## MDEV 099, Intermediate Algebra, Guided Notebook, Fall 2015

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Topic 11.2 Guided Notebook

Topic 11.2 Solving Linear Equations in One Variable

**Topic 11.2 Objective 1:** Solve Linear Equations Containing Non-Simplified Expressions

What should be done with non-simplified expressions before using the properties of equality?

**Example 1:**

Study the solution for Example 1 on page 11.2-3 and record the answer below. Check your answer by clicking on the link.

Solve: $4x + 7 - 2x = 5 - 3x - 3$

What should be done if the equation contains grouping symbols?

**Example 2:**

Complete Example 2 on page 11.2-4 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Solve: $7 - 2(4z - 3) = 3z + 1$

**Example 3:**

Complete Example 3 on page 11.2-5 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Solve: $2(3x - 1) - 5x = 3 - (3x + 1)$
**Topic 11.2 Objective 2:** Solve Linear Equations Containing Fractions

This objective discusses removing fractions. You do not have to remove the fractions, but it is an option. When an equation contains fractions, how can you remove the fractions?

**Example 5:**
Complete Example 5 on page 11.2-7 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Solve: \( \frac{w + 3}{2} - 4 = w + \frac{1}{3} \)

**Example 6:**
Complete Example 6 on page 11.2-9 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Solve: \( \frac{5x - 7}{2} - \frac{3}{8} = \frac{3}{4}x - \frac{11}{8} \)

**Topics 11.2 Objective 3:** Solve Linear Equations Containing Decimals; Apply a General Strategy

This objective discusses removing decimals. You do not have to remove the decimals to solve it but it is an option. When an equation contains decimals, how can you remove the decimals?

**Example 7:**
Study the solution for Example 7 on page 11.2-10 and record the answer below. You may solve the equation without removing the decimals.

Solve. \( 1.4x - 3.8 = 6 \)
Example 8:
Complete Example 8 on page 11.2-11 on your own. You may solve the equations without removing the decimals. Check your answer by clicking on the link.

Solve. \(0.1x + 0.03(7 - x) = 0.05(7)\)

Read and summarize the CAUTION statement on page 11.2-12.

What are the steps for A General Strategy for Solving Linear Equations in One Variable?

1.

2.

3.

4.

5.

6.

Topic 11.2 Objective 4: Identify Contradictions and Identities

What are the three cases for the solution of a linear equation in one variable?

When no variable terms remain and a false statement results the equation is called a(n) ________________, which means what?
When no variable terms remain and a true statement results the equation is called a(n) __________________, which means what?

**Example 9:**
Study the solution for Example 9 part a on page 11.2-16 and record the answer below. Complete part b on your own and check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Determine if the equation is a contradiction or an identity. State the solution set.

a. \(3x + 2(x - 4) = 5x + 7\)  
b. \(3(x - 4) = x + 2(x - 6)\)

**Topic 11.2 Objective 5: Use Linear Equations to Solve Application Problems**

**Example 11:**
Complete Example 11 on page 11.2-18 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

In the U.S., the average pounds of red meat eaten, \(M\), is related to the average pounds of poultry eaten, \(P\), by the equation

\[100M = 14000 - 42P\]

Determine the average amount of poultry eaten if the average amount of red meat eaten is 100.1 pounds. (Source: U.S. Department of Agriculture)
**Topic 11.8 Guided Notebook**

**Topic 11.8 Compound Inequalities; Absolute Value Equations and Inequalities**

**Topic 11.8 Objective 1:** Find the Union and Intersection of Two Sets

Write down the definition of **Intersection**. What symbol is used?

**Example 2:**
Complete Example 2 on page 11.8-4 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Let $A = \{x | x > -2\}$ and $B = \{x | x \leq 5\}$. Find $A \cap B$, the intersection of the two sets.

Write down the definition of **Union**. What symbol is used?

**Example 4:**
Complete Example 4 on page 11.8-6 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Let $A = \{x | x < -2\}$ and $B = \{x | x \geq 5\}$. Find $A \cup B$, the union of the two sets.

**Example 5:**
Study the solutions for Example 5 parts a and b on page 11.8-7.
Topic 11.8

**Topic 11.8 Objective 2:** Solve Compound Linear Inequalities in One Variable

Write down the **Guidelines for Solving Compound Linear Inequalities**.

1.

2.

3.

**Example 7:**
Complete Example 7 on page 11.8-11 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Solve $9 - 4x < -7$ or $5x + 6 < 3(x + 2)$. Graph the solution set and then write it in interval notation.

Explain why the solution to $2x - 3 \leq -1$ and $x - 7 \geq -3$ is a null set.

Explain why the solution to $10x + 7 > 2$ or $3x - 6 \leq 9$ is the set of real numbers.

**Topic 11.8 Objective 3:** Solve Absolute Value Equations

Write down the **Absolute Value Equation Property**.

**Example 9:**
Complete Example 9 on page 11.8-16 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Solve $|1 - 3x| = 4$
Read and summarize the CAUTION statement on 11.8-17.

Write down the **Strategy for Solving Absolute Value Equations**.

1. 
2. 
3. 
4. 

**Example 13:**
Complete Example 13 on page 11.8-20 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Solve. \(-3|2-m| + 8 = 2\)

**Note:** We will not be covering Objective 4 in this course.
**Topic 12.2 Guided Notebook**

**Topic 12.2 Graphing Linear Equations in Two Variables**

**Topic 12.2 Objective 1:** Determine If an Ordered Pair Is a Solution to an Equation

What is a **Solution to an Equation in Two Variables**?

**Example 1:** Study the solutions to Example 1 parts a and b on page 12.2-4 and record the answers below. Complete parts c and d on your own and check your answers by clicking on the link.

Determine if each ordered pair is a solution to the equation \(x + 2y = 8\)

a. \((-2,5)\)  
b. \((2,6)\)  
c. \((-11, \frac{3}{2})\)  
d. \((0, 4)\)

**Topic 12.2 Objective 2:** Determine the Unknown Coordinate of an Ordered Pair Solution

What is an **ordered pair solution**?

**Example 2:**

Study the solution for Example 2 part a on page 12.2-6 and record the answer below. Complete parts b and c on your own and check your answers by clicking on the link. If your answers are incorrect, watch the video to find your error.

Find the unknown coordinate so that each ordered pair satisfies \(2x - 3y = 15\).

a. \((6, ?)\)  
b. \((?, 7)\)  
c. \((-\frac{5}{2}, ?)\)
**Topic 12.2 Objective 3:** Graph Linear Equation by Plotting Points

What is the graph of an equation in two variables?

To make such a graph:

1. We can __________ several points that ______________ the _______________.
2. Then we __________ the points with a ___________ or _________________.

Write down a Linear Equation in Two Variables (Standard Form).

How many points are required to determine a line?

**Example 5:**

Complete Example 5 on page 12.2-16 parts a and b on your own. Check your answers by clicking on the link. If your answers are incorrect, watch the video to find your error.

Graph by plotting points.

a. \( y = 2x \)  
   b. \( 3x + 2y = 5 \)

**Topic 12.2 Objective 4:** Find \( x \)- and \( y \)-Intercepts

What are intercepts?

What is a \( y \)-intercept? What is the corresponding ordered pair?

What is an \( x \)-intercept? What is the corresponding ordered pair?
Example 6: Study the solution for Example 6 on page 12.2-18 and record the answer below.

Find the intercepts of the graph shown. What are the \(x\)-intercepts? What are the \(y\)-intercepts?

![Graph showing intercepts](image)

Record the method for **Finding \(x\)- and \(y\)-Intercepts of a Graph Given an Equation**.

Example 7: Study the solution for Example 7 part a on page 12.2-20 and record the answer below. Complete part b on your own and check your answer by clicking on the link.

Find the \(x\)- and \(y\)-intercepts for the graph of each equation.

a. \(2x + y = 4\) 

b. \(4x = 3y + 8\)

**Topic 12.2 Objective 5: Graph Linear Equations Using Intercepts**

Study the solution for Example 8 on page 12.2-21 and record the answer below.

Graph \(3x - 2y = 6\) using intercepts.
Example 9:
Complete Example 9 on page 12.2-23 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Graph $2x = 5y$ using intercepts.

Topic 12.2 Objective 6: Use Linear Equations to Model Data

Example 10:
Complete Example 10 on page 12.2-24 on your own. Check your answers by clicking on the link. If your answers are incorrect, watch the video to find your error.

The number of U.S. drive-in theaters can be modeled by the linear equation $y = -7.5x + 435$, where $x$ is the number of years after 2000. (Source: United Drive-In Theater Owners Association, 2009)

a. Find the missing coordinate for the ordered pair solution $(?, 390)$.

b. Interpret the point from part (b).

c. Find and interpret the $y$-intercept.

d. What does the $x$-intercept represent in this problem?

e. Sketch the graph of the equation for the year 2000 and beyond.

Topic 12.2 Objective 7: Graph Horizontal and Vertical Lines

Describe the graph of the equation $x = a$?

Describe the graph of the equation $y = b$?
**Topic 12.3 Guided Notebook**

**Topic 12.3 Slope**

**Topic 12.3 Objective 1:** Find the Slope of a Line Given Two Points

What is a key feature of a line?

How is the **slant** or **steepness** of a line measured?

Write down the definition of **Slope**.

What is the **Slope Formula**? Be sure to include the diagram.

---

**Example 2:**
Study the solution for Example 2 on page 12.3-8 and record the answer below.

Find the slope of the line containing the points \((-2, 4)\) and \((1, -3)\).

Summarize the information on **Positive versus Negative Slope** from page 12.3-10.

---

**Example 3:**
Study the solution for Example 3 part a on page 12.3-10 and record the answer below. Complete part b on your own and check your answer by clicking on the link.

Find the slope of the line containing the given points. Simplify if possible.

a. \((-6, -1)\) and \((4, 5)\)

b. \((1, 5)\) and \((3, -1)\)
**Topic 12.3 Objective 2: Find the Slopes of Horizontal and Vertical Lines**

**Example 4:** Study the solutions for Example 4 parts a and b on page 12.3-11 and record the answers below. Watch the video for detailed solutions.
Find the slope of the line containing the given points. Simplify if possible.

a. \((-3, 2)\) and \((1, 2)\)  
b. \((4, 2)\) and \((4, -5)\)

Summarize the information on *Slopes of Horizontal and Vertical Lines* from page 12.3-13.

Why shouldn’t we avoid using the term “no slope”?

Sketch Figure 18 on page 12.3-13, which summarizes the relationship between the slope and the graph of a linear equation.

**Topic 12.3 Objective 3: Graph a Line Using the Slope and a Point**

**Example 5:** Study the solution for Example 5 on page 12.3-14 and sketch the graph below.
Graph the line that has slope \(m = \frac{3}{2}\) and passes through the point \((1, -2)\).

**Example 6:** Complete Example 6 on page 12.3-15 on your own.
Graph the line that has slope \(m = -3\) and passes through the point \((2, -1)\).
**Topic 12.3 Objective 4:** Find and Use the Slopes of Parallel and Perpendicular Lines

What are **parallel lines**?

Write down the information on **Parallel Lines** found on page 12.3-17.

What are **perpendicular lines**?

Write down the information on **Perpendicular Lines** found on page 12.3-19.

**Example 8:**
Refer to Example 7 to help you complete Example 8 on page 12.3-21 on your own. Check your answer by clicking on the link.

a. Graph a line $l_2$ that is parallel to $l_1$ and passes through the point (3,–2)

b. Graph a line $l_3$ that is perpendicular to $l_1$ and passes through the point (3,–2)

**Topic 12.3 Objective 5:** Use Slope in Applications

What is **grade**? Give an example.

What is the slope of a roof called?
Example 9: Study the solution for Example 9 on page 12.3-22 and record the answer below.

A standard wheelchair ramp should rise no more than 1 foot vertically for every 12 feet horizontally. Find the grade of this ramp. Round to the nearest tenth of a percent. (Source: Americans with Disabilities Act Accessibility Guidelines (ADAAG))

What is average rate of change? Why is it called this in many applications?

Example 10:
Study the solution for Example 10 on page 12.3-24 and record the answer below. Watch the video for a detailed solution.

The average tuition and fees for U.S. public two-year colleges were $2130 in 1999. The average tuition and fees were $2540 in 2009. Find and interpret the slope of the line connecting the points (1999, 2130) and (2009, 2540). (Source: College Board, Trends in College Pricing 2009)
HOW THE BRAIN LEARN

During the first few weeks of the semester we will have lessons regarding the brain and how it learns interspersed with the regular lessons. Why? ...you may ask, because one of the goals of this math class is to improve your study skills to help you with your future math courses and other college courses and understanding how your brain works will be one way to accomplish that.

Understanding how the brain learns will help you understand the reasoning behind the study cycle that is used in this class and how each step in the cycle is essential.

Figure 1: Study Cycle

This will lead to improving your metacognition skills, which are the skills for you to diagnose what, or if you have learned the content.

These lessons are not just busy work. Understanding why you are doing something and how it is helping you learn can be a key to your success. It is all tied together with the course in the effort to make you the best student you can be and a successful student.

The lessons will consist of information from resources for you to read followed by activities or questions for you to complete. So, let’s get started with the first lesson.
How the Brain Learns: Lesson 1 Neurons

Objective: Upon completing this lesson, you will be able to identify the parts of the neuron and their function(s).

The brain is composed of a trillion cells of at least two known types, nerve cells (neurons) and glial cells. Neurons represent about 10% of the total – roughly 100 billion. Glial cells hold the neurons together and act as filters to keep harmful substances out of the neurons. Each brain neuron is about one hundredth of the size of the period at the end of this sentence.  (Sousa, 2011)

Even though most of the neurons where information is stored are present at birth, there is lifelong growth of the support and connecting cells that enrich the communication between neurons. Dendrites are treelike extensions (dendrite actually comes from the Greek word meaning tree-like) that protrude from a neuron and receive information from other neurons and transmit information to other neurons along axons. The dendrites receive electrical impulses from other neurons and transmit them along a long fiber, the axon. Each neuron can have up to 10,000 branches, dendrites, emerging from its core but only one axon.

New dendrites grow as branches from frequently activated neurons. Once these dendrites are formed, the brain’s plasticity allows it to reshape and reorganize the networks of dendrite-neuron connections in response to increased or decreased use of these pathways.

Axons are surrounded with a fatty layer of tissue called the myelin sheath which helps speed up the neural impulses between neuron. The sheath insulates the axon from the other cells and increases the speed of impulse transmission. It makes up what is called the “white matter” in our brains. Practice thickens the myelin sheath by requiring repetition of the same impulses again and again. Both quantity (repetition) and quality (correctness) of practice is important to myelinate axons.

http://www.apppsychology.com/Book/Biological/neuroscience.htm

Figure 2: Neuron
How do we get myelin onto our nerve axons? Use the neuron again and again or in one word... practice. Practice, in a variety of formats, helps fatten up the myelin sheath, which strengthens the connections between neurons in different area of our brain and helps those neurons perform in unison. Practice also helps grow and thicken the dendrites.

Impulses are sent between neurons from the axon’s terminal buttons by shooting neurotransmitters across the synapse. A synapse is a little space between neurons because neurons do not touch each other. Neurotransmitters are brain chemicals like dopamine, amino acids serotonin, and tryptophan carry information across the space separating the axon extensions of one neuron, from the dendrite that leads to the next neuron on the pathway. There are also neurotransmitters that may inhibit signals to be passed between cells.

Syn-naps is a word play on synapse to remind us that there needs to be a brain rest when the neurotransmitter can be restored to be available to release the next message. When neurotransmitters are depleted by too much information traveling through a nerve circuit without a break, the speed of transmission along the nerve slows down to a less efficient level. When this happens, information processing takes longer. (Willis, 2006)

While learning does not increase the number of brain cells, it does increase their size, their dendrites, and their ability to form more complex networks. The brain goes through physical and chemical changes each time it learns. (Sousa, How the Brain Learns, 2011)

Forming and strengthening the connections between the neurons in our brain is the foundation of learning. The next brain lesson will introduce other concepts to help you understand and take charge of your learning process.


How the Brain Learns, Lesson 1: Neurons  
Name _________________________

Please submit this completed worksheet with Print Lab 2.

1. Sketch the neuron and label the key parts as shown in Figure 2.

2. Define the following terms and their function if they have one.
   a. neuron
   b. glial cells
   c. dendrite
   d. axon
   e. plasticity
   f. neurotransmitter
   g. synapse
   h. myelin sheath

3. What physical effect does practice have on your brain?
**Topic 12.4 Guided Notebook**

**Topic 12.4 Equations of Lines**

**Topic 12.4 Objective 1:** Determine the Slope and y-Intercept from a Linear Equation

To determine the slope and y-intercept directly from an equation what must be done first?

