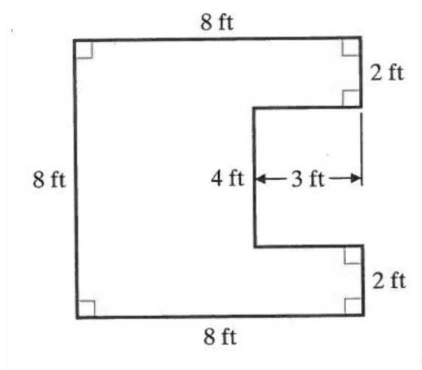
1) $\begin{cases} 4x + 4y = 28 \\ -4x + y = -23 \end{cases}$

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

3) $3 \cdot 2^{-3}$

4) $7\left(x^{-2}\right)^{3}$

5) Find a) the total perimeter of this shape and b) the total enclosed area.
(An 8 foot square with a 4 foot by 3 foot rectangular cutout)



- **<u>For today:</u>**

5.7a - Division by a Monomial;

Objectives:

- Divide polynomials by monomials

<u>Based on:</u>

Distributive Property:

$$\frac{a+b}{c} = \frac{a}{c} + \frac{b}{c}$$

6.1a - Greatest Common Factor of Two or More Terms

- Find the greatest common factor of a set of terms

"GCF" of {*ac, bc, dc*} is c.

(Like the distributive property "backwards")

& 6.1b - Greatest Common Factor of a Polynomial

- Factor polynomials by finding the greatest common factor

Distributive Property:

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

Examples: Divide the following polynomials by the monomial.

1) $\dfrac{8x^2 - 8x - 4}{2}$

2) $\dfrac{2 + 4x}{2x}$

3) $\dfrac{5x^5 - 8x + 7}{x^3}$

4) $\dfrac{6x^5 - 7x^4 - 3x + 7}{3x}$

Find the GCF for each of the following sets of algebraic terms:

5) $\{ 30, 66, 42 \}$

6) $\{ 12xy, 60, 36xy \}$

7) $\left\{ 11x^3y, 33x^2y \right\}$

8) $\left\{ 21x^2y^2, 21xy^3, 3xy \right\}$

Factor the polynomial by finding the GCF, then write the polynomial in factored form.

9) $21xy^3 + 49x^3y$

10) $-12x^2 - 3x^3$

11) $39x + 33xy^3 - 15y$

12) $2x^3y^4 + 4x^3y + 10x^3y^3$

Math 65 / Notes & Practice #7 / 20 points / Due ________. / Name:________________________

- **Home Work Practice. Complete these at home. Show correct work and use of the equal sign. We will not go over these in class. However, you may compare your answers with others in the class. Leave no negative exponents in your answer, unless it's asking for scientific notation.**

1) Write 7.61×10^{-6} in decimal form.:

2) Find the product: $(x+1)^2$

3) Simplify: $\left(\dfrac{-3}{mn^2}\right)^{-3}$

4) Divide the polynomial in the numerator by the monomial in the denominator. Simplify your answer.

$$\frac{6x^4 - 8x + 6x^3 - 2}{6x^3}$$

- **For today:**

6.1c – Factoring Expressions by Grouping

Objectives:

Based on the Distributive Property.

- Factoring Expressions by Grouping Pairs of Terms, example:

$$ax^3 + ax^2 + bx + b$$
$$= (ax^3 + ax^2) + (bx + b)$$
$$=$$
$$=$$

6.2 – Factoring Trinomials:
Leading Coefficient is 1

Objectives:

- Factor out a common monomial factor and then factor the remaining $x^2 + bx + c$ trinomial
- Factor trinomials with a leading coefficient of 1 (of the form $x^2 + bx + c$)
- Identify the factors of a given number
- Solve factoring applications

Quick example:

$$(x+2)(x+3) = x^2 + 3x + 2x + 6$$
$$(x+2)(x+3) = x^2 + 5x + 6$$

Note: $3 \times 2 = 6$

But: $3 + 2 = 5$

So: $x^2 + 5x + 6 = (x+2)(x+3)$

The *expanded* trinomial in *factored* form

Examples:

Factor each expression by factoring out the common binomial.

1) $6y^3(x-3)+7(x-3)$

2) $4y(y-2)-5b(y-2)$

Completely factor the expression by grouping, if possible. Be extra careful when there's a minus in the middle!

3) $a^2-aw-5a+5w$

4) $4ac-6bd+bc-24ad$

5) $10v^3+15v^2-2v-3$

Factor the given trinomial using the trial and error method. If the trinomial cannot be factored, write "Not Factorable".