What is **Slope-Intercept Form**?

**Example 2:**
Complete Example 2 parts a and b on page 12.4-6 on your own. Check your answers by clicking on the link.

Find the slope and y-intercept of the given line.

a. $4x - 10y = 0$  
   b. $y = 4$

**Topic 12.4 Objective 2:** Use the Slope-Intercept Form to Graph a Linear Equation

Study the animation on page 12.4-7.

**Example 4:** Complete Example 4 on page 12.4-9 on your own. Check your answer by clicking on the link.

Graph the equation $2x + 3y = 9$ using the slope and y-intercept.
**Topic 12.4 Objective 3:** Write the Equation of a Line Given Its Slope and $y$-Intercept

If the slope and $y$-intercept is given, how do you write the equation of the line?

**Example 5:** Study the solution for Example 5 on page 12.4-10 and record the answers below.

Write an equation of the line with the given slope and $y$-intercept.

a. slope $-4$; $y$-intercept $3$

b. slope $\frac{2}{5}$; $y$-intercept $-7$

---

**Topic 12.4 Objective 4:** Write the Equation of a Line Given Its Slope and a Point on the Line

What is the **Point-Slope Form**?

**Example 7:** Complete Example 7 on page 12.4-13 on your own and check your answer.

Use the point-slope form to determine the equation of the line that has slope $-\frac{3}{4}$ and passes through the point $(2, -5)$. Write the equation in slope-intercept form.

**Example 8:**

Study the solution for Example 8 on page 12.4-15 and record the answers below.

Write the equation of a line that passes through the point $(-3, 2)$ and has the given slope.

a. $m = 0$

b. undefined slope

---

**Topic 12.4 Objective 5:** Write the Equation of a Line Given Two Points

**Example 9:** Complete Example 9 on page 12.4-16 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Write the equation of the line passing through the points $(-4, 1)$ and $(2, 4)$. Write your answer in slope-intercept form.
Complete Table 1 from page 12.4-17

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<td>Slope is _____ and ______ is a point on the line</td>
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<td>$y = mx + b$</td>
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<tr>
<td>$Ax + By = C$</td>
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<tr>
<td>Horizontal Line</td>
<td>Slope is ________, and $y$-intercept is _____</td>
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<tr>
<td>$x = a$</td>
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**Topic 12.4 Objective 6: Determine the Relationship Between Two Lines**

Parallel lines have the ___________ slope but ______________ $y$-intercepts.
Perpendicular lines have ________________________________ slopes.
**Coinciding Lines** have the ___________ slope and the __________ $y$-intercept.
Two lines with different slopes will ________________.

**Example 10:** Study the solution for Example 10 part a on page 12.4-19 and record the answer below. Complete parts b–d on your own and check your answers by clicking on the link.
For each pair of lines, determine if the lines are parallel, perpendicular, coinciding, or only intersecting.

a. $3y = -2y + 7$  
   $3x - 2y = 8$

b. $y = -3x + 1$  
   $6x + 2y = 2$

c. $4x - 5y = 15$
   $y = \frac{4}{5}x + 1$

d. $3x - 4y = 2$
   $x + 2y = -12$
**Topic 12.4**

**Topic 12.4 Objective 7: Write the Equation of a Line Parallel or Perpendicular to a Given Line**

**Example 11:** Study the solution for Example 11 part a on page 12.4-20 and record the answer below. Complete part b on your own and check your answer by clicking the link. Write the equation of the line that passes through the point (6,–5) and is

a. perpendicular to \( 6x - 2y = -1 \) \hspace{1cm} b. parallel to \( y = -2x + 4 \)

**Topic 12.4 Objective 8: Use Linear Equations to Solve Applications**

**Example 12:** Complete Example 12 parts a and b on page 12.4-23 on your own. Check your answers by clicking on the link. If your answers are incorrect, watch the video to find your error.

If attendance at professional football games is 17 million in a given year then the corresponding attendance at college football games is 31 million. Increasing attendance at professional football games to 25 million increases attendance at college football games to 55 million. *(Source: Statistical Abstract, 2010)*

a. Assume that the relationship between professional football attendance (in millions) and college football attendance (in millions) is linear. Find the equation of the line that describes this relationship. Write your answer in slope-intercept form.

b. Use your equation from part (a) to estimate the attendance at college football games if the attendance at professional football games is 21 million
**Topic 13.1 Guided Notebook**

**Topic 13.1 Solving Systems of Linear Equations by Graphing**

**Topic 13.1 Objective 1:** Determine If an Ordered Pair Is a Solution to a System of Linear Equations in Two Variables

What is the definition of a **System of Linear Equations in Two Variables**? Give two examples.

What is the definition of the **Solution to a System of Linear Equations in Two Variables**?

**Example 1:**
Complete Example 1 parts a and b on page 13.1-5 on your own. Check your answers by clicking on the link. If your answers are incorrect, watch the video to find your error.

Determine if each ordered pair is a solution to the following system: \[
\begin{align*}
2x + 3y &= 12 \\
x + 2y &= 7
\end{align*}
\]

a. \((-3, 6)\)  
   b. \((3,2)\)
**Topic 13.1 Objective 2: Determine the Number of Solutions to a System Without Graphing**

What are the three possible outcomes when two linear equations are graphed? Include a sketch of each.

Write down the definitions for the following terms.

**Consistent**

**Inconsistent**

**Dependent**

**Independent**

Describe the slopes and $y$-intercepts of two lines with the following number of solutions.

**One solution**

**No solutions**

**Infinite number of solutions**
Example 2: Study the solution for Example 2 part a on page 13.1-8 and record the answer below. Complete parts b and c on your own and check your answers by clicking on the link.

Determine the number of solutions to each system without graphing.

a. \[
\begin{align*}
    y &= 3x - 4 \\
    6x + 3y &= 8
\end{align*}
\]

b. \[
\begin{align*}
    2x - 4y &= \frac{8}{3} \\
    3x - 6y &= 4
\end{align*}
\]

c. \[
\begin{align*}
    5x - 2y &= 3 \\
    \frac{5}{2}x + y &= 7
\end{align*}
\]

Topics 13.1 Objective 3: Solve Systems of Linear Equations by Graphing

What are the three methods for solving systems of linear equations in two variables?

There is no need to solve which systems by graphing? Why?

What are the steps for Solving Systems of Linear Equations in Two Variables by Graphing?

1. 

2. 

3.
Example 3: Study the solution for Example 3 on page 13.1-12 and record the answer below.

Solve the following system by graphing:

\[
\begin{align*}
    y &= 2x + 1 \\
    y &= -x + 4
\end{align*}
\]

Example 4: Study the solution for Example 4 on page 13.1-14 and record the answer below.

Solve the following system by graphing:

\[
\begin{align*}
    3x + y &= -2 \\
    x + y &= 2
\end{align*}
\]
Topic 13.2 Guided Notebook

Topic 13.2 Solving Systems of Linear Equations by Substitution

**Topic 13.2 Objective 1:** Solve Systems of Linear Equations by Substitution

What are the steps for **Solving Systems of Linear Equations in Two Variables by Substitution**?

1. 
2. 
3. 
4.

**Example 1:**
Study the solution for Example 1 on page 13.2-5 and record the answer below.

Use the substitution method to solve the following system:

\[
\begin{align*}
4x + 2y &= 10 \\
y &= 3x - 10
\end{align*}
\]
Example 3:
Complete Example 3 on page 13.2-8 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Solve the following system:

\[
\begin{align*}
4x + 3y &= 7 \\
x + 9y &= -1
\end{align*}
\]

Example 4:
Complete Example 4 on page 13.2-9 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Use the substitution method to solve the following system:

\[
\begin{align*}
6x - 3y &= -33 \\
2x + 4y &= 4
\end{align*}
\]

Topic 13.2 Objective 2: Solve Special Systems by Substitution

What are the three possible outcomes when two linear equations are graphed? Include a sketch of each.
Describe the slopes, $y$-intercepts, and number of solutions of two lines described below. Also state if they are consistent, inconsistent, dependent, and/or independent. Show an Example for each.

**Intersecting Lines**

**Parallel Lines**

**Coinciding Lines**

When solving algebraically, how are the following situations recognized?

1. The system is independent and consistent.

2. The system is independent and inconsistent.

3. The system is dependent and consistent.

**Example 5:**
Study the solution for Example 5 on page 13.2-11 and record the answer below.

Use the substitution method to solve the following system:

\[
\begin{align*}
2x + 10y &= 8 \\
2x + 5y &= 4
\end{align*}
\]
Read and summarize the CAUTION statement on page 13.2-15.

**Example 6:** Study the solution for Example 6 on page 13.2-15 and record the answer below.

Use the substitution method to solve the following system:

\[
\begin{align*}
3x - y &= -1 \\
-12x + 4y &= 8
\end{align*}
\]

**Example 7:**
Complete Example 7 parts a and b on page 13.2-17 on your own. Check your answers by clicking on the link. If your answers are incorrect, watch the video to find your error.

Use the substitution method to solve the following system:

a. \[
\begin{align*}
\frac{1}{4}x + y &= 5 \\
x + 4y &= 8
\end{align*}
\]

b. \[
\begin{align*}
-2.4x + 1.5y &= -3 \\
0.8x - 0.5y &= 1
\end{align*}
\]
Topic 13.3 Guided Notebook
Topic 13.3 Solving Systems of Linear Equations by Elimination

**Topic 13.3 Objective 1:** Solve Systems of Linear Equations by Elimination

Summarize the elimination method as found on page 13.3-3. Include the Logic for the Elimination Method.

What is another name for the elimination method?

**Example 1:**
Study the solution for Example 1 on page 13.3-3 and record the answer below.

Solve the following system.

\[
\begin{align*}
8x + 2y &= 10 \\
x - 2y &= -2
\end{align*}
\]

To eliminate a variable, the coefficients of the variable in the two equations must be \____________________. How can we make this happen?
Example 2: Study the solution for Example 2 on page 13.3-6 record the answer below.

Solve the following system.

\[
\begin{align*}
4x + 2y &= -4 \\
x + 2y &= 5
\end{align*}
\]

Record the steps for Solving Systems of Linear Equations in Two Variables by Elimination.

1.

2.

3.

4.

5.

Example 3: Study the solution for Example 3 on page 13.3-9 record the answer below.
Use the elimination method to solve the following system.

\begin{align*}
3x + 4y &= 7 \\
5x + 4y &= 7
\end{align*}

Example 5: Complete Example 5 on page 13.3-12 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Use the elimination method to solve the following system.

\begin{align*}
5x - 6y &= 20 \\
4x + 9y &= 16
\end{align*}
Example 6: Complete Example 6 on page 13.3-13 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Use the elimination method to solve the following system.

\[
\begin{align*}
3x - \frac{3}{5}y &= \frac{4}{5} \\
\frac{1}{2}x + 3y &= -\frac{9}{5}
\end{align*}
\]

Topic 13.3 Objective 2: Solve Special Systems by Elimination

When solving by elimination, an _________________________ system will lead to a ___________________________ and a ___________________________ system will lead to an ___________________________.

Example 7: Study the solution for Example 7 part a on page 13.3-14 and record the answer below. Complete part b on your own and check your answer by clicking on the link.

Use the elimination method to solve each system.

a. \[
\begin{align*}
3x + y &= 6 \\
6x + 2y &= 4
\end{align*}
\]

b. \[
\begin{align*}
2x - 8y &= 6 \\
3x - 12y &= 9
\end{align*}
\]
Metacognitive Skills: MDEV099 Exam 1

Metacognitive skills refer to the ability to judge how well you have learned something and to effectively direct your own learning and studying. This is a self-evaluation tool designed to help you focus your studying and to improve your metacognitive skills with regards to this math class.

Use the following scale to complete the ‘Before Studying’ column and then the ‘After Studying’ column once you study.

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Exam 1 Topics

Refer to this assessment after your test and circle any of the ratings you would change — this identifies the “disconnects” between what you thought you knew well and what you actually knew well.
How the Brain Learns: Lesson 2 Memory

Objective: Upon completing this lesson, you will be able to define the three stages of memory and how memories go from one stage to another, as well as, what can be done to enhance the process.

The stages of memory are the following: sensory (or immediate), working (or short-term), and long-term. Immediate and working memories are temporary memories.

![Stages of Memory Diagram](http://healthpsych.psy.vanderbilt.edu/alcoholMemory_files/image007.jpg)

**Sensory memory** operates subconsciously or consciously and holds data for up to 30 seconds. The individual’s experiences determine its importance. You cannot recall information that your brain does not retain. (Sousa, 2011)

**Working memory**, or short-term memory, is the place where conscious, rather than subconscious, processing occurs. When something is in working memory, it generally captures our focus and demands our attention. It involves the ability to hold and manipulate information for use in the immediate future. After repeated practice, working memories are set down as permanent neuronal circuits of axons and dendrites ready to be activated when information is needed. “Cells that fire together, wire together.” Practice results in repeated stimulation of the memory circuit. Like hikers along a trail who eventually carve a depression in the road, repeated practice stimulates cells in the memory circuit so that the circuit is reinforced and becomes stronger. Working memory is embedded by repetition into **long-term memory**, but it still needs periodic repetition for it to remain in your active memory bank and not gradually fade from disuse. (Willis, 2006)

Memories are not stored intact. Instead, they are stored in pieces and distributed in sites throughout the cerebrum (the largest part of the brain that coordinates mental actions). Which storage sites to select could be determined by the number of associations that the brain makes between new and past learning. The more connections made, the more understanding and
meaning the learner can attach to the new learning, and the more likely it is that it will be stored in different networks.

![Diagram of neuron network](image)

Figure 2: Creating a memory: (1) Neuron A receives a stimulus, which causes it to set off neuron B. (2) If neuron A fires again soon, a link is established. Later, neuron A can just fire weakly to set off neuron B. (3) The firing of neurons A and B may set off neighboring neurons C and D. If this happens repeatedly, the four cells become a network and will fire together in the future – forming a memory.

Just because you may feel you have learned the new information or skill doesn’t mean it will be transferred to long-term storage. Extensive research on retention indicates that 70 – 90 percent of new learning is forgotten within 18 to 24 hours after the lesson. Processing and transfer between working memory and long-term storage needs adequate time for encoding and consolidation of the new information into the storage networks. (Sousa, 2011)

Once the information is successfully retrieved, it still needs to be reviewed between four and seven times to ensure retention. (Willis, 2006)

Our goal is efficiently get information into the long term memory so we can recall it and make connections when needed.


How The Brain Learns, Lesson 2: Memory

Name ________________________

Please submit this completed worksheet with Print Lab 3.

1. Sketch the study cycle introduced in Lesson 1.

2. List and describe the three stages of memory.

3. What can help ‘move’ a memory from short-term to long-term storage?

4. How much memory can be lost in 18 – 24 hours if it’s not practiced?

5. How many times does information need to be reviewed to ensure that it’s retained?

6. Explain how you think the study cycle enhances the process of getting memories in long-term storage.
Topic 13.4 Guided Notebook
Topic 13.4 Applications of Linear Systems

**Topic 13.4 Objective 1:** Solve Related Quantity Applications Using Systems

What are the six steps for the **Problem-Solving Strategy for Applications Using Systems of Linear Equations**?

1. 

2. 

3. 

4. 

5. 

6. 

**Example 1:** Study the solution for Example 1 on page 13.4-4 and record the answer below.

The storage capacity of Deon’s external hard drive is 32 times that of his jump drive, a small portable memory device. Together, his two devices have 264 gigabytes of memory. What is the memory size of each device?

Compare the solution process for the same problem from Example 4 Topic 11.3. Use the link found on page 13.4-5.


**Example 2:** Complete Example 2 on page 13.4-6 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

The sum of the ages of Ben and his younger sister Annie is 18 years. The difference of their ages is 4 years. What is the age of each child?

**Topic 13.4 Objective 2: Solve Geometry Applications Using Systems**

**Example 3:** Complete Example 3 on page 13.4-7 on your own and check your solution.

The display panel of a graphing calculator has the shape of a rectangle with a perimeter of 264 millimeters. If the length of the display panel is 18 millimeters longer than the width, find its dimensions.

The measures of two **complementary angles** add to __________, while the measures of two **supplementary angles** add to __________.

**Example 4:** Complete Example 4 on page 13.4-8 and check your solution.

Find the measures of two supplementary angles if the measure of the larger angle is 20 degrees less than three times the measure of the smaller angle.
**Topic 13.4 Objective 3:** Solve Uniform Motion Applications Using Systems

**Example 5:** Complete Example 5 on page 13.4-9 and check your solution. Recall using the table in Section 11.5 Examples 8 and 9 of this guided notebook.