6) $x^2+7x+10$

7) $x^2-11x+24$

8) x^2+x-12

9) $2x^2-10x-12$

10) $3q^4-15q^3-18q^2$

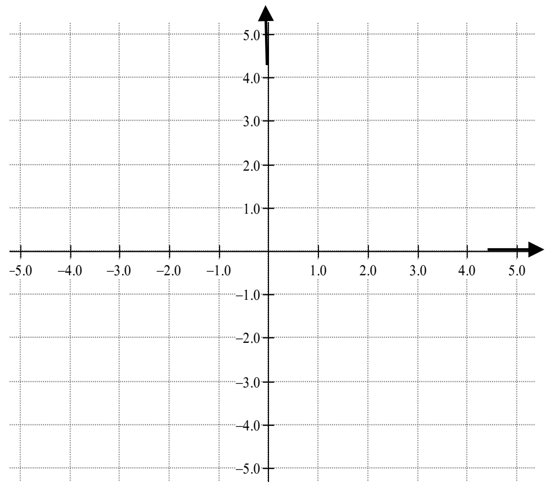
11) $p^2+3pq-4q^2$

Math 65 / Notes & Practice #8 / 20 points / Due ________. / Name:________________________

Home Work Practice. Complete these at home. Show correct work and use of the equal sign. We will not go over these in class. However, you may compare your answers with others in the class.

1) Solve the following system of equations by graphing. Don't forget to write your answer as an ordered pair.

$$\begin{cases} x + y = 4 \\ 2x - 3y = 3 \end{cases}$$



2) **Find $\boldsymbol{p(7a-\ 4)}$ for the polynomial $\boldsymbol{p(x) = -3x + 15}$**

$\boldsymbol{p(7a-\ 4) =}$

- <u>**For today:**</u>

6.3a – Factoring Trinomials by Trial and Error. Objectives:

- Factor trinomials by using reverse FOIL (or trial-and-error method)

Given a trinomial, can we "un-FOIL" it? **ADD or SUBTRACT in each?**

Quick example: $3x^2 + 8x + 5 = (\qquad\qquad)(\qquad\qquad)$

6.3b – Factoring Trinomials by Grouping

- Factor trinomials by using the ac-method

The "recipe":

$$ax^2 + bx + c = \ ax^2 + px + qx + c$$

Now you can use "factoring-by-grouping".

Let's try it on the previous example:

$$ac = N$$

$$p \ + \ q = b$$

Note: the first step before factoring ANY polynomial is to look for a greatest common factor for each term. Factor "out" the GCF first! Remember, the GCF does not disappear, it is still part of the factored expression.

Examples, try each by trial and error and factoring by grouping:

1) $2x^2 + 20x + 32$

2) $x^2 - 7x + 12$

3) $x^2 - 2x - 15$

4) $5x^2 - 6x - 8$

5) $3x^2 + 25x + 42$

6) $8y^2 + 27y + 9$

7) $5t^3 + 39t^2 - 8t$

8) $2dr^3 + 8dr^2 + 14dr$

9) $2(a + 4b)^2 - 2(a + 4b) - 12$

10) $70u^4 + 115u^3 + 15u^2$

Math 65 / Notes & Practice #9 / 20 points / Due ________. / Name:_______________________

Home Work Practice. Complete these at home. Show correct work and use of the equal sign. We will not go over these in class. However, you may compare your answers with others in the class.

1) $5\left(5ab^3\right)^0$

2) $3\left(2a^2b^{-2}\right)^{-3}$

3) $\dfrac{\left(4x^2\right)\left(5x^{-1}\right)^2}{\left(18y^3\right)\left(4y^{-1}\right)}$

4) $\left(2x^2+7\right)\left(x^2-6\right)$

5) $(6x+2y)^2$

- **For today:**

6.4a – Special Factorizations – Squares / Objectives:

- Determine whether a trinomial has a special factorization
- Factor perfect square trinomials
- Factor the differences of two squares

It will help to recognize perfect square integers:

Perfect Squares from 1 to 400																				
Integer n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Square n^2	1	4	9	16	25	36	49	64	81	100	121	144	169	196	225	256	289	324	361	400

What's the difference between a perfect square trinomial and a difference of squares?

Recall:

$(a+b)(a-b)=$

$(a+b)^2=(a+b)(a+b)=$

$(a-b)^2=(a-b)(a-b)=$

Quick examples, factor the following:

x^2-196

$x^2+34x+289$

$x^2-22x+121$

Note: the first step before factoring ANY polynomial is to look for a greatest common factor for each term. Factor "out" the GCF first! Remember, the GCF does not disappear; it is still part of the factored expression.

Examples, completely factor the following polynomials, if possible:

1) $16x^2 - 9$

2) $25 + 10x + x^2$

3) $9x^4 - y^4$

4) $x^2 - 8xy + 16y^2$

5) $-20y^2 - 60xy - 45x^2$

6) $4x^2 + 25$

7) $27x^2 - 12$

8) $16x^4 + 8x^2 + 1$

9) $1 - 9x^4$

10) $9x^4 - 6x^2y^2 + y^4$

Math 65 / Notes & Practice #10 / 20 points / Due ________. / Name:______________________

Home Work Practice. Complete these at home. Show correct work and use of the equal sign. We will not go over these in class. However, you may compare your answers with others in the class.

Factor the given polynomial by finding the greatest common monomial factor

1) $15x^3 + 3x^3y^3 + 21x^4$

Factor each expression by factoring out the common binomial.