Shawn is training for the Dirty Duo running-and-bicycling race. During a three-hour training session, his total distance cycling and running was 33 miles. If he cycled at a rate of 18 miles per hour and ran at a rate of 6 miles per hour, how much time did he spend doing each activity?

When motions work together the rates are ______________, but when they work against each other, the rates are ______________.

**Example 6:** Complete Example 6 on page 13.4-11 on your own. Check your answer by clicking on the link. Recall using the table in Section 11.5 Examples 8 and 9 of this guided notebook.

A jet plane travels 1950 miles in 3.9 hours going with the wind. On the return trip, the plane must fly into the wind and the travel time increases to 5 hours. Find the speed of the jet plane in still air and the speed of the wind. Assume the wind speed is the same for both trips.
Topic 13.4

**Topic 13.4 Objective 4: Solve Mixture Applications Using Systems**

**Example 7:** Complete Example 7 on page 13.4-14 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error. Recall using the illustrations in Section 11.6 Examples 8 and 9 of this guided notebook.

A shipping company delivered 160 packages one day. The cost of regular delivery is $6.50, and the cost for express delivery is $17.50. Total shipping revenue for the day was $1513. How many of each kind of delivery were made?

**Example 8:**
Complete Example 8 on page 13.4-16 on your own. Check your answer by clicking on the link. Recall using the illustrations in Section 11.6 Examples 8 and 9 of this guided notebook.

A chemist needs eight liters of a 50% alcohol solution but only has a 30% solution and an 80% solution available. How many liters of each solution should be mixed to form the needed solution?

**Example 9:**
Complete Example 9 on page 13.4-19 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Logan and Payton went to Culver’s for lunch. Logan ate two Butterburgers with cheese and a small order of fries for a total of 1801 calories. Payton ate one Butterburger with cheese and two small orders of fries for a total of 1313 calories. How many calories are in a Culver’s Butterburger with cheese? How many calories are in a small order of fries?
**Topic 13.5 Guided Notebook**

**Topic 13.5 Systems of Linear Inequalities**

**Topic 13.5 Objective 1:** Determine If an Ordered Pair Is a Solution to a System of Linear Inequalities in Two Variables

What is the definition of a **System of Linear Inequalities in Two Variables**? Illustrate with two examples.

What is the definition of a **Solution to a System of Linear Inequalities in Two Variables**?

**Example 1:**
Study the solution for Example 1 part a on page 13.5-4 and record the answer below. Complete parts b and c on your own and check your answers by clicking on the link.

Determine if each ordered pair is a solution to \[
\begin{cases}
2x + y \geq -3 \\
x - 4y \leq 12
\end{cases}
\]

a. (4,2)               b. (2,–5)          c. (0,–3)

**Topic 13.5 Objective 2:** Graph Systems of Linear Inequalities

What is the **graph of a system of linear inequalities in two variables**?
View the animation on page 13.5-6 for an overview of graphing systems of linear inequalities.

Record the **Steps for Graphing Systems of Linear Inequalities**.

1. 

2. 

Read and summarize CAUTION statement on page 13.5-6.

**Example 3:** Complete Example 3 on page 13.5-9 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Graph the system of linear inequalities.

\[
\begin{align*}
& x + y < 4 \\
& x - 2y < -2 
\end{align*}
\]

How many solutions does a system of linear inequalities typically have?

What is an **inconsistent system of inequalities**?
**Example 4:** Study the solution for Example 4 on page 13.5-10 and record the answer below. Watch the video for a detailed solution.

Graph the system of linear inequalities.

\[
\begin{align*}
  y &\leq -\frac{1}{3}x - 3 \\
  y &> -\frac{1}{3}x + 2
\end{align*}
\]

Explain the solution region for the system below by viewing the link on page 13.5-14.

\[
\begin{align*}
  x &\geq 0 \\
  y &\geq 0
\end{align*}
\]

**Example 6:** Study the solution for Example 6 on page 13.5-14. Study the solution for Example 4 on page 13.5-10 and record the answer below. Watch the video for a detailed solution.
**Topic 13.5**

**Topic 13.5 Objective 3: Solve Applications Involving Systems of Linear Inequalities**

**Example 7:** Study the solution for Example 7 on page 13.5-16 and record your answer below. Watch the video for a detailed solution.

Savannah is planning a barbeque for her family and friends. She will spend $150 or less to buy hamburger patties that cost $3 per pound and boneless chicken breasts that cost $5 per pound. To limit waste, she will purchase at most 40 pounds of meat all together. Also, the amount of hamburger and chicken purchased must be non-negative. A system of linear inequalities that models this situation is

\[
\begin{align*}
3h + 5c & \leq 150 \\
h + c & \leq 40 \\
h & \geq 0 \\
c & \geq 0
\end{align*}
\]

Where \( h \) = pounds of hamburger patties and \( c \) = pounds of chicken breasts.

a. Graph the system of linear inequalities.

b. Can Savannah purchase 20 pounds of hamburger patties and 15 pounds of chicken breasts for the barbeque?

c. Can Savannah purchase 10 pounds of hamburger patties and 30 pounds of chicken breasts for the barbeque?

*We will not cover Section 13.6 in this course.*
**Topic 14.1 Guided Notebook**  
**Topic 14.1 Exponents**

**Topic 14.1 Objective 1:** Simplify Exponential Expressions Using the Product Rule

Write down the definitions for the following terms.

**Exponential expression**

**Base**

**Exponent**

What is the **Product Rule for Exponents**?

**Example 1:** Study the solutions for Example 1 parts a and b on page 14.1-5 and record the answers below. Complete parts c and d on your own and check your answers by clicking on the link.

Use the product rule to simplify each expression.

a. \(5^4 \cdot 5^6\)  
b. \(x^5 \cdot x^7\)  
c. \(y^3 \cdot y\)  
d. \(b^3 \cdot b^5 \cdot b^4\)

Read and summarize the CAUTION statement on page 14.1-5.

**Example 2:** Study the solutions for Example 2 parts a and b on page 14.1-6 and record the answers below. Complete part c on your own and check your answer by clicking on the link.

Simplify using the product rule.

a. \((4x^2)(7x^3)\)  
b. \((m^4 n^2)(m^3 n^6)\)  
c. \((-3a^5 b^3)(-8a^2b)\)
**Topic 14.1 Objective 2: Simplify Exponential Expressions Using the Quotient Rule**

What is the **Quotient Rule for Exponents**?

**Example 3:** Study the solutions for Example 3 parts a and b on page 14.1-8 and record the answers below. Complete parts c and d on your own and check your answers by clicking on Use the quotient rule to simplify each expression.

- a. $\frac{t^9}{t^5}$
- b. $\frac{7^5}{7^3}$
- c. $\frac{y^{24}}{y^{15}}$
- d. $\frac{(-4)^{14}}{(-4)^{11}}$

**Example 4:**

Study the solutions for Example 4 parts a and b on page 14.1-9 and record the answers below. Complete part c on your own and check your answer by clicking on the link.

Simplify using the quotient rule.

- a. $\frac{15x^6}{3x^3}$
- b. $\frac{a^4b^9c^5}{a^2b^3c}$
- c. $\frac{4m^6n^7}{12m^5n^3}$

**Topic 14.1 Objective 3: Use the Zero-Power Rule**

What is the **Zero-Power Rule**?

**Example 5:**

Study the solutions for Example 5 parts a - e on page 14.1-11 and record the answers below.

Simplify using the zero-power rule.

- a. $6^0$
- b. $(-3)^0$
- c. $-3^0$
- d. $(2x)^0$
- e. $2x^0$
**Topic 14.1 Objective 4:** Use the Power-to-Power Rule

What is the **Power-to-Power Rule**?

**Example 6:** Study the solution for Example 6 part a on page 14.1-14 and record the answer below. Complete part b on your own and check your answer by clicking on the link.

Simplify using the power-to-power rule.

a. $(y^5)^6$

b. $[(-2)^3]^6$

**Topic 14.1 Objective 5:** Use the Product-to-Power Rule

What is the **Product-to-Power Rule**?

**Example 7:** Study the solutions for Example 7 parts a and b on page 14.1-16 and record the answers below. Complete parts c and d on your own and check your answers.

Simplify using the product-to-product rule.

a. $(mn)^8$

b. $(x^2y)^5$

c. $(3y)^4$

d. $(-4p^5q^3)^2$

**Topic 14.1 Objective 6:** Use the Quotient-to-Power Rule

What is the **Quotient-to-Power Rule**?
Example 8: Study the solutions for Example 8 parts a and b on page 14.1-18 and record the answers below. Complete parts c and d on your own and check your answers.

Simplify using the quotient-to-power rule.

a. \( \left( \frac{m}{n} \right)^9 \)  
b. \( \left( \frac{x^2}{y^5} \right)^4 \)  
c. \( \left( \frac{x}{2} \right)^5 \)  
d. \( \left( \frac{3x^2}{5y^4} \right)^3 \)

**Topic 14.1 Objective 7: Simplify Exponential Expressions Using a Combination of Rules**

List the four conditions for an exponential expression to be considered simplified.

Write down the **Rules for Exponents**.

- **Product Rule:**
- **Power-to-Power Rule:**
- **Quotient Rule:**
- **Product-to-Power Rule:**
- **Zero-Power Rule:**
- **Quotient-to-Power Rule:**

Example 9: Study the solutions for Example 9 parts a and b on page 14.1-20 and record the answers below. Complete parts c and d on your own and check your answers.

Simplify using the rules for exponents.

a. \( (e^3)^5 (e^2)^6 \)  
b. \( \left( \frac{15x^8y^5}{3x^6y} \right)^2 \)  
c. \( (-2w^3z^2)(-2wz^2)^4 \)  
d. \( \frac{(4m^2n^0)(2n^3)^2}{8mn^5} \)
How the Brain Learns: Lesson 3 Practice Makes Permanent

Objective: Upon completing this lesson, you will be able to summarize the benefits practicing has in encoding information into your long term memory.

Recall the three stages of memory from lesson 2: sensory (or immediate), working (or short-term), and long-term. Immediate and working memories are temporary memories. Our goal in learning is to successfully encode and make connections in long term memory so we can correctly recall and utilize them when needed.

Practice is key to maintaining connections in the brain. We want to get the information to long-term memory and not just store it until test time. It is true that if you don’t use it, you lose it. The old saying “practice makes perfect” isn’t accurate. A more accurate version is ‘perfect practice make permanent.’

The study cycle is built around the concept of practicing effectively. As a student, you want to go beyond rote learning or just doing as little as possible to get by. You need to be in charge of your learning and knowing if you are actually learning (that’s metacognition). You need to strive to do your best and only you can control that.

Remember that we want to build dendrites from the neurons and increase the thickness of the myelin sheath surrounding the axons so the signals are stronger and permanent. We do this with PRACTICE.

Research states that we learn:

- 10% of what we READ
- 20% of what we HEAR
- 30% of what we SEE
- 50% of what we SEE and HEAR
- 70% of what is DISCUSSED with OTHERS
- 80% of what is EXPERIENCED PERSONALLY
- 95% of what we TEACH TO SOMEONE ELSE

Notice that the study cycle takes you through each of the experiences listed above but you have to participate in each step. Reading the lesson before coming to class gets you started. Watching the videos, attending and participating in lecture helps you see, hear and discuss the topics. Homework helps you experience the topics and labs are where you discuss the topics with others and have the opportunity to help others.

Each of these steps involves practice which helps build dendrites and thicken the myelin sheath!

Once a concept has been introduced and you are ready to practice,

1. be sure to TRY first before asking for help or referring to other resources. This will make your brain work on making connections and recalling on its own. Each time you recall information, you relearn it.
2. Disconnect. Turn off the cell phone and other distractions so your process doesn’t get interrupted.
3. Take breaks. Remember that the synapse needs a break now and then to replenish the neurotransmitters, so taking a break every 20 minutes or so can help. It’s best to practice over spaced intervals and not cram everything into one study time.
1. Describe another area, other than math, where you have had to practice to improve your understanding or skills.

2. Summarize in your own words how practice helps to encode information into the long term memory.

3. Explain why you think you should try a problem first before asking questions or looking at your notes.
Topic 14.2 Guided Notebook

Topic 14.2 Introduction to Polynomials

**Topic 14.2 Objective 1:** Classify Polynomials

What is a **simplified term**?

What is the definition of a **Monomial**?

Which of the terms from the interactive video on page 14.2-3 is a monomial? Why?

Write down the definitions for the following terms.

- **Polynomial**
- **Terms of the polynomial**
- **Simplified polynomial**
- **Polynomials in one variable**

How many terms do each of the following have? Give an example of each.

- **Monomial**
- **Binomial**
- **Trinomial**
- **Polynomial**
Example 1: Complete Example 1 parts a – d on page 14.2-5 and check your answers.

Classify each polynomial as a monomial, binomial, trinomial, or none of these.

a. $5x - 7$  
b. $\frac{1}{3}x^2$  
c. $5x^3 - 7x^2 + 4x + 1$  
d. $-2x^3 - 5x^2 + 8x$

Topic 14.2 Objective 2: Determine the Degree and Coefficient of a Monomial

What is the definition of the **Degree of a Monomial**?

What is the degree of a constant term? Why?

What is the definition of the **Coefficient of a Monomial**?

Example 2: Study the solutions for Example 2 parts a–c on page 14.2-6 and record the answers below. Complete parts d–f on your own and check your answers by clicking on the link. If your answers are incorrect, watch the video to find your error.

Determine the coefficient and degree of each monomial.

a. $4.6x^3$  
b. $7x$  
c. $x^2y^4$  
d. $12$  
e. $\frac{3}{4}x^2yz^3$  
f. $-2xyz^7$

Topic 14.2 Objective 3: Determine the Degree and Leading Coefficient of a Polynomial

What is the definition of the **Degree of a Polynomial**?

What does it mean for a polynomial to be written in **descending order**?

What is **standard form** for polynomials?
Write down the definition of the **Leading Coefficient of a Polynomial in One Variable**.

**Example 3:** Study the solution for Example 3 part a on page 14.2-9 and record the answer below. Complete part b on your own and check your answer by clicking on the link.

Write each polynomial in standard form. Then find its degree and leading coefficient.

a. \(4.2m - 3m^2 + 1.8 - 7m^3\)  
b. \(\frac{2}{3}x^3 - 3x^2 + 5 - x^4 + \frac{1}{4}x\)

**Topic 14.2 Objective 4:** Evaluate a Polynomial for a Given Value

**Example 4:** Study the solutions for Example 4 parts a and b on page 14.2-10 and record the answers below. Complete parts c and d on your own and check your answers.

Evaluate the polynomial \(x^3 + 3x^2 + 4x - 5\) for the given values of \(x\).

a. \(x = -2\)  
b. \(x = 0\)  
c. \(x = 2\)  
d. \(x = \frac{5}{2}\)

**Topic 14.2 Objective 5:** Simplify Polynomials by Combining Like Terms

How do you simplify a polynomial?
Example 5: Study the solutions for Example 5 parts a and b on page 14.2-12 and record the answers below. Complete parts c–e on your own and check your answers.

Simplify each polynomial by combining like terms.

a. \(3x^2 + 8x - 4x + 2\)

b. \(2.3x - 3 - 5x + 8.4\)

c. \(2x + 3x^2 - 6 + x^2 - 2x + 9\)

d. \(\frac{2}{3}x^2 + \frac{1}{5}x - \frac{1}{10}x - \frac{1}{6}x^2 + \frac{1}{4}\)

e. \(6x^3 + x^2 - 7\)
**Topic 14.3 Guided Notebook**  
**Topic 14.3 Adding and Subtracting Polynomials**

**Topic 14.3 Objective 1: Add Polynomials**

What is the procedure for *Adding Polynomials*?

**Example 2:** Study the solutions for Example 1 and Example 2 part a. Complete parts b and c on your own and check your answers by clicking on the link. If your answers are incorrect, watch the video to find your error.

Add.

a. \((y^2 + 3y + 7) + (y^2 - 3y - 2)\)

b. \((10p^3 + 7p - 13) + (5p^2 - 4p)\)

c. \((3m^3 + m^2 - 8) + (2m^3 - 4m^2 + 3m) + (5m^2 + 4)\)

**Topic 14.3 Objective 2: Find the Opposite of a Polynomial**

In Topic 10.1 we learned that a ___________________________ can be used to represent the ___________________________ of a real number.

What is the “opposite” of the polynomial \(x^2 - 5x + 7\)?

What are **Opposite Polynomials**?
Summarize the TIP found on page 14.3-6.

**Example 3:** Study the solutions for Example 3 parts a – c on page 14.3-6 and record the answers below.

Find the opposite of each polynomial

a. \( x^2 + 6x + 8 \)  
b. \( 8y - 27 \)  
c. \(-m^3 - 5m^2 + m + 7\)

**Topic 14.3 Objective 3: Subtract Polynomials**

What is the procedure for **Subtracting Polynomials**?

**Example 4:** Study the solution for Example 4 part a on page 14.3-8 and record the answer below. Complete part b on your own and check your answer by clicking on the link.

Subtract.

a. \((9x + 13) - (6x - 4)\)  
b. \((3a^2 + 5a - 8) - (-2a^2 + a - 7)\)
How The Brain Learns: Lesson 4 Factors that Affect Learning

Objective: Upon completing this lesson, you will be able to identify the effects that sleep, nutrition, exercise and stress have on learning.

We discussed the physiological aspects to learning in Lesson 1 and we will go back to that in this final lesson regarding how your brain learns. Your brain is affected by various chemicals some of which are sent out by a part of your brain called the amygdala. The amygdala can be controlled by emotion and as a result it controls the type of neurotransmitters and chemicals in your brain. Some of these help the learning process and some inhibit the process. You can help avoid what’s sometimes referred to as an ‘amygdala hijacking’ by taking care of yourself. Here are a few things that you can control.

SLEEP – Because sleep is the time when the brain is least distracted by the sensory input bombarding it all day, it can devote a greater portion of its energy (metabolism) to organizing and filing the memories formed during the day. It is believed that memories that remain after one day are in the process of being successfully consolidated into neuronal pathways with new dendrites and synaptic connections. It is during sleep that the brain reaccumulates the greatest amount of the neurochemicals needed to stimulate dendritic growth. Studies suggest that if students review their notes thoroughly and stop and go to sleep when they begin to feel drowsy, the quality and quantity of retained memory is superior to extending the review time any number of hours once drowsiness has set in. This recognition of the need for sleep has led researchers to test and confirm their predictions that increasing sleep time from six or less to eight hours can increase memory and alertness up to 25 percent. (Willis, 2006)

NUTRITION – Your brain must manufacture the right proteins and fats to do things such as grow new connections or add myelin, the fatty sheath around axons. You do this by digesting proteins and fats in food and using the pieces, that is, the amino acids and fatty acids, to make the new brain proteins and fats. (Chudler) We won’t get into the details of certain food in this short lesson, but remember it is important to incorporate a healthy diet. Don’t skip meals, have healthy snacks throughout the day and drink plenty of water to maintain your energy.

EXERCISE – Regular physical activity can improve the cognitive function (process related to knowledge) and brain plasticity (ability to change). How much exercise? Many agree that half an hour of moderate exercise at least 5 days a week is a good place to start.

STRESS – It’s not easy to control stress and there are so many factors that can cause stress. But stress sets the amygdala off on a path that can hinder the learning experience. What you can do is try to recognize what may be causing stress and then finding a resource or person to help you deal with it. MSUM has resources available to help whether it be health related, personal or family issues or other factors. For example: maybe organizing your schedule could help if you feel overwhelmed by everything you need to get done. Utilize the resources that available to help you.
How The Brain Learns, Lesson 4

How The Brain Learns, Lesson 4: Other Factors that Effect Learning

Name ______________________________

Please submit this completed worksheet with Print Lab 5.

1. Why is sleep important to the learning cycle?

2. What part do good nutrition and exercise play in the learning cycle?

3. This is the final lesson on how the brain learns and this is the last item.

Please comment on any parts of these lessons that you found helpful in understanding how you can help yourself learn.
Topic 14.4 Guided Notebook
Topic 14.4 Multiplying Polynomials

**Topic 14.4 Objective 1:** Multiply Monomials

What is the procedure for **Multiplying Monomials**?

**Example 1:**
Study the solution for Example 1 part a on page 14.4-3 and record your answer below. Complete parts b and c on your own and check your answers by clicking on the popup.

Multiply.

a. \((6x^5)(7x^2)\)  
b. \((-\frac{3}{4}x^2)(-\frac{2}{9}x^8)\)  
c. \((3x^2)(-0.2x^3)\)

**Topic 14.4 Objective 2:** Multiply a Polynomial by a Monomial

What is the procedure for **Multiplying Polynomials by Monomials**?

**Example 2:** Study the solution for Example 2 part a on page 14.4-4 and record your answer below. Complete part b on your own and check your answer by clicking on the popup.

Multiply.

a. \(3x(4x - 5)\)  
b. \(-4x^2(3x^2 + x - 7)\)
Example 3:
Complete Example 3 parts a and b on page 14.4-5 on your own. Check your answers by clicking on the link. If your answers are incorrect, watch the video to find your error.

Multiply.

b. \( \frac{1}{2} x^2(4x^2 - 6x + 2) \)

b. \( 0.25x^3(6x^3 - 10x^2 + 4x - 7) \)

Topic 14.4 Objective 3: Multiply Two Binomials

What is the procedure for Multiplying Two Binomials?

Example 4: Study the solutions for Example 4 parts a and b on page 14.4-6 and record your answers below. Complete part c on your own and check your answer by clicking on the link.

Multiply using the distributive property twice.

a. \((x + 3)(x + 2)\)  

b. \((x + 6)(x - 2)\)  

c. \((x - 4)(x - 5)\)

The FOIL method is just an acronym to remind you of the steps of the distributive property. List what the letters FOIL represent.
Example 5: Study the solution for Example 5 part a on page 14.4-8 and record your answer below. Complete parts b and c on your own and check your answers by clicking on the link. If your answers are incorrect, watch the video to find your error.

Multiply.

a. \((x - 4)(2x + 3)\)  
b. \(\left(\frac{1}{2}x - 6\right)(3x - 4)\)  
c. \((5x + 7)(4x + 3)\)  

Read and summarize the CAUTION statement on page 14.4-10.

Topic 14.4 Objective 4: Multiply Two or More Polynomials

Example 6:
Study the solution for Example 6 part a on page 14.4-11 and record your answer below. Complete part b on your own and check your answer.

Multiply.

a. \((x + 2)(2x^2 - 7x + 3)\)  
b. \((y^2 + 2y - 9)(2y^2 - 4y + 7)\)  

Example 7:
Work through Example 7 on page 14.4-12 and check your answers

Multiply.

a. \(-4x(2x - 1)(x + 3)\)  
b. \((x - 1)(x + 3)(3x - 2)\)
Topic 14.5 Guided Notebook
Topic 14.5 Special Products

**Topic 14.5 Objective 1: Square a Binomial Sum**

What is a *binomial sum*?

Copy the method for squaring the binomial sum, \((A + B)^2\).

What is the *Square of a Binomial Sum Rule*?

Read and summarize the CAUTION statement on page 14.5-3.

**Example 1:**

Study the solution for Example 1 parts a and b on page 14.5-4 and complete parts c and d on your own and check your answers.

Multiply.

\[
c. \quad (z^2 + \frac{1}{4})^2
d. \quad (10y + \frac{2}{5})^2
\]
**Topic 14.5 Objective 2:** Square a Binomial Difference

What is a **binomial difference**?
Read and summarize the CAUTION statement on page 14.5-5.

**Example 2:**
Complete parts c and d on your own and check your answers by clicking on the link.

Multiply.

c. \((w^3 - 0.7)^2\)  
d. \((5p - 1.2)^2\)

What are **perfect square trinomials**?

**Topic 14.5 Objective 3:** Multiply the Sum and Difference of Two Terms

What are **conjugates**?

What is the **Sum and Difference of Two Terms Rule (Product of Conjugates Rule)**?
Example 3:
Study the solution for Example 3 parts a and b on page 14.5-9 and complete parts c and d on your own and check your answers by clicking on the link.

Multiply.

c. \((8 - x)(8 + x)\)  
d. \((3z^2 + 0.5)(3z^2 - 0.5)\)

Write down the three Special Product Rules for Binomials.
Topic 14.6

**Topic 14.6 Guided Notebook**

**Topic 14.6 Negative Exponents and Scientific Notation**

**Topic 14.6 Objective 1:** Use the Negative-Power Rule

What is the definition of a **Negative Exponent**?

**Example 1:**
Study the solutions for Example 1 parts a–c on page 14.6-4 and record the answers below. Complete parts d–f on your own and check your answers by clicking on the link. If your answers are incorrect, watch the video to find your error.

Write each expression with positive exponents. Then simplify if possible.

a. \( x^{-4} \)  
b. \( 2^3 \)  
c. \( 7x^{-3} \)  
d. \( (-2)^{-4} \)  
e. \( -3^{-2} \)  
f. \( 2^{-1} + 3^{-1} \)

Read and summarize the CAUTION statement on page 14.6-5.

What is the **Negative-Power Rule**?

**Example 2:**
Study and record the solutions for Example 2 parts a–c on page 14.6-6. Complete parts d–f on your own and check your answers by clicking on the link.

Write each expression with positive exponents. Then simplify if possible.

a. \( \frac{1}{y^{-5}} \)  
b. \( \frac{1}{6^2} \)  
c. \( \frac{3}{4t^{-7}} \)  
d. \( \frac{-8}{q^{-11}} \)  
e. \( \frac{m^{-9}}{n^{-4}} \)  
f. \( \frac{5^{-3}}{2^{-4}} \)
**Topic 14.6 Objective 2:** Simplify Expressions Containing Negative Exponents Using a Combination of Rules

What are the four requirements for simplified exponential expressions?

Summarize the **Rules for Exponents**.

- Product Rule
- Quotient Rule
- Zero-Power Rule
- Power-to-Power Rule
- Product-to-Power Rule
- Quotient-to-Power Rule
- Negative-Power Rule

**Example 3:**
Study and record the solutions for Example 3 parts a and b on page 14.6-9. Complete parts c and d on your own and check your answers.

Simplify.

a. \((9x^{-5})(7x^2)\)  
   b. \((p^{-4})^2\)  
   c. \(\frac{52m^{-4}}{13m^{-10}}\)  
   d. \((w^{-1}z^3)^{-4}\)
Example 4:
Study and record the solutions for Example 4 parts a and b on page 14.6-10. Complete parts c and d on your own and check your answers.

Simplify.

a. \( \frac{(3xz)^2}{(2yz)^3} \)  
b. \( \left( \frac{10}{x} \right)^3 \)  
c. \( \frac{(2a^5b^{-6})^3}{4a^{-1}b^5} \)  
d. \( \left( \frac{-5xy^{-3}}{x^2y^3} \right)^4 \)

Topic 14.6 Objective 3: Convert a Number from Standard Form to Scientific Notation

What is Scientific Notation?

What is the procedure for Converting from Standard Form to Scientific Notation?

1.

2.

Example 5:
Study the solutions for Example 5 parts a and b on page 14.6-13 and record the answers below. Complete parts c and d on your own and check your answers by clicking on the link. Write each number in scientific notation.

a.  56,800,000,000,000,000  
b.  0.0000000467

c.  0.00009012  
d.  200,000,000
**Topic 14.6 Objective 4:** Convert a Number from Scientific Notation to Standard Form

What is the procedure for *Converting from Standard Form to Scientific Notation*?

1. 

2. 

**Example 6:**
Study and record the solutions for Example 6 parts a and b on page 14.6-15. Complete parts c and d on your own and check your answers.

Write each number in standard form.

a. $4.98 \times 10^{-5}$  
b. $9.4 \times 10^7$  
c. $-3.015 \times 10^9$  
d. $1.203 \times 10^{-4}$

**Topic 14.6 Objective 5:** Multiply and Divide with Scientific Notation

**Example 7:**
Study and record the solutions for Example 7 parts a and b on page 14.6-. Complete parts c and d on your own and check your answers.

Perform the indicated operations. Write your results in scientific notation.

a. $(1.8 \times 10^5)(3 \times 10^8)$  
b. $\frac{2.16 \times 10^{12}}{4.5 \times 10^5}$

c. $(-7.4 \times 10^9)(6.5 \times 10^{-4})$  
d. $\frac{5.7 \times 10^{-3}}{7.5 \times 10^{-7}}$
### Metacognitive Skill: MDEV 099 Exam 2

Use the following scale to complete the ‘Before Studying’ column and then the ‘After Studying’ column once you study.

- 5 I am confident I can do any problems in this category correctly.
- 4 I am confident I can do most of the problems in this category correctly.
- 3 I understand how to do the problems in this category, but I still make a lot of mistakes.
- 2 I feel unsure about how to do these problems.
- 1 I know I don’t understand how to do these problems.

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<td>13.5 Determine if an ordered pair is a solution to a system of linear inequalities in two variables</td>
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<td>13.5 Graph systems of linear inequalities</td>
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Refer to this assessment after your test and circle any of the ratings you would change – this identifies the “disconnects” between what you thought you knew well and what you actually knew well.
Topic 14.7 Guided Notebook
Topic 14.7 Dividing Polynomials

**Topic 14.7 Objective 1:** Divide Monomials

What is the procedure for **Dividing Monomials**?

**Example 1:**
Study the solution for Example 1 on page 14.7-3 and record the answers below.

Divide

b. \( \frac{32x^7}{4x^3} \)

b. \( \frac{9y^4}{45y^4} \)

c. \( \frac{60y}{5y^4} \)

**Topic 14.7 Objective 2:** Divide a Polynomial by a Monomial

What is the procedure for **Dividing Polynomials by Monomials**?

**Example 2:**
Study and record the solution for Example 2 part a on page 14.7-5. Complete part b on your own and check your answer.

Divide.

a. \( \frac{12x^3 - 28x^2}{4x^2} \)

b. \( \frac{9m^5 - 15m^4 + 18m^3}{3m^3} \)
**Example 3:**
Study the solution for Example 3 on page 14.7-7 and record the answer below.

Divide $\frac{54t^3 - 12t^2 - 24t}{6t^2}$.

---

**Topic 14.7 Objective 3: Divide Polynomials Using Long Division**

Read and summarize the CAUTION statement on page 14.7-8.

What is the **Process for Polynomial Long Division**?

1. 

2. 

3. 

4. 

**Example 4:**
Study the solution for Example 4 on page 14.7-9 and record the answer below.

Divide $(2x^2 + x - 15) \div (x + 3)$
Example 5:
Complete Example 5 on page 14.7-12 on your own and check your answer.

Divide \( \frac{x^2 + 26x - 6x^3 - 12}{2x - 3} \)

Example 6:
Complete Example 6 on page 14.7-14 on your own and check your answer.

Divide \( \frac{3t^3 - 11t - 12}{t + 4} \)
Topic 14.8 Guided Notebook
Topic 14.8 Polynomials in Several Variables

**Topic 14.8 Objective 1:** Determine the Degree of a Polynomial in Several Variables

What is the definition of a **Polynomial in Several Variables**?

**Example 1:**
Study the solution for Example 1 part a on page 14.8-3 and record your answer below. Complete part b on your own and check your answer by viewing the popup,

Determine the coefficient and degree of each term; then find the degree of the polynomial.

c. \(2x^3y - 7x^2y^3 + xy^2\)  
b. \(3x^2yz^3 - 4xy^3z + xy^2z^4\)

**Topic 14.8 Objective 2:** Evaluate Polynomials in Several Variables

**Example 2:**
Study and record the solution for Example 2 part a on page 14.8-5. Complete part b on your own and check your answer.

b. Evaluate \(3x^2y - 2xy^3 + 5\) for \(x = -2\) and \(y = 3\).

c. Evaluate 
\(-a^3bc^2 + 5a^2b^2c - 2ab\) for \(a = 2, b = -1\) and \(c = 4\).
**Topic 14.8 Objective 3:** Add or Subtract Polynomials in Several Variables

**Example 3:**
Study and record the solutions for Example 3 parts a and b on page 14.8-6. Complete parts c and d on your own and check your answers.

Add or subtract as indicated.

a. \((2x^2 + 3xy - 7y^2) + (4x^2 - xy + 11y^2)\)

b. \((4a^2 - 3ab + 2b^2) - (6a^2 - 5ab + 7b^2)\)

c. \((7x^4 + 3x^3y^3 - 2xy^3 + 5) + (2x^4 - x^3y^3 + 8xy^3 - 10)\)

d. \((10x^3y + 2x^2y^2 - 5xy^3 - 8) - (6x^3y + x^2y^2 - 3xy^3)\)

**Topic 14.8 Objective 4:** Multiply Polynomials in Several Variables

**Example 4:**
Study the solution for Example 4 on page 14.8-8 and record the answer below.

Multiply: \(5xy^2(4x^2 - 3xy + 2y^2)\)
Example 5:
Study the solution for Example 5 on page 14.8-9 and record the answer below.