2) $5y(3a - 8) - 4b(3a - 8)$

Completely factor the expression by grouping, if possible.

3) $ax - 4bx + 4az - 16bz$

Factor the given polynomial

4) $x^2 + 8x + 12$

- **For today:**

6.5 – Additional Factoring Practice / Objectives:

- Factor out a common monomial factor and then factor the remaining x^2+bx+c trinomial (polynomial has 3 terms with a leading coefficient of 1)
- Factor polynomials by grouping (polynomial has 4 terms)
- Factor the differences of two squares (polynomial has 2 terms)
- Factor the differences of cubes (2 terms - this won't be on tests, quizzes, or HCR's)
- Factor the sums of cubes (2 terms - this won't be on tests, quizzes, or HCR's)
- Factor trinomials by using the ac-method (polynomial has 3 terms of the form ax^2+bx+c)
- Identify special factorizations

See the second page of 6.5 Lesson on Hawkes for the General Guidelines for Factoring Polynomials

Note: the first step before factoring ANY polynomial is to look for a greatest common factor for each term. Factor "out" the GCF first! Remember, the GCF does not disappear; it is still part of the factored expression.

Examples, completely factor the following polynomials, if possible:

1) $p^2 - py - 2p + 2y$

2) $25 - 4x^2$

3) $3v^2 - 2v - 1$

4) $12x^2 - 27y^2$

5) $5x^2 + 18x - 8$

6) $9 + 4x^2$

7) $8y^3 + x^3$

8) $6x^2 + 21x + 18$

9) $27y^3 - 1$

10) $16y^3 + 12y^2 - 4y - 3$

Math 65 / Notes & Practice #11 /20 points / Due ________. / Name:______________________

Home Work Practice. Complete these at home. Show correct work and use of the equal sign. We will not go over these in class. However, you may compare your answers with others in the class.

Solve the following equations for the indicated unknown:

1) $16y+23y-3=16y-2y+2$

2) $\frac{5n}{6}+\frac{1}{9}=\frac{3n}{2}+\frac{1}{9}$

Completely factor the following polynomial expressions

3) $x^2+13x-30=$

4) $6t^4-3t^3-30t^2=$

- **<u>For today:</u>**

6.6 –/ Solving Quadratic Equations by Factoring / Objectives:

- Solve quadratic equations by factoring
- Write equations given the roots

Definition: Quadratic equations are equations that can be written in the form: $ax^2+bx+c=0, \quad a\neq 0$ This form is known as the **standard form** or **general form**.

Remember that solutions to an equation are those values for x **that make the equation true.**

Quadratic equations can have 2, 1, or no solutions.

We use the Zero-Factor Property to solve quadratic equations by factoring:

If $\boldsymbol{A\cdot B=0, then\ A=0\ \ OR\ \ B=0,\ OR\ both\ \ A=0\ and\ B=0}$

Note: the form of $\boldsymbol{A\&B \rightarrow A=(x-c)\ \&\ B=(x-d)}$ $\boldsymbol{c\ \&\ d}$ **are known as the "roots" or solutions**

- **Let's look at Activities #4 problems (3) – (6) and #5 (1), (2), & (4)**

Solve the following equations (make sure you have the quadratic equation in STANDARD FORM before factoring):

1) $(2x)(x+2)=0$

2) $x^2+10x+24=0$

3) $64x^2=9$

4) $5x^2-17x+16=2$

5) $64x^4-49x^2=0$

6) $(x-6)^2=64$

Write a polynomial equation with integer coefficients that has the given roots (solutions).

7) $y=-8, y=4$

8) $x=0, x=5$

9) $t=\frac{1}{2}, t=-7$

10) $r=0, r=3, r=-3$

Math 65 / Notes & Practice #12 /20 points /Due ________. / Name:________________________

Home Work Practice. Complete these at home. Show correct work and use of the equal sign. We will not go over these in class. However, you may compare your answers with others in the class.

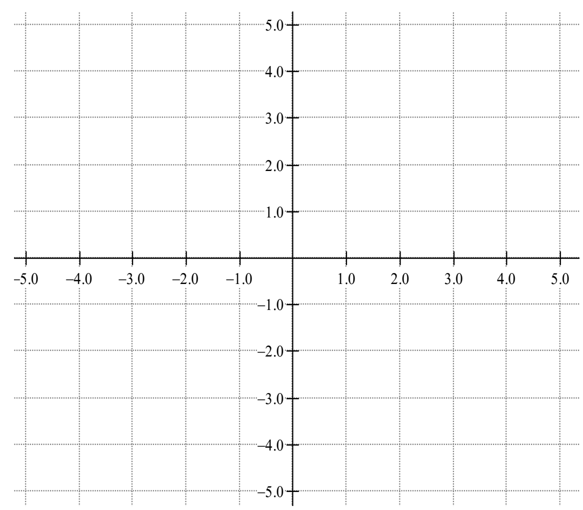
Solve the following equations for the indicated unknown by factoring:

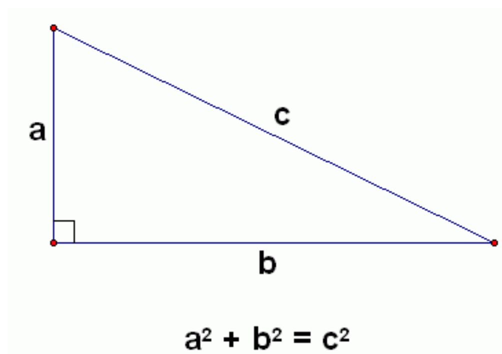
1) $x^2 + 13x - 30 = 0$

2) $6t^4 - 3t^3 - 30t^2 = 0$

3) Solve the following system of equations by graphing each line given.

$$\begin{cases} 3x + 2y = -5 \\ x - 2y = -7 \end{cases}$$





- **<u>For today:</u>**

6.7 – Applications of Quadratic Equations / Objectives:

- Solve problems related to the Pythagorean theorem → → →
- Use quadratic equations to solve problems related to consecutive integers
- Use quadratic equations to solve problems related to geometry
- Use quadratic equations to solve problems related to numbers

Attack Plan for Application Problems

1. Read the problem carefully at least twice.
2. Decide what is asked for and assign a variable or variable expression to the unknown quantities.
3. Organize a chart, table, or diagram relating all the information provided.
4. Form an equation. (A formula of some type may be necessary.)
5. Solve the equation.
6. Check your solution with the wording of the problem to be sure it makes sense.

- **Examples: (Show your write up on a separate paper, no frills, and attach to this)**

1) The product of two consecutive even integers is 728. Find the integers.

2) Find two consecutive odd integers such that the sum of their squares is 394.

3) One integer is 10 more than another. Their product is 375. Find the integers.

4) The length of a rectangle is 10 more than the width. The area is 504 square yards. Find the length and width of the rectangle.

5) A theater can seat 170 people. The number of rows is 7 less than the number of seats in each row. How many rows of seats are there?

6) One number is 4 more than another. The difference between their squares is 136. What are the numbers?

7) The height of a triangle is 5 feet less than the base. The area of the triangle is 168 square feet. Find the length of the base and the height of the triangle.

8) The area of a rectangle is 330 square centimeters. If the perimeter is 74 centimeters, find the length and width of the rectangle.

9) At a certain time of day, a tree that is x meters tall casts a shadow that is $x - 23$ meters long. If the distance from the top of the tree to the end of the shadow is $x + 2$ meters long, what is the height, x, of the tree?

Math 65 / Notes & Practice #13 /20 points / Due ________ /Name:_________________________

- **For today:**

7.1a – Defining Rational Expressions

Objectives:

- Determine the values for which a given rational expression is undefined
- Reduce rational expressions to lowest terms

The term **rational number** is the technical name for a fraction in which both the numerator and denominator are integers. Similarly, the term **rational expression** is the technical name for a fraction in which both the numerator and denominator are polynomials.

Rational Expressions

A **rational expression** is an algebraic expression that can be written in the form

$\frac{P}{Q}$ where P and Q are polynomials and $Q \neq 0$.

Examples of rational expressions are

$$\frac{4x^2}{9}, \quad \frac{y^2-25}{y^2+25}, \quad \text{and} \quad \frac{x^2+7x-6}{x^2-5x-14}.$$

Note: the denominator of a fraction can never be zero and the same is true for a rational expression. Any numerical replacement of the variable in the rational expression that causes division by zero is called a **restricted value.** For the three examples, what are the restricted values, if any?

Further, just like rational numbers can be reduced by canceling common **FACTORS** in the numerator and the denominator, so too with **rational expressions.** (See slide 4 in Hawkes)

****

7.1b Multiplication and Division with Rational Expressions.

Objectives:

- Divide rational expressions
- Multiply and divide rational expressions
- Multiply rational expressions

Division with Rational Expressions

If $P, Q, R,$ and S are polynomials with $Q, R, S \neq 0$, then

$$\frac{P}{Q} \div \frac{R}{S} = \frac{P}{Q} \cdot \frac{S}{R}$$

Note: that $\frac{S}{R}$ is the reciprocal of $\frac{R}{S}$

Multiplication with Rational Expressions

If $P, Q, R,$ and S are polynomials and $Q, S \neq 0$, then

$$\frac{P}{Q} \cdot \frac{R}{S} = \frac{P \cdot R}{Q \cdot S}$$

- When dividing fractions you MUST multiply the FIRST fraction by the RECIPROCAL of the SECOND fraction.
- To complete the process of multiplying rational expressions (fractions) make sure *all* numerators and denominators are completely factored.
- Also, keep in mind that each division bar is a grouping symbol and that there are "invisible" parenthesis around the *P, R, Q*, & *S*.
- At this point, be sure to cancel any common factors.
- We typically leave the denominator in factored form and simplify the numerator.
- State any restricted values from the original problem.