Multiply: \((3x - 2y)(4x + 3y)\)

Example 6:
Study and record the solution for Example 6 part a on page 14.8-10. Complete parts b and c on your own and check your answers.

Multiply:
\[\begin{align*}
a. \quad (6x^2 + 5y)^2 & \quad b. \quad (4x^3 - 9y^2)^2 & \quad c. \quad (2x^2y - 7)(2x^2y + 7)
\end{align*}\]

Example 7:
Study the solution for Example 7 on page 14.8-11 and record the answer below.

Multiply: \((x + 2y)(x^2 - 4xy + y^2)\)
Topic 15.1 Guided Notebook

Topic 15.1 Greatest Common Factor and Factoring by Grouping

**Topic 15.1 Objective 1:** Find the Greatest Common Factor of a Group of Integers

Write down the definitions for the following terms.

**Factoring**

**Factored form**

**Factor (as a noun)**

**Factor (as a verb)**

**Factor over the integers**

**Greatest common factor**

Record the steps for *Finding the GCF of a Group of Integers*.

1.

2.

3.

**Example 1:**

Study the solutions for Example 1 parts a and b on page 15.1-4 and record the answers below. Complete part c on your own and check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Find the GCF of each group of integers.

a. 36 and 60  
   b. 28 and 45  
   c. 75, 90, and 105
**Topic 15.1 Objective 2: Find the Greatest Common Factor of a Group of Monomials**

What is the **greatest common factor (GCF)** of a group of monomials?

What are the **Common Variable Factors for a GCF**?

**Example 2:** Study the solutions for Example 2 parts a – c on page 15.1-6 and record the answers below.

Find the GCF of each group of exponential expressions.

a. \(x^4\) and \(x^7\)  
b. \(y^3, y^6,\) and \(y^9\)  
c. \(w^6z^2, w^3z^5,\) and \(w^5z^4\)

What is the three-step process for **Finding the GCF of a Group of Monomials**?

1. 

2. 

3. 

**Example 3:**
Study the solutions for Example 3 parts a and b on page 15.1-8 and record the answers below. Complete parts c and d on your own and check your answers by clicking on the link. If your answers are incorrect, watch the video to find your error.

Find the GCF of each group of monomials.

a. \(14x^6\) and \(21x^8\)  
b. \(6a^2, 10ab,\) and \(14b^2\)

c. \(40x^5y^6, -48x^9y,\) and \(24x^2y^4\)  
d. \(14m^3n^2, 6m^5n,\) and \(9m^4\)
**Topic 15.1 Objective 3:** Factor Out the Greatest Common Factor from a Polynomial

What is the greatest common factor (GCF) of a polynomial?

What is the four-step process for Factoring Out the GCF from a Polynomial?

1.

2.

3.

4.

**Example 4:** Study the solution for Example 4 part a on page 15.1-11 and record the answer below. Complete parts b and c on your own and check your answers.

Factor out the GCF from each binomial

a. $6x + 12$  

b. $w^5 + w^4$  

c. $8y^3 - 12y^2$

Read and summarize the CAUTION statement on page 15.1-13.

**Example 5:** Study the solution for Example 5 part a on page 15.1-13 and record the answer below. Complete part b on your own and check your answer by clicking on the link.

Factor out the GCF from each polynomial

a. $9p^5 + 18p^4 + 54p^3$  

b. $10a^4b^6 - 15a^3b^7 + 35a^2b^8$
Example 6: Study the solution for Example 6 on page 15.1-14 and record the answer below. Factor out the negative sign with the GCF. 

\[ -8x^3 + 28x^2 - 20x \]

Example 7: Study the solution for Example 7 part a page 15.1-16 and record the answer below. Complete part b on your own and check your answer by clicking on the link.

Factor out the common binomial factor as the GCF.

a. \[ 4x(y + 5) + 11(y + 5) \]

b. \[ 7x(x + y) - (x + y) \]

**Topic 15.1 Objective 4: Factor by Grouping**

What is the four-step process for **Factoring a Polynomial by Grouping**?

1.

2.

3.

4.

Example 8: Study the solutions for Example 8 parts a and b on page 15.1-18. Complete parts c and d on your own and check your answers by clicking on the link.

Factor by grouping.

a. \[ 3m^2 + 3m - 2mn - 2n \]

b. \[ 4w^3 - 14w^2 - 10w + 35 \]

Read and summarize the CAUTION statement on page 15.1-20.
**Topic 15.2 Guided Notebook**

**Topic 15.2 Factoring Trinomials of the Form** \(x^2 + bx + c\)

**Topic 15.2 Objective 1:** Factor Trinomials of the Form \(x^2 + bx + c\)

Watch the animation about factoring trinomials on page 15.2-3. Record the steps for Factoring Trinomials of the Form \(x^2 + bx + c\).

1.

2.

3.

**Example 1:** Study the solution for Example 1 part a on page 15.2-4 and record the answer below. Complete part b on your own and check your answer by clicking on the link.

Factor each trinomial.

a. \(x^2 + 11x + 18\)  
   b. \(x^2 + 13x + 30\)

What is a **prime number**?

What is the definition of a **Prime Polynomial**?

Read and summarize the CAUTION statement on page 15.2-6.

**Example 2:** Study the solution for Example 2 on page 15.2-7 and record your answer below.

Factor \(x^2 + 14x + 20\)
**Example 3:** Study the solution for Example 3 part a on page 15.2-8 and record the answer below. Complete parts b and c on your own and check your answers by clicking on the link.

Factor.

a. \( x^2 - 13x + 40 \) \hspace{1cm} b. \( m^2 - 5m - 36 \) \hspace{1cm} c. \( w^2 + 7w - 60 \)

**Topic 15.2 Objective 2:** Factor Trinomials of the Form \( x^2 + bxy + cy^2 \)

**Example 4:** Study the solution for Example 4 part a on page 15.2-10 and record the answer below. Complete part b on your own and check your answer by clicking on the link.

Factor.

e. \( x^2 + 10xy + 24y^2 \) \hspace{1cm} b. \( m^2 + 22mn - 48n^2 \)

**Topic 15.2 Objective 3:** Factor Trinomials of the Form \( x^2 + bx + c \) after Factoring Out the GCF

When is a polynomial factored completely?

**Example 5:** Study the solution for Example 5 part a on page 15.2-12 and record the answer below. Complete part b on your own and check your answer by clicking on the link.

Factor completely.

a. \( 4x^2 - 28x - 32 \) \hspace{1cm} b. \( 2y^3 - 36y^2 + 64y \)

**Example 6:** Complete Example 6 on page 15.1-14 on your own. Check your answer by clicking on the link.

Factor \( -x^2 + 3x + 10 \)
Topic 15.3 Guided Notebook

Topic 15.3 Factoring Trinomials of the Form $ax^2 + bx + c$ Using Trial and Error

**Topic 15.3 Objective 1:** Factor Trinomials of the Form $ax^2 + bx + c$ Using Trial and Error

Watch the animation about factoring trinomials on page 15.3-3 and take notes below.

What is the four-step strategy for **Factoring Trinomials of the Form $ax^2 + bx + c$**?

1.

2.

3.

4.

**Example 1:** Study the solution for Example 1 on page 15.3-5 and record the answer below.

Factor $3x^2 + 7x + 2$.

Why doesn’t the order of the binomial factors matter?
Example 2: Study the solution for Example 2 on page 15.3-6 and record the answer below.

Factor $5x^2 + 17x + 6$.

Example 3: Complete Example 3 parts a and b on page 15.3-8 on your own. Check your answers by clicking on the link.

Factor.

a. $4x^2 - 5x - 6$  
b. $12n^2 - 16n + 5$

Example 4: Study the solution for Example 4 on page 15.3-10 and record the answer below.

Factor $2y^2 - 19y + 15$.

Topic 15.3 Objective 2: Factor Trinomials of the Form $ax^2 + bxy + cy^2$ Using Trial and Error

Example 5: Study the solution for Example 5 part a on page 15.3-12 and record the answer below. Complete part b on your own and check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Factor.

a. $6x^2 + 17xy - 3y^2$  
b. $2m^2 + 11mn + 12n^2$
Topic 15.4 Guided Notebook

Topic 15.4 Factoring Trinomials of the Form $ax^2 + bx + c$ Using the ac Method

Topic 15.4 Objective 1: Factor Trinomials of the Form $ax^2 + bx + c$ Using the ac Method

Record the steps for The ac Method for Factoring Trinomials of the Form $ax^2 + bx + c$

1.

2.

3.

4.

5.

What are the two other names for the ac Method?

Example 1: Study the solution for Example 1 on page 15.4-4 and record the answer below.

Factor $3x^2 + 14x + 8$ using the ac method.
**Example 2:** Study the solution for Example 2 on page 15.4-6 and record the answer below.

Factor $2x^2 - 3x - 20$ using the $ac$ method.

**Example 3:** Complete Example 3 parts a – c on page 15.4-7 on your own. Check your answers by clicking on the link.

Factor each trinomial using the $ac$ method. If the trinomial is prime, state this as your answer.

b. $2x^2 + 9x - 18$

c. $6x^2 - 23x + 20$

d. $5x^2 + x + 6$
**Topic 15.4 Objective 2:** Factor Trinomials of the Form $ax^2 + bxy + cy^2$ Using the $ac$ Method

**Example 4:**
Complete Example 4 on page 15.4-8 and check your answer.

Factor $2p^2 + 7pq - 15q^2$ using the $ac$ method.

**Topic 15.4 Objective 3:** Factor Trinomials of the Form $ax^2 + bx + c$ after Factoring out the GCF

**Example 5:**
Complete Example 5 on page 15.4-10 and check your answer.

Factor completely: $24t^5 - 52t^4 - 20t^3$

**Example 6:**
Complete Example 6 on page 15.4-11 and check your answer.

Factor completely: $-2x^2 + 9x + 35$
Topic 15.5 Guided Notebook
Topic 15.5 Factoring Special Forms

**Topic 15.5 Objective 1:** Factor the Difference of Two Squares

Summarize **Factoring the Difference of Two Squares.**

---

**Example 1:**
Study the solutions for Example 1 parts a and b on page 15.5-4 and record the answers below.

Factor each expression completely.

a. \( x^2 - 9 \)

b. \( 16 - y^2 \)

---

What is a **perfect square**?

---

**Example 2:**
Study the solution for Example 2 part a on page 15.5-6 and record the answer below. Complete parts b–d on your own and check your answers.

Factor each expression completely.

a. \( z^2 - \frac{25}{16} \)

b. \( 36x^2 - 25 \)

c. \( 4 - 49n^6 \)

d. \( 81m^2 - n^2 \)
Example 3:
Study and record the solution for Example 3 part a on page 15.5-7. Complete part b on your own and check your answer.

Factor each expression completely.

a. \(3x^2 - 75\)  
b. \(36x^3 - 64x\)

Example 4:
Study the solution for Example 4 on page 15.5-9 and record the answer below.

Factor completely. \(16x^4 - 81\)

Topic 15.5 Objective 2: Factor Perfect Square Trinomials

Summarize Factoring Perfect Square Trinomials.

Example 5:
Study the solutions for Example 5 parts a and b on page 15.5-11 and record the answers below.

Factor each expression completely.

a. \(x^2 + 6x + 9\)  
b. \(y^2 - 10y + 25\)
**Example 6:**
Study and record the solution for Example 6 part a on page 15.5-12. Complete part b on your own and check your answer.

Factor each expression completely.

a. \(4x^2 + 12x + 9\)  
b. \(25y^2 - 60y + 36\)

**Example 7:**
Complete Example 7 parts a and b on page 15.5-13 on your own and check your answers.

Factor each expression completely.

a. \(16x^2 + 24xy + 9y^2\)  
b. \(m^4 - 12m^2 + 36\)

**Topic 15.5 Objective 3:** Factor the Sum or Difference of Two Cubes

Summarize **Factoring the Sum and Difference of Two Cubes**

What are **perfect cubes**?
Example 8:
Study and record the solutions for Example 8 parts a and b on page 15.5-16.

Factor each expression completely.

a. \( x^3 + 64 \) 

b. \( z^3 - 8 \)

Example 9:
Study and record the solution for Example 9 part a on page 15.5-18. Complete parts b and c on your own and check your answers.

Factor each expression completely.

a. \( 125y^3 - 1 \) 

b. \( 128z^3 + 54y^3 \) 

c. \( 8x^3 y^3 + y^5 \)
Topic 15.6 Guided Notebook

Topic 15.6 A General Factoring Strategy

**Topic 15.6 Objective 1:** Factor Polynomials Completely

What is the four-step **General Strategy for Factoring Polynomials Completely**?

1. 

2. 
   a. 

   b. 

   c. 

3. 

4. 

Example 1:
Study and record the solutions for Example 1 parts a and b on page 15.6-4. Complete parts c and d on your own and check your answers.

Factor each expression completely.

a. $w^2 - w - 20$

b. $4y^4 - 32y$

c. $x^2 - 14x + 49$

d. $3z^3 - 15z^2 - 42z$

Example 2:
Study and record the solution for Example 2 part a on page 15.6-7. Complete parts b and c on your own and check your answers.

Factor each expression completely.

a. $2x^3 - 5x^2 - 8x + 20$

b. $3a^2 - 10a - 8$

c. $3z^2 + z - 1$
Example 3:
Work through Example 3 part a on page 15.6-8 and record the answer below. Complete parts b–d on your own and check your answers by clicking on the link. If your answers are incorrect, watch the video to find your error.

Factor each expression completely.

a. \(10x^2 + 11xy - 6y^2\)

b. \(2p^2 - 32pq + 128q^2\)

c. \(7x^2z - 14x\)

d. \(-3y^4z - 24yz^4\)
**Topic 15.7 Guided Notebook**

**Topic 15.7 Solving Polynomial Equations by Factoring**

**Topic 15.7 Objective 1:** Solve Quadratic Equations by Factoring

Write down the definitions for the following terms.

**Polynomial equation**

**Standard form**

**Degree of a polynomial equation**

Write the definition of a **Quadratic Equation**.

What is the **Zero Product Property**?

**Example 1:**
Study and record the solution for Example 1 part a on page 15.7-5. Complete part b on your own and check your answer.

Solve each equation.

a. \((x + 10)(x - 3) = 0\)  
   b. \(x(3x + 5) = 0\)
What is the four-step process for **Solving Polynomial Equations by Factoring**?

1. 
2. 
3. 
4. 

**Example 2:**
Study and record the solution for Example 2 part a on page 15.7-6. Complete part b on your own and check your answer.

Solve each equation by factoring.

a. \( z^2 + 4z - 12 = 0 \)  
b. \( -4x^2 + 28x - 40 = 0 \)

**Example 3:**
Study and record the solution for Example 3 part a on page 15.7-8. Complete parts b and c on your own and check your answers.

Solve each equation by factoring.

a. \( 9w^2 + 64 = 48w \)  
b. \( 4m^2 = 49 \)  
c. \( 3x(x - 2) = 2 - x \)
**Example 4:**
Complete Example 4 on page 15.7-11 parts a and b on your own and check your answers.

Solve each equation by factoring.

a. \((x + 2)(x - 5) = 18\)

b. \((x + 3)(3x - 5) = 5(x + 1) - 10\)

Read and summarize the CAUTION statement on page 15.7-12.

**Topic 15.7 Objective 2: Solve Polynomial Equations by Factoring**

**Example 5:**
Study and record the solution for Example 5 part a on page 15.7-13. Complete parts b and c on your own and check your answers.

Solve each equation by factoring.

a. \((x + 7)(2x - 1)(5x + 4) = 0\)

b. \(24x^3 + 8x^2 = 100x^2 - 28x\)

c. \(z^3 + z^2 = z + 1\)
Example 6:
Study the solution for Example 6 on page 15.7-15 and record the answer below.

Solve by factoring.

$$(2x - 9)(3x^2 - 16x - 12) = 0$$
**Topic 15.8 Guided Notebook**  
**Topic 15.8 Applications of Quadratic Equations**

**Topic 15.8 Objective 1:** Solve Application Problems Involving Consecutive Numbers

Read and summarize the CAUTION statement on page 15.8-3.

**Example 1:**  
Study the solution for Example 1 on page 15.8-3 and record the answer below.

The house numbers on the west side of a street are consecutive positive odd integers. The product of the house numbers for two next-door-neighbors on the west side of the street is 575. Find the house numbers.

**Topic 15.8 Objective 2:** Solve Application Problems Involving Geometric Figures

**Example 2:**  
Complete Example 2 on page 15.8-5 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

A swimming pool is 20 feet wide and 30 feet long. A sidewalk border around the pool has uniform width and an area that is equal to the area of the pool. Find the width of the border.
**Topic 15.8 Objective 3:** Solve Application Problems Using the Pythagorean Theorem

Write down the definition for the following terms.

*Right triangles*

*Right angle*

*Hypotenuse*

*Legs*

What is the **Pythagorean Theorem**?

**Example 3:**
Complete Example 3 on page 15.8-8 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

A wire is attached to a cell phone tower for support. The length of the wire is 40 meters less than twice the height of the tower. The wire is fixed to the ground at a distance that is 40 meters more than the height of the tower. Find the length of the wire.
Read and summarize the CAUTION statement on page 15.8-9.

**Topic 15.8 Objective 4:** Solve Application Problems Involving Quadratic Models

**Example 4:**
Study the solution for Example 4 on page 15.8-10 and record the answer below. Watch the video for a detailed solution.

The Grand Canyon Skywalk sits 4000 ft above the Colorado River. If an object is dropped from the observation deck, its height \( h \), in feet after \( t \) seconds, is given by

\[
h = -16t^2 + 4000.
\]

How long will it take for the object to be 400 feet above the Colorado River?
Example 5:
Complete Example 5 on page 15.8-12 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

For household incomes under $100,000, the relationship between the percentage of households with home broadband access and the annual household income can be approximated by the model,

\[ y = -0.01x^2 + 1.7x + 9.5. \]

Here, \( x \) is the annual household income (in $1000s) and \( y \) is the percentage of households with home broadband access. Use the model to estimate the annual household income if 75.5 percent of such households have home broadband access.
**Topic 16.1 Guided Notebook**  
**Topic 16.1 Simplifying Rational Expressions**

**Topic 16.1 Objective 1:** Evaluate Rational Expressions

Write down the definition for a **Rational Expression**.

**Example 1:**
Study and record the solutions for Example 1 parts a and b on page 16.1-4.
Evaluate \( \frac{x+8}{x-2} \) for the given value of \( x \).

a. \( x = 4 \)  
b. \( x = -6 \)

**Example 2:**
Study the solution for Example 2 on page 16.1-5 and record the answer below.

Evaluate \( \frac{x^2 - y}{9x + 5y} \) for \( x = 3 \) and \( y = -1 \).

**Topic 16.1 Objective 2:** Find Restricted Values for Rational Expressions

Write down the definition of a **Restricted Value**.

What is the technique for **Finding Restricted Values for Rational Expressions in One Variable**?
Example 3:
Study and record the solution for Example 3 part a on page 16.1-7. Complete part b on your own and check your answer.

Find any restricted values for each rational expression.

a. \( \frac{3x + 5}{3x - 2} \)  

b. \( \frac{x^2 + 2x - 35}{x^2 + x - 30} \)

Example 4:
Study the solutions for Example 4 parts a and b on page 16.1-8 which demonstrate that rational expressions do not always have restricted values.

Topic 16.1 Objective 3: Simplify Rational Expressions

When is a fraction written in **lowest terms** or **simplest form**?

What is the **Simplification Principle for Rational Expressions**?

What are the three steps for **Simplifying Rational Expressions**?

1. 

2. 

3.
Example 5:
Study the solution for Example 5 on page 16.1-11 and record the answer below.

Simplify \( \frac{2x^2 - 6x}{7x - 21} \)

Example 6:
Study the solution for Example 6 on page 16.1-12 and record the answer below.

Simplify \( \frac{5x}{x^2 + 5x} \)

Read and summarize the CAUTION statement on page 16.1-13.

Example 7:
Complete Example 7 on page 16.1-13 on your own and check your answer.

Simplify \( \frac{y^2 + 2y - 24}{y^2 + 4y - 32} \)

Example 8:
Complete Example 8 on page 16.1-14 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Simplify \( \frac{2m^2 + m - 15}{2m^3 - 5m^2 - 18m + 45} \)

Example 9:
Complete Example 9 on page 16.1-14 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Simplify \[ \frac{x^2 - xy - 12y^2}{2x^2 + 7xy + 3y^2} \]

\[ \textbf{Example 10:} \]
Study the solution for Example 10 on page 16.1-15 and record the answer below.

Simplify \[ \frac{w^2 - y^2}{2xy + 2xw} \]

\[ \textbf{Example 11:} \]
Study the solution for Example 11 on page 16.1-16 and record the answer below.

Simplify \[ \frac{3x - 10}{10 - 3x} \]

\[ \textbf{Example 12:} \]
Complete Example 12 on page 16.1-17 on your own and check your answer.

Simplify \[ \frac{2x^2 - 27x + 70}{49 - 4x^2} \]
Topic 16.2 Guided Notebook
Topic 16.2 Multiplying and Dividing Rational Expressions

**Topic 16.2 Objective 1:** Multiply Rational Expressions

What are the three steps for **Multiplying Rational Expressions**?

1. 

2. 

3. 

**Example 1:**
Study the solution for Example 1 on page 16.2-5 and record the answer below.

Multiply \( \frac{5x^2}{2y} \cdot \frac{6y^2}{25x^3} \)

**Example 2:**
Study the solution for Example 2 on page 16.2-6 and record the answer below.

Multiply \( \frac{3x-6}{2x} \cdot \frac{8}{5x-10} \)

**Example 3:**
Complete Example 3 on page 16.2-7 on your own and check your answer.

Multiply \( \frac{x^2-4}{x^2+2x-35} \cdot \frac{x^2-25}{x+2} \)
Example 4:
Complete Example 4 on page 16.2-8 on your own and check your answer.

\[
\frac{2x^2 + 3x - 2}{3x^2 - 2x - 1} \cdot \frac{3x^2 + 4x + 1}{2x^2 + x - 1}
\]

Example 5:
Study the solution for Example 5 on page 16.2-8 and record the answer below.

\[
\frac{3x^2 + 9x + 27}{x - 1} \cdot \frac{x + 3}{x^3 - 27}
\]

Example 6:
Complete Example 6 on page 16.2-10 on your own and check your answer.

\[
\frac{3x^2 + 10x - 8}{2x - 3x^2} \cdot \frac{4x + 1}{x + 4}
\]

Example 7:
Complete Example 7 on page 16.2-11 on your own and check your answer.

\[
\frac{x^2 + xy}{3x + y} \cdot \frac{3x^2 + 7xy + 2y^2}{x^2 - y^2}
\]
Topic 16.2 Objective 2: Divide Rational Expressions

What is the two-step process for Dividing Rational Expressions?

1.

2.

Example 8:
Study the solutions for Example 8 parts a and b on page 16.2-13 and record the answers below.

Divide each rational expression.

a. \( \frac{6x^5}{9y^3} \div \frac{5x^4}{3y^2} \)

b. \( \frac{(x + 2)(x - 1)}{(3x - 5)} \div \frac{(x - 1)(x + 4)}{(2x + 3)} \)

Example 9:
Complete Example 9 on page 16.2-15 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Divide \( \frac{9y^2 - 81}{4y^2} \div \frac{y + 3}{8} \)
Example 11:
Complete Example 11 on page 16.2-16 on your own and check your answer.

\[
\frac{x^3 - 8}{2x^2 - x - 6} \div \frac{x^2 + 2x + 4}{6x^2 + 11x + 3}
\]

Example 12:
Complete Example 12 on page 16.2-17 on your own and check your answer.

\[
\frac{x^3 - 8y^3}{3x + y} \div \frac{4x - 8y}{6x^2 + 17xy + 5y^2}
\]

Example 13:
Complete Example 13 on page 16.2-18 and check your answer.

Perform the indicated operations.

\[
\frac{x^2 + 2x - 15}{x^2 + 2x - 8} \cdot \frac{x^2 + 3x + 2}{x^2 + 4x - 21} \div \frac{x + 2}{x^2 + 9x + 14}
\]
Topic 16.3 Guided Notebook

Topic 16.3 Least Common Denominators

**Topic 16.3 Objective 1:** Find the Least Common Denominator of Rational Expressions

What are the three steps for Finding the Least Common Denominator (LCD) of Rational Expressions?

1. 

2. 

3. 

**Example 1:**
Study and record the solutions for Example 1 parts a and b on page 16.3-4. Find the LCD of the rational expressions.

a. \( \frac{7}{10x^3} - \frac{3}{5x^2} \)

b. \( \frac{x + 2}{3x} - \frac{x - 1}{2x^2 + 6x} \)

**Example 2:**
Complete Example 2 on page 16.3-6 parts a and b on your own and check your answers. Find the LCD of the rational expressions.

a. \( \frac{z^2}{6 - z} - \frac{9}{2z - 12} \)

b. \( \frac{y + 2}{y^2 + 2y - 3} - \frac{2y}{y^2 + 5y + 6} \)
Example 3:
Complete Example 3 on page 16.3-7 parts a and b on your own and check your answers.

Find the LCD of the rational expressions.

\[
a. \frac{4x}{10x^2 - 7x - 12} - \frac{2x - 3}{5x^2 - 11x - 12} \\
b. \frac{10 - x}{6x^2 + 5x + 1} + \frac{x^2 - 7x}{9x^2 + 6x + 1} - \frac{4}{10x^2 - x - 3}
\]

Topic 16.3 Objective 2: Write Equivalent Rational Expressions

What is the three-step process for Writing Equivalent Rational Expressions?

1.

2.

3.

Example 4:
Study and record the solutions for Example 4 parts a and b on page 16.3-10.

Write each rational expression as an equivalent rational expression with the desired denominator.

\[
a. \frac{3}{2x} = \frac{10x^3}{10x^3} \\
b. \frac{x + 2}{3x + 15} = \frac{x + 2}{3(x - 1)(x + 5)}
\]
Example 5:
Complete Example 5 on page 16.3-11 parts a and b on your own and check your answers.

Write each rational expression as an equivalent rational expression with the desired denominator.

a. \( \frac{-7}{1 - 4y} = \frac{8}{8y^2 - 2y} \)  
   b. \( \frac{5z}{z^2 + z - 6} = \frac{5z}{(z - 4)(z - 2)(z + 3)} \)
**Topic 16.4 Guided Notebook**  
**Topic 16.4 Adding and Subtracting Rational Expressions**

**Topic 16.4 Objective 1:** Add and Subtract Rational Expressions with Common Denominators

**Example 1:**  
Study the solutions for Example 1 parts a and b on page 16.4-4 and record the answers below.

Add or subtract.

a. \( \frac{4z}{3} + \frac{5z}{3} \)

b. \( \frac{3r - 2r}{7s^2} \)

**Example 2:**  
Complete Example 2 on page 16.4-6 parts a and b on your own and check your answers.

Add or subtract.

a. \( \frac{9x}{x-4} + \frac{7x-2}{x-4} \)

b. \( \frac{5y+1}{y-2} - \frac{2y+3}{y-2} \)

**Example 3:**  
Complete Example 3 on page 16.4-8 parts a – c on your own and check your answers.

Add or subtract.

a. \( \frac{4}{x^2+2x-8} + \frac{x}{x^2+2x-8} \)

b. \( \frac{x}{x+2} - \frac{x-3}{x+2} \)

c. \( \frac{x^2-2}{x-5} - \frac{4x+3}{x-5} \)
**Topic 16.4 Objective 2:** Add and Subtract Rational Expressions with Unlike Denominators

Record the steps for **Adding and Subtracting Rational Expressions with Unlike Denominators**?

1. 

2. 

3. 

4. 

**Example 4:**
Study and record the solution for Example 4 part a on 16.4-10. Complete part b on your own and check your answer.

Perform the indicated operations and simplify.

a. \( \frac{7}{6x} + \frac{3}{2x^5} \)  
b. \( \frac{3x}{x-3} - \frac{x-2}{x+3} \)

**Example 5:**
Study and record the solution for Example 5 part a on 16.4-13. Complete part b on your own.

Perform the indicated operations and simplify.

a. \( \frac{z+2}{3z} - \frac{5}{3z+12} \)  
b. \( \frac{5}{4m-12} + \frac{3}{2m} \)
Example 6:
Study and record the solution for Example 6 part a on 16.4-15. Complete part b on your own and check your answer.

Perform the indicated operations and simplify.

a. \(2 + \frac{4}{x-5}\)

b. \(\frac{x^2-2}{x^2+6x+8} - \frac{x-3}{x+4}\)

Example 7:
Complete Example 7 on page 16.4-18 parts a and b on your own and check your answers.

Perform the indicated operations and simplify.

a. \(\frac{x+7}{x^2-9} + \frac{3}{x+3}\)

b. \(\frac{x+1}{2x^2+5x-3} - \frac{x}{2x^2+3x-2}\)

Example 8:
Study the solution for Example 8 on page 16.4-19 and record the answer below.

Perform the indicated operations and simplify.

\(\frac{2y}{y-5} + \frac{y-1}{5-y}\)
Example 9:
Complete Example 9 on page 16.4-20 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Perform the indicated operations and simplify.

\[
\frac{x + 1}{x^2 - 6x + 9} + \frac{3}{x - 3} - \frac{6}{x^2 - 9}
\]
### Metacognitive Skills MDEV 099 Exam 3

Use the following scale to complete the ‘Before Studying’ column and then the ‘After Studying’ column once you study.

- **5** I am confident I can do any problems in this category correctly.
- **4** I am confident I can do most of the problems in this category correctly.
- **3** I understand how to do the problems in this category, but I still make a lot of mistakes.
- **2** I feel unsure about how to do these problems.
- **1** I know I don’t understand how to do these problems.

Refer to this assessment after your test and circle any of the ratings you would change – this identifies the “disconnects” between what you thought you knew well and what you actually knew well.

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Topic 16.5 Guided Notebook
Topic 16.5 Complex Rational Expressions

**Topic 16.5 Objective 1:** Simplify Complex Rational Expressions by First Simplifying the Numerator and Denominator

Write down the definition of a **Complex Rational Expression**. Provide one example.

What is a **simplified complex rational expression**?

This section will review two methods for simplifying a complex fraction. Once you have familiarized yourself with both methods, feel free to use either method.

**Example 1:**
Study the solution for Example 1 on page 16.5-4 and record the answer below.

\[
\text{Simplify } \frac{\frac{2}{9x}}{\frac{5}{6xy}}
\]

What are the three steps for **Method I for Simplifying Complex Rational Expressions**?

1. 
2. 
3.
Example 2:
Study and record the solution for Example 2 part a on page 16.5-6. Complete part b on your own and check your answer.

Use Method I to simplify each complex rational expression.

\[
\begin{align*}
&\text{b. } \frac{1}{3} - \frac{1}{x} \\
&\text{b. } \frac{1}{9} - \frac{1}{x^2}
\end{align*}
\]

\[
\begin{align*}
&\frac{4}{x-1} - \frac{5}{x-1} \\
&\frac{6}{x-1} - 7
\end{align*}
\]

Topic 16.5 Objective 2: Simplify Complex Rational Expressions by Multiplying by a Common Denominator

Example 3:
Study the solution for Example 3 on page 16.5-9 and record the answer below.

Simplify \( \frac{\frac{2}{9x}}{\frac{5}{6xy}} \)
What is the three-step process for Method II for Simplifying Complex Rational Expressions

1.

2.

3.

Example 4:
Study and record the solution for Example 4 part a on page 16.5-11. Complete part b on your own and check your answer.

Use Method II to simplify each complex rational expression.

a. \( \frac{1}{3} \frac{1}{x} \) \( \frac{1}{9} \frac{1}{x^2} \)

b. \( \frac{4}{x-1} \frac{5}{x-1} \) \( \frac{6}{x-1} \frac{7}{x-1} \)

Which of the two methods do you prefer? Why?
Example 5:
Complete Example 5 on page 16.5-14 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Simplify the complex rational expressions using Method I or Method II.

\[
\frac{5}{n-2} - \frac{3}{n} \quad \frac{6}{n^2} + \frac{2}{n}
\]

Example 6:
Complete Example 6 on page 16.5-15 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Simplify the complex rational expression.

\[
\frac{1 - 9y^{-1} + 14y^{-2}}{1 + 3y^{-1} - 10y^{-2}}
\]
Topic 16.6 Guided Notebook
Topic 16.6 Solving Rational Equations

**Topic 16.6 Objective 1:** Identify Rational Equations

What is the definition of a **Rational Equation**?