- **Examples: state the restricted (aka excluded) values for each and then reduce.**

1. $\dfrac{30x - 20}{90x}$

2. $\dfrac{-16n + 8}{10n - 5}$

3. $\dfrac{4x^2}{14x^2 - 16x}$

4. $\dfrac{a^2 - 10a + 25}{a^2 - 25}$

5. $\dfrac{x^2 + 3x - 70}{2x^2 + 20x}$

6. $\dfrac{81}{27y - 54}$

7. $\dfrac{2x^3 - 10x^2 - 12x}{x^2 - 8x + 12}$

8. $\dfrac{n^2 + 11n + 18}{n^2 + 8n - 9}$

9. $\dfrac{2a + 4}{3a^3 - 3a^2 - 18a}$

- Multiply or divide and simplify

10. $\frac{4m^2}{5n} \cdot \frac{25m^2}{24n}$

11. $\frac{14}{3x^2} \div \frac{8}{x^2}$

12. $\frac{a^2 + 10a + 24}{ab + 4b} \div \frac{a + 6}{b}$

13. $\frac{4}{(x + 4)^2} \div \frac{16}{x^2 - 16}$

14. $\dfrac{2m^2 + 3m - 9}{mn} \cdot \dfrac{7m}{m + 3}$

15. $\dfrac{y^2 + 10y + 25}{5y^2 + 31y + 30} \cdot \dfrac{5y^2 - 4y - 12}{y + 5}$

16. $\dfrac{5x^2 - 42x - 27}{x - 5} \div \dfrac{x - 9}{x^2 - 9x + 20}$

17. $\dfrac{y^2 - 7y + 12}{y^2 + 3y - 28} \div \dfrac{y^2 - 10y + 9}{y^2 + 3y - 4} \cdot \dfrac{y^2 - 2y - 63}{y^2 - 5y - 36}$

Math 65 / Notes & Practice #14 / *Due* __________. / (20 pts) Name:______________________

- **<u>For today:</u>**

<u>7.2 – Addition and Subtraction with Rational Expressions</u>

Objectives:

- Add and subtract rational expressions
- Add rational expressions
- Subtract rational expressions

Placement of Negative Signs

- Important point for negatives and fractions:

If P and Q are polynomials and $Q \neq 0$, then

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

Recall to add or subtract rational expressions, or ANY fractions, you must have common denominators:

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

Examples:

1) $\dfrac{x+3}{2x+3} + \dfrac{3x+3}{2x+3}$

2) $\dfrac{y}{6x} - \dfrac{x-8}{8y}$

3) $\dfrac{8}{x-9} - \dfrac{5}{9-x}$

4) $\dfrac{-2x-1}{x+6} - \dfrac{7x+8}{x+6}$

5) $\frac{4x^2}{x^2 - 9} - \frac{2}{x + 3}$

6) $\frac{2x - 7}{x^2 - 4x + 4} + \frac{2}{x - 2}$

7) $\frac{7}{x - 4} + \frac{3x + 8}{x^2 + 5x - 36}$

8) $\frac{x + 10}{x^2 + 3x + 2} - \frac{18}{x^2 + 4x + 3}$

7.3 – Complex Fractions → **These fractions have "little" fractions within the bigger fraction.**

Objectives:

- Simplify complex algebraic expressions
- Simplify complex fractions

Quick examples: (simplified in Hawkes, slides 4 & 6)

$$\frac{\frac{1}{x+3}-\frac{1}{x}}{1+\frac{3}{x}} \quad \text{and} \quad \frac{x+y}{x^{-1}+y^{-1}}=\frac{x+y}{\frac{1}{x}+\frac{1}{y}}$$

- **A complex algebraic expression** is an expression that involves rational expressions and more than one operation.

- **To simplify complex fractions we need to manipulate the complex fraction so that there are no "little" fractions left in the numerator or denominator of the "overall" fraction. There are two methods:**

To Simplify Complex Fractions (First Method)

1. Simplify the numerator so that it is a single rational expression.
2. Simplify the denominator so that it is a single rational expression.
3. Divide the numerator by the denominator and reduce to lowest terms.

Recall that if you have a single fraction divided by a single fraction, you multiply the numerator's fraction by the reciprocal of the denominator's fraction:

$$\frac{\frac{A}{B}}{\frac{C}{D}}=\frac{A}{B}\div\frac{C}{D}=\frac{A}{B}\times\frac{D}{C}=$$

To Simplify Complex Fractions (Second Method)

1. Find the LCM of all the denominators in the numerator and denominator of the complex fraction.
2. Multiply both the numerator and denominator of the complex fraction by this LCM.
3. Simplify **both** the numerator and denominator and reduce to lowest terms.

$$\frac{\frac{A}{B}}{\frac{C}{D}}\times\frac{BD}{BD}=\frac{A}{B}\cdot\frac{D}{C}=$$

Examples: Use both methods to simplify the following complex fractions.