**Example 1:**
Study the solutions for Example 1 parts a – d on page 16.6-3 and record the answers below.

Determine if each statement is a rational equation. If not, state why.

a. \( \frac{x - 4}{x} + \frac{4}{x + 5} = \frac{6}{x} \)

b. \( \frac{5}{y} + \frac{7}{y + 2} \)

c. \( \frac{\sqrt{k + 1}}{k + 3} = \frac{k - 5}{k + 4} \)

d. \( 5n^{-1} = 3n^{-2} \)

**Topic 16.6 Objective 2:** Solve Rational Equations

**Example 2:**
Study and record the solution for Example 2 part a on page 16.6-5.

Solve.

a. \( \frac{1}{2}x + \frac{2}{3} = \frac{3}{4} \)

b. \( \frac{1}{x} + \frac{1}{2} = \frac{1}{3} \)

What are **extraneous solutions**?
What is the five-step process for Solving Rational Equations?

1.

2.

3.

4.

5.

**Example 3:**
Study the solution for Example 3 on page 16.6-8 and record the answer below.

Solve \( \frac{2}{x} - \frac{x-3}{2x} = 3 \)

**Example 4:**
Complete Example 4 on page 16.6-10 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Solve \( \frac{4}{5} - \frac{3}{x-3} = \frac{1}{x} \)
Example 5:
Complete Example 5 on page 16.6-11 on your own and check your answer.

Solve \( \frac{m}{m+2} + \frac{5}{m-2} = \frac{20}{m^2 - 4} \)

Example 6:
Work through Example 6 on page 16.6-13 and record the answer below.

Solve \( \frac{2}{x-3} - \frac{4}{x^2 - 2x - 3} = \frac{1}{x+1} \)

**Topic 16.6 Objective 3:** Identify and Solve Proportions

Write down the definition for the following terms.

**Ratio**

**Proportion**

**Cross-multiplying**
Example 7:
Study and record the solution for Example 7 part a on page 16.6-15. Complete part b on your own and check your answer by clicking on the link.

Solve.

a. \[ \frac{8}{x + 3} = \frac{5}{x} \]

b. \[ \frac{x}{6} = \frac{2}{x - 1} \]

Topic 16.6 Objective 4: Solve a Formula Containing Rational Expressions for a Given Variable

What is a formula?

Example 8:
Study the solution for Example 8 part a on page 16.6-17 and record the answer below. Complete part b on your own. Watch the video to see the complete solution.

Solve each formula for the given variable.

a. \[ I = \frac{E}{r + R} \] for \( R \)

b. \[ \frac{1}{f} = \frac{1}{c} + \frac{1}{d} \] for \( d \)
Topic 16.7 Guided Notebook
Topic 16.7 Applications of Rational Equations

**Topic 16.7 Objective 1:** Use Proportions to Solve Problems

What is a proportion?

**Example 1:**
Study the solution for Example 1 on page 16.7-3 and record the answer below.

A quality-control inspector examined a sample of 200 light bulbs and found 18 of them to be defective. At this ratio, how many defective bulbs can the inspector expect in a shipment of 22,000 light bulbs?

**Example 2:**
Complete Example 2 on page 16.7-5 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

A landscaper plants grass seed at a general rate of 7 pounds for every 1000 square feet. If the landscaper has 25 pounds of grass seed on hand, how many additional pounds of grass seed will he need to purchase for a job to plant grass on a 45,000 square-foot yard?

What are similar triangles?

In similar triangles corresponding angles are ________________________________.

In similar triangles corresponding sides are ________________________________.
Example 3:
Study the solution for Example 3 on page 16.7-6 and record the answer below.

Find the unknown length for \( n \) for the following similar triangles.

Example 4:
Complete Example 4 on page 16.7-8 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

A forest ranger wants to determine the height of a tree. She measures the tree’s shadow as 84 feet long. Her own shadow at the same time is 7.5 feet long. If she is 5.5 feet tall, how tall is the tree?

Topic 16.7 Objective 2: Use Formulas Containing Rational Expressions to Solve Problems

Example 5:
Study the solution for Example 5 on page 16.7-9 and record the answer below.

In electronics, the total resistance \( R \) of a circuit containing two resistors in parallel is given by the formula

\[
\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2},
\]

where \( R_1 \) and \( R_2 \) are the two individual resistances. If the total resistance is 10 ohms and one resistor has twice the resistance of the other, find the resistance of each circuit.
**Topic 16.7 Objective 3:** Solve Uniform Motion Problems Involving Rational Equations

**Example 6:**
Complete Example 6 on page 16.7-11 on your own and check your answer.

Emalie can travel 16 miles upriver in the same amount of time it takes her to travel 24 miles downriver. If the speed of the current is 4 mph, how fast can her boat travel in still water?

**Example 7:**
Complete Example 7 on page 16.7-13 on your own and check your answer.

Fatima rode an express train 223.6 miles from Boston to New York City and then rode a passenger train 218.4 miles from New York City to Washington, D.C. If the express train travels 30 miles per hour faster than the passenger train and her total trip took 6.5 hours, what was the average speed of the express train?

**Topic 16.7 Objective 4:** Solve Problems Involving Rate of Work

What is a **Rate of Work**?

Can rates be added?

Can times be added?
Example 8:
Study the solution for Example 8 on page 16.7-16 and record the answer below.

Avril can paint a room in 4 hours if she works alone. Anisa can paint the same room in 2 hours if she works alone. How long will it take the two women to paint the room if they work together?

Example 9:
Complete Example 9 on page 16.7-18 on your own and check your answer.

A small pump takes 8 more hours than a larger pump to empty a pool. Together, the pumps can empty the pool in 3 hours. How long will it take the larger pump to empty the pool if it works alone?

Example 10:
Complete Example 10 on page 16.7-19 on your own and check your answer.

A garden hose can fill a pond in 2 hours whereas an outlet pipe can drain the pond in 10 hours. If the outlet pipe is accidentally left open, how long would it take to fill the pond?
**Topic 17.1 Guided Notebook**  
**Topic 17.1 Relations and Functions**

**Topic 17.1 Objective 1:** Identify Independent and Dependent Variables

When is a variable **dependent**?

When is a variable **independent**?

**Example 1:**  
Study the solutions for Example 1 parts a – c on page 17.1-4 and record the answers below.

For each of the following equations, identify the dependent variable and the independent variable(s).

a. \( y = 3x + 5 \)  
b. \( w = ab + 3c^2 \)  
c. \( 3x^2 + 9y = 12 \)

**Topic 17.1 Objective 2:** Find the Domain and Range of a Relation

What is a **relation**?

What is the **domain**?

What is the **range**?
Example 2:
Complete Example 2 on page 17.1-6 on your own and check your answer.

Find the domain and range of each relation.

a. \[\{(-5, 7), (3, 5), (6, 7), (12, -4)\}\]

b.

Example 3:
Complete Example 3 on page 17.1-7 on your own and check your answers.

What is a feasible domain?
Topic 17.1 Objective 3: Determine If Relations are Functions

Define a Function.

How do you determine if a set of ordered pairs is a function?

How do you determine if an equation is a function?

Example 4:
Complete Example 4 parts a – f on page 17.1-10 on your own and check your answers.

Determine if each of the following relations is a function.

a. \{(−3,6),(2,5),(0,6),(17,−9)\}  \hspace{1cm} b. \{(4,5),(7,−3),(4,10),(−6,1)\}

c. \{(−2,3),(0,3),(4,3),(6,3),(8,3)\}  \hspace{1cm} d. \left| y−5 \right| = x + 3

e. \quad y = x^{2} − 3x + 2  \hspace{2cm} f. \quad 4x − 8y = 24

Topic 17.1 Objective 4: Determine If Graphs Are Functions

What is the Vertical Line Test and what is it used for?
Example 5:
Complete Example 5 parts a – f on pages 17.1-11 and 17.1-12 on your own and check your answers. Use the vertical linen test to determine if each graph is a function.

![Graphs](image)

Topic 17.1 Objective 5: Solve Application Problems Involving Relations and Functions

Example 6: Study the solutions for Example 6 parts a – d on page 17.1-13 and record the answers below.

The data in the table represent the average daily hours of sleep and average daily hours of video entertainment for six students at a local college.

<table>
<thead>
<tr>
<th>Video Entertainment</th>
<th>Sleep</th>
<th>Video Entertainment</th>
<th>Sleep</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>4</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>7</td>
<td>5</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td>7</td>
<td>6</td>
</tr>
</tbody>
</table>

a. If a researcher believes the number of hours of video entertainment affects the number of hours of sleep, identify the independent variable and the dependent variable.

b. What are the ordered pairs for this data?

c. What are the domain and range?

d. Is this relation a function? Explain.
Example 7:
Study and record the solution for Example 7 part a on page 17.1-15 and record the answer below. Complete parts b - d on your own and check your answers.

The percent of households, $y$, with high-speed internet access in 2007 can be modeled by the equation $y = 0.70x + 20.03$, where $x$ is the annual household income (in $1000s). (Source: U.S. Department of Commerce)

a. Identify the independent and dependent variables.

b. Use the model equation to estimate the percent of households in 2007 with high-speed internet access (to the nearest whole percent) if the annual household income was $50,000. What point would this correspond to on the graph of the equation?

c. Is the relation a function? Explain

d. Determine the feasible domain.
Topic 17.2 Guided Notebook

Topic 17.2 Function Notation and the Algebra of Functions

**Topic 17.2 Objective 1:** Express Equations of Functions Using Function Notation

What is an example of function notation and how is it read?

What is a benefit of function notation?

Record the steps for **Expressing Equations of Functions Using Function Notation**.

1. 

2. 

3. 

**Example 1:**
Study and record the solutions for Example 1 parts a and b on page 17.2-5. Complete part c on your own and check your answer by clicking on the link.

Write each function using function notation. Let $x$ be the independent variable and $y$ be the dependent variable.

a. $y = 2x^2 - 4$  
   b. $y - \sqrt{x} = 0$  
   c. $3x + 2y = 6$
Topic 17.2

**Topic 17.2 Objective 2: Evaluate Functions**

What does $f(x)$ represent and what is it called?

How do you evaluate a function?

**Example 2:**
Study and record the solution for Example 2 part a on page 17.2-6. Complete parts b – d on your own and check your answers by clicking on the link.

If $f(x) = 4x - 5$, $g(t) = 3t^2 - 2t + 1$ and $h(r) = \sqrt{r} - 9$, evaluate each of the following.

a. $f(3)$  

b. $g(-1)$  

c. $h(16)$  

d. $f\left(\frac{1}{2}\right)$

**Example 3:**
Study and record the solution for Example 3 part a on page 17.2-8. Complete parts b – d on your own and check your answers by clicking on the link.

If $P(x) = 4x^3 - 2x^2 + 8x + 7$, evaluate each of the following.

a. $P(4)$  

b. $P(-2)$  

c. $P\left(-\frac{1}{2}\right)$

**Example 4:**
Study and record the solution for Example 4 part a on page 17.2-9. Complete part b on your own and check your answer by clicking on the link.

If $R(x) = \frac{5x^2 - 9}{7x + 3}$, evaluate each of the following.

a. $R(1)$  

b. $R(-3)$
**Topic 17.2 Objective 3:** Find the Domain of a Polynomial or Rational Function

What is the **domain** of a polynomial function?

What is the **domain** of a rational function?

What is the procedure for **Finding the Domain of a Rational Function**?

**Example 6:**
Study Example 5 and complete Example 6 on page 17.2-13 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Find the domain of \( g(x) = \frac{x^2 + 2x - 15}{x^2 + 5x - 24} \)

**Topic 17.2 Objective 4:** Find the Sum, Difference, Product, and Quotient of Functions

Record the **Algebra of Functions**.

1.

2.

3.

4.
Example 8:
Study and record the solution for Example 8 part a on page 17.2-16. Complete part b on your own and check your answer by clicking on the link.

For \( P(x) = x^4 - 9x^2 + 7 \) and \( Q(x) = 3x^4 - 4x^2 + 2x - 10 \), find each of the following.

a. \( (P + Q)(x) \)

b. \( (P - Q)(x) \)

Example 10:
Complete Example 10 on page 17.2-18 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

For \( P(x) = 15x^3 + 41x^2 + 4x + 3 \) and \( Q(x) = 5x + 2 \), find \( \left( \frac{P}{Q} \right)(x) \). State any values that cannot be included in the domain of \( \left( \frac{P}{Q} \right)(x) \). (Note that \( Q(x) \) cannot be 0.)
Topic 17.3 Guided Notebook
Topic 17.3 Graphs of Functions and Their Applications

**Topic 17.3 Objective 1:** Graph Simple Functions by Plotting Points

What is the **Graph of a Function**?

Write down the definition of a **Linear Function**.

Record the **Strategy for Graphing Simple Functions by Plotting Points**.

1. 

2. 

3. 

**Example 1:**
Complete Example 1 parts a – c on page 17.3-4 on your own. Check your answers by clicking on the link. If your answers are incorrect, watch the video to find your error.

Graph each function by plotting points.

a. \( f(x) = 2x - 1 \)  
   b. \( g(x) = x^2 + 2x - 3 \)  
   c. \( h(x) = 2|x| - 1 \)
**Topic 17.3 Objective 2: Interpret Graphs of Functions**

**Example 3:**
Study the solutions for Example 2 and complete Example 3 parts a – e on page 17.3-9 on your own.

The graph of the function in Figure 2 gives the outside temperatures over one 24-hour period in spring. Use the given graph to answer the questions.

a. Over what time periods was the temperature rising?

b. Over what time periods was the temperature falling?

c. What was the highest temperature for the day? At what time was it reached?

d. What was the lowest temperature for the day shown? At what time was it reached?

e. Over what time period did the temperature decrease most rapidly?

**Example 4:**
Complete Example 4 on page 17.3-10 on your own and check your.

A Boeing 757 jet took off and climbed steadily for 20 minutes until it reached an altitude of 18,000 feet. The jet maintained that altitude for 30 minutes. Then it climbed steadily for 10 minutes until it reached an altitude of 26,000 feet. The jet remained at 26,000 feet for 40 minutes. Then it descended steadily for 20 minutes until it reached an altitude of 20,000 feet, where it remained for 30 more minutes. During the final 20 minutes of the flight, the jet descended steadily until it landed at its destination airport. Draw a graph of the 757’s altitude as a function of time.
**Topic 17.3 Objective 3: Solve Application Problems Involving Functions**

**Example 5:**
Study the solutions for Example 5 on page 17.3-11 and record the answers below (see video for part f).

A rock is dropped from the top of a cliff. Its height, \( h \), above the ground, in feet, at \( t \) seconds is given by the function \( h(t) = -16t^2 + 900 \). Use the model to answer the following questions.

a. Evaluate \( h(0) \). What does this value represent?

b. Evaluate \( h(2) \). What does this value represent? How far has the rock fallen at this time?

c. Evaluate \( h(10) \). Is this possible? Explain.

d. Evaluate \( h(7.5) \). Interpret this result.

e. Determine the feasible domain and the range that makes sense (or feasible range) within the context of the problem.

f. Graph the function.
Example 6:
Study the solutions for Example 6 on page 17.3-13 and record the answers below (see video for part d).

The average monthly rent, \( R \), for apartments in Queens, New York, is modeled by the function \( R(a) = 2.2a \), where \( a \) is the floor area of the apartment in square feet. Use the model to answer the following questions.

a. What is the average monthly rent for apartments in Queens, New York, with a floor area of 800 square feet?

b. What is the floor area of an apartment if its rent is $1430 per month?

c. Determine the feasible domain and the feasible range of the function.

d. Graph the function.
Metacognitive Skills: MDEV 099 Exam 4

Use the following scale to complete the ‘Before Studying’ column and then the ‘After Studying’ column once you study.

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<th>After Studying</th>
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<td>17.1 Find the Domain and Range of a Relation</td>
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<td>17.1 Determine If Graphs Are Functions</td>
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<td>17.2 Find the Domain of a Polynomial or Rational Function</td>
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Exam 4 Topics
**Topic 18.1 Guided Notebook**
*Topic 18.1 Radical Expressions*

**Topic 18.1 Objective 1:** Find Square Roots of Perfect Squares

What is the definition of Principal and Negative Square Roots?

Write a radical expression and label all its parts.

**Example 1:**
Study the solutions for Example 1 parts a – c on page 18.1-4, and record the answers below. Complete parts d - f on your own and check your answers by clicking on the link. If your answers are incorrect watch the video to find your error.

Evaluate.

a. $\sqrt{64}$

b. $-\sqrt{169}$

c. $\sqrt{-100}$

d. $\sqrt{\frac{9}{25}}$

e. $\sqrt{0.81}$

f. $\sqrt{0}$

**Topic 18.1 Objective 2:** Approximate Square Roots

What happens when the radicand is not a perfect square?

The principal square root of 12 should be between what two numbers? Explain why.
Example 2:
Study the solutions for Example 2 parts a – c on page 18.1-7, and record the answers below.