1a) $\dfrac{\frac{5x^2}{2y^3}}{\frac{3x}{5y^2}}$

1b) $\dfrac{\frac{5x^2}{2y^3}}{\frac{3x}{5y^2}}$

2a) $\dfrac{\frac{x+6}{3x}}{\frac{x-5}{4x^2}}$

2b) $\dfrac{\frac{x+6}{3x}}{\frac{x-5}{4x^2}}$

3a) $\dfrac{\frac{2}{x^2}-\frac{4}{x^3}}{\frac{5}{x^2}-\frac{20}{x^4}}$

3b) $\dfrac{\frac{2}{x^2}-\frac{4}{x^3}}{\frac{5}{x^2}-\frac{20}{x^4}}$

Use the method of your choice to simplify the following complex fractions:

4) $$\frac{4+\frac{6}{x}}{4-\frac{2}{x^2}}$$

5) $$\frac{6}{3x^{-3}+4y^{-2}}$$

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

7) $$\frac{\frac{7}{x^2-4}-\frac{2}{x+2}}{\frac{4}{x-2}+\frac{2}{x^2-4}}$$

Simplify the following complex algebraic expressions:

8) $$\frac{7}{x+2}-\frac{5}{7x}\div\frac{x+2}{14x}$$

9) $$\left(\frac{7}{x}+\frac{3}{x+3}\right)\cdot\frac{2x+6}{x}$$

Math 65 / Notes & Practice #15 / *Due* __________. /(20 pts) Name:________________________

Home Work Practice. Complete these at home. Show correct work and use of the equal sign. We will not go over these in class. However, you may compare your answers with others in the class.

1) Find two consecutive odd integers such that the sum of their squares is 74.
   a) Identify your variable; b) Set up and solve equation; c) Answer in a sentence.

2) Find $g(a-4)$ for the following polynomial $g(x) = 4x + 1$

$g(a-4) =$

3) Perform the indicated operation: $(-3x - 2) - \left(2x^2 + 8x\right)$

- **<u>For today:</u>**

7.4a: Solving Equations: Ratios and Proportions

Objectives:

- Compare two quantities as ratios
- Solve proportions

A **ratio** is a comparison of two numbers by division. Ratios are written in the form

$a{:}b$ or $\dfrac{a}{b}$ or a to b.

Proportion

A **proportion** is an equation stating that two ratios are equal.

In symbols, $\dfrac{a}{b} = \dfrac{c}{d}$ is a proportion.

7.4b: Solving Equations with Rational Expressions / Objectives:

- Solve other equations with rational expressions

To Solve an Equation Containing Rational Expressions

1. Find the LCD of the fractions.
2. Multiply both sides of the equation by this LCD and simplify.
3. Solve the resulting equation. (This equation will have only polynomials on both sides.)
4. Check each solution in the **original equation**. (Remember that no denominator can be 0 and any solution that gives a 0 denominator is to be discarded.)

Quick Example, Solve for x: $\dfrac{x}{2} - \dfrac{1}{3} = \dfrac{x}{3}$

Examples for 7.4a

1) Write the following comparison as a ratio reduced to lowest terms *with the same units*.

34 quarters to 2 dollars

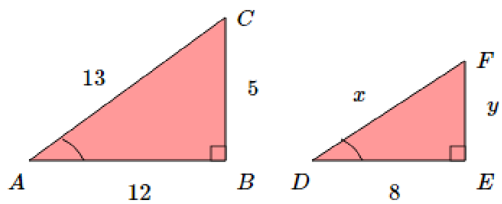
2) Solve: $\frac{49}{147} = \frac{21}{x}$

3) The distance to your uncle's house is 728 miles, and the distance to Atlanta is 260 miles. If it took 14 hours to drive to your uncle's house, how long would it take to drive to Atlanta?

4) Consider the following triangles.

$\triangle ABC \sim \triangle DEF$.

Note that these triangles are not drawn to scale.
Find the value of *x* and *y*.



5) Solve: $\frac{2}{-9} = \frac{-10}{-5x}$

Examples for 7.4b; State restrictions on the variables and then solve for the unknown

6) $\frac{6}{5x} - \frac{1}{9} = \frac{4}{9x}$

7) $\frac{x+8}{x-9} - \frac{5}{3x+2} = \frac{x-3}{x-9}$

8) $\frac{x}{x+3} = \frac{2}{x+1} - \frac{2x}{x^2+4x+3}$

Math 65 / Notes & Practice #16 / *Due* __________. / Name:______________________

(20 points)

Home Work Practice. Complete these at home. Show correct work and use of the equal sign. We will not go over these in class. However, you may compare your answers with others in the class.

1) The area of a rectangle is 168 square feet. If the perimeter is 62 feet, find the length and width of the rectangle. a) Identify your variable(s), use a picture; b) Set up and solve an equation; c) Answer in a sentence.

2) Find the equation (in slope-intercept form) of the line with the slope -2 that passes through the point (3, 2).

3) Perform the indicated operation: $(x-4)\left(x^2+4x+16\right)$

- **For today:**

9.1: Evaluating Radicals **Objectives:**

- Estimate square roots
- Evaluate cube roots
- Evaluate square roots
- Use a calculator to evaluate square and cube roots

Radical Terminology

The symbol $\sqrt{}$ is called a **radical sign.**

The number under the radical sign is called the **radicand.**

The complete expression, such as $\sqrt{64}$, is called a **radical** or **radical expression.**

Square Root

If a is a nonnegative real number, then

$\sqrt{a}$ is the **principal square root** of a,

and

$-\sqrt{a}$ is the **negative square root** of a.

Discuss Cube Roots and Perfect Cubes

9.2: Simplifying Radicals **Objectives:**

- Simplify radicals, including square roots and cube roots

Properties of Square Roots

If a and b are **positive** real numbers, then

1. $\sqrt{ab} = \sqrt{a}\sqrt{b}$

2. $\sqrt{\dfrac{a}{b}} = \dfrac{\sqrt{a}}{\sqrt{b}}$

Simplest Form for Square Roots:

A square root is considered to be in **simplest form** when the radicand has no perfect square as a factor.

Square Root of x^2

If x is a real number, then $\sqrt{x^2} = |x|$.

Note: If $x \geq 0$ is given, then we can write $\sqrt{x^2} = x$.

Examples for 9.1

1) Use your knowledge of square roots and cube roots to determine whether each of the following numbers is rational, irrational, or nonreal. Evaluate the radical expression. If it is irrational, estimate its value and then check with a calculator to two decimals.

$\sqrt{25}$ $\sqrt[3]{-1000}$ $\sqrt{69}$

$\sqrt{49}$ $-\sqrt{9}$ $\sqrt[3]{216}$

$\sqrt[3]{-343}$ $\sqrt{0.0016}$ $\sqrt{\frac{25}{121}}$

$\sqrt{\frac{1}{64}}$ $\sqrt{-18}$ $\sqrt[3]{729}$

2) Use your calculator to find the value of the radical expression accurate to four decimal places. $-5-9\sqrt{7}$

Examples for 9.2: Simplify the following expressions by showing work on a separate paper stapled to this.

1. $\sqrt{192}$
2. $\sqrt{32x^4}$
3. $\sqrt{24x^3y^6}$
4. $\sqrt[3]{72}$
5. $\sqrt[3]{-128x^7y^6}$
6. $-\sqrt{45a^2b^6c^7}$
7. $\sqrt{\frac{32a^5}{81b^8}}$
8. $\sqrt{\frac{75x^8}{121y^{12}}}$
9. $\sqrt[3]{\frac{125y^{12}}{27x^6}}$
10. $-\sqrt{250x^{15}y^{10}}$
11. $\sqrt[3]{-72a^2b^9}$
12. $\sqrt{-36x^2y^5}$
13. $\sqrt{32x^4y^9}$
14. $\sqrt[3]{80x^2y^7}$
15. $\sqrt{600a^3b^4c}$

Math 65 / Notes & Practice #17 / *Due* __________. / Name:________________________

(20 points)

Home Work Practice. Complete these at home. Show correct work and use of the equal sign. We will not go over these in class. However, you may compare your answers with others in the class.

1) If the square of a positive integer is added to 2 times the integer, the result is 120. Find the integer.
a) Identify your variable(s), use a picture; b) Set up and solve an equation; c) Answer in a sentence.

2) State any restriction(s) on the variable, if they exist:
Solve the equation, if possible. If there is a solution, express your answer as either an integer or a simplified fraction.

$$\frac{x+4}{x-8} - \frac{3}{4x+1} = \frac{x+7}{x-8}$$

3) Perform the indicated operation: $\frac{1}{5} + \frac{3}{10} - \frac{5}{12}$

- **<u>For today:</u>**

9.5 Equations with Radicals **Objectives:**

- Solve equations that contain radical expressions

The following are all examples of equations with radicals:

$2 = \sqrt{-2-y}$ $\sqrt{2t+6} = \sqrt{6t-2}$ $\sqrt[3]{-12+x} = -3$

$\sqrt{x} - \sqrt{2x-14} = 1$ $\sqrt{5x-1} = x+1$ $\sqrt{7-w} + 2 = 5$

How are we going to solve these equations?

Method for Solving Equations with Radicals

1. Isolate one of the radicals on one side of the equation. (An equation may have more than one radical.)
2. Raise both sides of the equation to the power corresponding to the index of the radical.
3. If the equation still contains a radical, repeat steps 1 and 2.
4. Solve the equation after all the radicals have been eliminated.
5. Be sure to check all possible solutions in the original equation and eliminate any extraneous solutions.

Examples for 9.5

1) $2 = \sqrt{-2 - y}$

2) $\sqrt{2t + 6} = \sqrt{6t - 2}$

3) $\sqrt{7 - w} + 2 = 5$

4) $\sqrt[3]{-12 + x} = -3$

5) $\sqrt{5x - 1} = x + 1$

6) $\sqrt{x} - \sqrt{2x - 14} = 1$

Math 65 / Notes & Practice #18 / *Due* __________. / Name:________________________

(20 points)

Week 10, Sections 10.1a: Quadratic Equations – The Square Root Method
10.2: Quadratic Equations – The Quadratic Formula
10.3: Applications – Quadratic Equations

Recall:

Quadratic equations are equations that can be written in the form

$$ax^2+bx+c=0,$$

where a, b, and c are real numbers and $a \neq 0$.

How do we solve this equation?

10.1a: Quadratic Equations – The Square Root Method

- **Solve quadratic equations using the definition of the square root (a new process!)**

Note: isolate what is being squared, if possible. This technique DOES NOT work if you have an ax^2 term and a bx term in the same equation!!

Examples: Solve the following quadratic equations and simplify where necessary.

Square Root Property

If $x^2=c$, then $x=\pm\sqrt{c}$.

If $(x-a)^2=c$, then $x-a=\pm\sqrt{c}$ $\left(\text{or } x=a\pm\sqrt{c}\right)$.

Note: If c is negative $(c<0)$, then the solutions will be nonreal.

1. $3x^2=81$

2. $81y^2=1$

3. $(9x-6)^2=18$

4. $3(x-4)^2=135$

10.2: Quadratic Equations – The Quadratic Formula (A third method for solving quadratic equations)
See slide #2 for the derivation of the quadratic formula.

Given the general quadratic equation in standard form: $ax^2+bx+c=0$

Its solutions are of the form: $x = \dfrac{-b \pm \sqrt{b^2-4ac}}{2a}$

I will provide this formula on the final for you, but you should try to memorize it! It shows up a lot!

The expression b^2-4ac, the part of the quadratic formula that lies under the radical sign, is called the **discriminant**. The discriminant identifies the number and type of solutions to a quadratic equation. Assuming a, b, and c are all real numbers, there are three possibilities: the discriminant is either positive, negative, or zero.

In the case where $b^2-4ac = 0$, we say $x = -b/(2a)$ is a **double root**. Additionally, if the discriminant is a perfect square, the equation is factorable.

Discriminant	Nature of Solutions
$b^2-4ac>0$	two real solutions
$b^2-4ac=0$	one real solution, $x=\dfrac{-b\pm 0}{2a}=-\dfrac{b}{2a}$
$b^2-4ac<0$	two nonreal solutions

Examples: Solve the following quadratic equations using the quadratic formula. Be sure to identify a, b, & c from the standard form of the equation. Let's look at the associated graphs for $y = ax^2+bx+c$

1. $x^2 - 5x + 6 = 0$

2. $4x^2 + 7x = 3$

3. $x^2 - 6x = -4$

4. $4y^2 = 2y - 1$

10.3: Applications – Use Quadratic Equations to Solve:

• Solve distance-rate-time problems • Solve number problems • Solve problems involving cost and profit • Solve problems involving geometry	• Solve problems involving gravity • Solve problems involving the Pythagorean Theorem • Solve problems involving work

Strategy for Solving Word Problems

1. **Understand the problem.**
   a. Read the problem carefully. (Read it several times if necessary.)
   b. If it helps, restate the problem in your own words.
2. **Devise a plan.**
   a. Decide what is asked for; assign a variable to the unknown quantity. Label this variable so you know exactly what it represents.
   b. Draw a diagram or set up a chart whenever possible.
   c. Write an equation that relates the information provided.
3. **Carry out the plan.**
   a. Study your picture or diagram for insight into the solution.
   b. Solve the equation.
4. **Look back over the results.**
   a. Does your solution make sense in terms of the wording of the problem?
   b. Check your solution in the equation.

On the final I will be asking you to 1) Identify your variable(s) with words or a labeled picture; 2) Set up and solve an equation associated with the problem; 3) Answer in a sentence with appropriate units. Use here also:

Examples:

1. distance = rate X time A small motorboat travels 7mph in still water. It takes 6 hours longer to travel 75 miles going upstream than it does going downstream. Find the rate of the current. (Hint: $7 + x$ = rate going downstream and $7 - x$ = rate going upstream.) (Round your answer to the nearest tenth.)

2. Cost. The Extreme Rock Climbing Club planned a climbing expedition. The total cost was $1800, which was to be divided equally among the members going. Prior to the trip, 15 members decided not to go. If the cost per person increased by $27, how many people went on the expedition?

3. Gravity. An arrow is shot vertically upward from a platform 45 ft high at a rate of 170 ft per sec. When will the arrow hit the ground? Use the formula: $h = -16t^2 + v_0t + h_0$. (Round your answer to the nearest tenth.)

4. Work Problem: Two companies working together can clear a parcel of land in 7 hours. Working alone, it would take Company A 2 hours longer to clear the land than it would Company B. How long would it take Company B to clear the parcel of land alone? (Round your answer to the nearest tenth.)

5. Pythagorean Theorem. The hypotenuse of a right triangle is three times the length of one of the legs. The length of the other leg is $\sqrt{288}$ feet. Find the lengths of the leg and hypotenuse.

6. Geometry. A rectangle has a length of 11 yards less than 3 times its width. If the area of the rectangle is 1742 square yards, find the length of the rectangle.