Use your calculator to approximate each square root and round the answer to three decimal places. Check that the answer is reasonable.

a. \( \sqrt{5} \)  
   b. \( \sqrt{45} \)  
   c. \( \sqrt{103} \)

**Topic 18.1 Objective 3:** Simplify Radical Expressions of the Form: \( \sqrt{a^2} \)

Does \( \sqrt{a^2} \) always equal \( a \)? Explain.

Example 3:
Study the solutions for Example 3 parts a – c on page 18.1-9, and record the answers below. Complete parts d - f on your own and check your answers by clicking on the link. If your answers are incorrect watch the video to find your error.

Simplify.

a. \( \sqrt{(-12)^2} \)  
   b. \( \sqrt{(2x - 5)^2} \)  
   c. \( \sqrt{100x^2} \)

   d. \( \sqrt{x^2 + 12x + 36} \)  
   e. \( \sqrt{9x^4} \)  
   f. \( \sqrt{y^6} \)

**Topic 18.1 Objective 4:** Find Cube Roots

What is the definition of **Cube Roots**?

Can cube roots have negative numbers in the radicand? Why or why not?
Is absolute value used when simplifying cube roots? Explain.

**Example 4:**
Study the solutions for Example 4 parts a – c on page 18.1-11. Complete parts d - f on your own and check your answers by clicking on the link. If your answers are incorrect watch the video to find your error.

Simplify.

d. \( \sqrt[3]{0.064} \)  
e. \( \sqrt[3]{\frac{8}{27}} \)  
f. \( \sqrt[3]{-64y^9} \)

**Topic 18.1 Objective 5:** Find and Approximate \( n \)th Roots.

What is the definition of **Principal \( n \)th Roots**?

What is the **index** of the radical expression and what does it indicate?

Write down the technique for **Simplifying Radical Expressions of the Form**: \( \sqrt[n]{a^n} \)
Example 5:
Study the solutions for Example 5 parts a – c on page 18.1-13. Complete parts d - f on your own and check your answers.

Simplify.

d. $\sqrt[5]{x^{15}}$

e. $\sqrt[6]{(x-7)^6}$

Example 6:
Study the solutions for Example 6 parts a – c on page 18.1-14, and record the answers below.

Use a calculator to approximate each root and round the answer to three decimal places. Check that the answer is reasonable.

a. $\sqrt[3]{6}$

b. $\sqrt[3]{200}$

c. $\sqrt[3]{154}$
**Topic 18.2 Guided Notebook**

**Topic 18.2 Radical Functions**

**Topic 18.2 Objective 1:** Evaluate Radical Functions

What is a **radical function**?

**Example 1:**

Study the solutions for Example 1 parts a – c on page 18.2-3, and record the answers below. Complete parts d - f on your own and check your answers by clicking on the link.

For the radical functions $f(x) = \sqrt{2x-5}$, $g(x) = \sqrt[3]{5x+9}$, and $h(x) = -3\sqrt[4]{x} + 2$ evaluate the following.

a. $f(15)$

b. $g(-2)$

c. $h(625)$

d. $g\left(-\frac{1}{5}\right)$

e. $f(0.5)$

f. $h(1)$

**Topic 18.2 Objective 2:** Find the Domain of a Radical Function.

When can the radicand of a radical expression be negative and when must it be non-negative?

Record the **Guideline to Finding the Domain of a Radical Function**.

For an *even* index:

For an *odd* index:
Example 2:
Study and record the solution for Example 2 part a on page 18.2-6. Complete parts b - c on your own and check your answers by clicking on the link.

Find the domain for each radical function.

a. \( F(x) = \sqrt[4]{12 - 4x} \)  
   b. \( h(x) = \sqrt[5]{3x + 5} \)  
   c. \( G(x) = \sqrt[5]{5x + 7} \)

**Topic 18.2 Objective 3: Graph Functions That Contain Square Roots or Cube Roots**

What is the **square root function**?

Complete the following chart to find ordered pairs that belong to the function.

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y = f(x) = \sqrt{x} )</th>
<th>( (x, y) )</th>
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<tbody>
<tr>
<td>0</td>
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<td>1</td>
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<td>9</td>
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</table>

Draw a sketch of the graph showing the ordered pairs of the points plotted.
Example 3:
Study the solution for Example 3 part a on page 18.2-8, and record the answer below. Complete parts b - c on your own and check your answers by clicking on the link.

Graph each function. Compare each graph to that of the square root function.

a. \( F(x) = \sqrt{x} + 1 \)

b. \( g(x) = \sqrt{x} + 1 \)

c. \( f(x) = -\sqrt{x} \)

In part a, why were the numbers -1, 0, 3, and 8 chosen for \( x \) while in part b the numbers 0, 1, 4, and 9 were chosen for \( x \)?

What is the cube root function?

Complete the following chart to obtain ordered pairs that belong to the function.

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y = f(x) = \sqrt[3]{x} )</th>
<th>( (x, y) )</th>
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<tbody>
<tr>
<td>-8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-1</td>
<td></td>
<td></td>
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<tr>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
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</tr>
<tr>
<td>8</td>
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</table>
Example 4:
Study the solution for Example 4 part a on page 18.2-11, and record the answer below. Complete parts b - c on your own and check your answers by clicking on the link. If your answers are incorrect watch the video to find your error.

Graph each function. Compare each graph to that of the cube root function.

a. $F(x) = \sqrt[3]{x-2}$

b. $g(x) = \sqrt[3]{x} - 2$

c. $h(x) = -\sqrt[3]{x}$
**Topic 18.3 Guided Notebook**

**Topic 18.3 Rational Exponents and Simplifying Radical Expressions**

**Topic 18.3 Objective 1:** Use the Definition for Rational Exponents of the Form: $a^{\frac{1}{n}}$

What is the definition of a **Rational Exponent of the Form** $a^{\frac{1}{n}}$?

**Example 1:**
Study the solutions for Example 1 parts a – c page 18.3-4. Complete parts d and e on your own and check your answers by clicking on the link.

Write each exponential expression as a radical expression. Simplify if possible.

- **d.** $(−81)^{\frac{1}{2}}$
- **e.** $(7x^3y)^{\frac{1}{5}}$

**Example 2:**
Study the solution for Example 2 part a on page 18.3-5, and record the answer below. Complete parts b and c on your own and check your answers by clicking on the link.

Write each radical expression as an exponential expression.

- **a.** $\sqrt[3]{5y}$
- **b.** $\sqrt[3]{7x^2y}$
- **c.** $\sqrt[4]{\frac{2m}{3n}}$

**Topic 18.3 Objective 2:** Use the Definition for Rational Exponents of the Form: $a^{\frac{m}{n}}$

What is the **Definition of a Rational Exponent of the Form** $a^{\frac{m}{n}}$?
**Topic 18.3**

**Example 3:**
Study the solutions for Example 3 parts a – c on page 18.3-8. Complete parts d and e on your own and check your answers by clicking on the link.

Write each exponential expression as a radical expression. Simplify if possible.

d. \((-36)^{\frac{5}{2}}\)

**Example 4:**
Study the solution for Example 4 part a on page 18.3-9, and record the answer below. Complete parts b and c on your own and check your answers by clicking on the link.

Write each radical expression as an exponential expression.

a. \(\sqrt[5]{x^3}\)

**Example 5:**
Study the solution for Example 5 parts a and b on page 18.3-10. Complete parts c - e on your own and check your answers by clicking on the link.

c. \(125^{\frac{1}{3}}\)

d. \(\frac{1}{8^{\frac{3}{3}}}\)

e. \((-25)^{\frac{3}{2}}\)

**Topic 18.3 Objective 3: Simplify Exponential Expressions Involving Rational Exponents**

**Example 6:**
Study the solutions for Example 6 parts a – c on page 18.2-13. Complete parts d - f on your own and check your answers by clicking on the link.

Use the rules for exponents to simplify each expression. Assume all variables represent non-negative values.

d. \((32x^{\frac{5}{6}}y^{\frac{10}{9}})^{\frac{3}{5}}\)

e. \(\left(\frac{125x^{\frac{5}{2}}}{y^{\frac{7}{9}}z^{\frac{4}{3}}}\right)^{\frac{4}{3}}, y \neq 0, z \neq 0\)

f. \(\left(4x^{\frac{1}{6}}y^{\frac{3}{4}}\right)^{2}, 3x^{\frac{5}{9}}y^{\frac{3}{2}}, y \neq 0\)
**Topic 18.3 Objective 4:** Use Rational Exponents to Simplify Radical Expressions

Write down the steps for Using Rational Exponents to Simplify Radical Expressions:

1.

2.

3.

**Example 7:**
Study the solutions for Example 7 parts a – c on page 18.3-16. Complete parts d - f on your own and check your answers by clicking on the link.

Use rational exponents to simplify each radical expression. Assume all variables represent non-negative values.

d. $\sqrt[3]{25x^3y^6}$

e. $\sqrt[4]{49}$

f. $\sqrt[n]{x}$, $x \neq 0$

---

**Topic 18.3 Objective 5:** Simplify Radical Expressions Using the Product Rule

What is the **Product Rule for Radicals**?

Record the steps for Using the Product Rule to Simplify Radical Expressions of the Form $\sqrt[n]{a}$

1.

2.

3.
Example 9:
Review Example 8 and parts a - c of Example 9. Try to complete part d on your own and check your answer.

Use the product rule to simplify. Assume all variables represent non-negative values.

d. \( \sqrt{50x^4y^3} \)

Example 10:
Study and record the solution for Example 10 part a on page 18.3-23. Complete parts b and c on your own and check your answers by clicking on the link.

Multiply and simplify. Assume all variables represent non-negative values.

a. \( 3\sqrt{10} \cdot 7\sqrt{2} \)

b. \( 2\sqrt[3]{4} \cdot 5\sqrt[3]{6} \)

c. \( \sqrt[4]{18x^3 \cdot 45x^2} \)

Topic 18.3 Objective 6: Simplify Radical Expressions Using the Quotient Rule

What is the Quotient Rule for Radicals?

Read and summarize the CAUTION statement on page 18.3-25.

What are the 3 conditions for a Simplified Radical Expression?

Condition 1

Condition 2

Condition 3
Example 12:
Study and record the solutions for Example 12 parts a and b on page 18.3-28. Complete parts c and d on your own and check your answers by clicking on the link.

Use the quotient rule to simplify. Assume all variables represent positive numbers.

c. \(\frac{\sqrt{150m^9}}{\sqrt{3m}}\)  
d. \(\frac{\sqrt{45x^3y^{-3}}}{\sqrt{20xy^{-1}}}\)
Topic 18.3
**Topic 18.4 Guided Notebook**  
**Topic 18.4 Operations with Radicals**

**Topic 18.4 Objective 1:** Add and Subtract Radical Expressions

What is the definition of **Like Radicals**?

**Example 1:**  
Study the solutions for Example 1 parts a – c on page 18.4-5 and record the answers below.

Add or subtract.

a. $\sqrt{11} + 6\sqrt{11}$  
b. $7\sqrt{3} - 5\sqrt{3}$  
c. $\frac{\sqrt{5}}{8} + 2\sqrt{5}$

**Example 3:**  
Study the solution for Example 3 part a on page 18.4-8, and record the answer below. Complete part b on your own and check your answer by clicking on the link.

Add or subtract.

a. $\sqrt{54} + 6\sqrt{72} - 3\sqrt{24}$  
b. $\sqrt{24} - \sqrt{192} + 4\sqrt{250}$

**Example 5:**  
Complete Example 5 parts a – c on page 18.4-10 on your own and check your answers.

Add or subtract. Assume variables represent non-negative values.

a. $\frac{\sqrt{45} - 4\sqrt{20}}{6x}$  
b. $\frac{\sqrt[3]{a^5} + a\sqrt[3]{a}}{3}$  
c. $\frac{3x^3\sqrt{24x^3y^3}}{2x\sqrt{3x^2y}} - \frac{x^2\sqrt{10xy^4}}{\sqrt{5y^2}}$
**Topic 18.4 Objective 2: Multiply Radical Expressions**

**Example 6:**
Study the solution for Example 6 part a on page 18.4-11, and record the answer below. Complete part b on your own and check your answer by clicking on the link.

- a. \(5\sqrt{2x}\left(3\sqrt{2x} - \sqrt{3}\right)\)
- b. \(\sqrt[3]{2n}\left(\sqrt[4]{4n} + \sqrt[5]{5n}\right)\)

**Example 7:**
Study the solution for Example 7 part a on page 18.4-13, and record the answer below. Complete part b on your own and check your answer by clicking on the link.

Multiply. Assume variables represent non-negative values.

- a. \((7\sqrt{2} - 2\sqrt{3})(\sqrt{2} - 5)\)
- b. \((\sqrt{m} - 4)(3\sqrt{m} + 7)\)

If the product of conjugates involves square roots, what results?

**Topic 18.4 Objective 3: Rationalize Denominators of Radical Expressions**

What is the procedure to **Rationalize a Denominator with One Term?**
Example 9:
Study the solutions for Example 9 parts a and b on page 18.4-16 and record the answers below.

Rationalize the denominator.

a. \( \frac{\sqrt{5}}{\sqrt{3}} \)  

b. \( \frac{2}{\sqrt{5x}} \)

Example 10:
Study the solution for Example 10 part a on page 18.4-17, and record the answer below. Complete part b on your own and check your answer by clicking on the link.

Rationalize the denominator.

a. \( \frac{3}{\sqrt{25x}} \)  

b. \( \frac{\sqrt[4]{7x}}{\sqrt[4]{27y^2}} \)

Example 11:
Complete Example 11 parts a – c on page 18.4-19 on your own. Check your answers by clicking on the link.

Simplify each expression first and then rationalize the denominator.

a. \( \frac{\sqrt{3x}}{\sqrt{50}} \)  

b. \( \frac{\sqrt[3]{18x}}{\sqrt[3]{27xy}} \)  

c. \( \frac{-4x^5}{\sqrt[3]{16y^5}} \)
What is the procedure to **Rationalizing a Denominator with Two Terms**?

**Example 12:**
Study the solutions for Example 12 parts a and b on page 18.4-20, and record the answers below. Complete part c on your own and check your answer by clicking on the link.

Rationalize the denominator.

a. \( \frac{2}{\sqrt{3} + 5} \)  

b. \( \frac{7}{3\sqrt{x} - 4} \)  

c. \( \frac{\sqrt{y} - 3}{\sqrt{y} + 2} \)
Topic 18.5 Guided Notebook
Topic 18.5 Radical Equations and Models

**Topic 18.5 Objective 1:** Solve Equations Involving One Radical Expression

What is the definition of a **Radical Equation**?

What is the key to solving a radical equation?

How can the *isolated* radical be eliminated from an equation?

What are **extraneous solutions** and when can they occur? Can these solutions be included in the solution set?

Write down the steps for **Solving Equations Involving One Radical Expression**.

1. 
2. 
3. 
4. 
Topic 18.5

Example 1:
Study and record the solution for Example 1 on page 18.5-6.

Solve \( \sqrt{3x - 2} + 6 = 11 \)

Example 3:
Review Example 2 and complete Example 3 on page 18.5-8 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Solve \( \sqrt{3x + 7} - x = 1 \).

Example 5:
Complete Example 5 on page 18.5-11 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Solve \( (x^2 - 9)^{\frac{1}{2}} + 3 = 5 \).
Topic 18.5 Objective 2: Solve Equations Involving Two Radical Expressions

Write down the steps for Solving Equations Involving Two Radical Expressions.

1. 
2. 
3. 
4. 

Example 6:
Complete Example 6 on page 18.5-12 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Solve $\sqrt{x + 9} - \sqrt{x} = 1$

Example 7:
Complete Example 7 on page 18.5-14 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Solve $\sqrt{2x + 3} + \sqrt{x - 2} = 4$

Example 8:
Complete Example 8 on page 18.5-14 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Solve $\sqrt[3]{2x^2 - 9} + \sqrt[3]{3x - 11} = 0$
**Topic 18.5 Objective 3:** Use Radical Equations and Models to Solve Application Problems

**Example 9:**
Study the solution for Example 9 part a on page 18.5-16. Complete part b on your own and check your answer by clicking on the link.

Solve the formula for the given variable.

b. Radius of a sphere: \( r = \sqrt[3]{\frac{3V}{4\pi}} \) for \( V \)

**Example 10:**
Study the solution for Example 10 part a on page 18.5-18. Complete part b on your own and check your answer by clicking on the link.

A SMOG grade for written text is a minimum reading grade level \( G \) that a reader must possess in order to fully understand the written text being graded. If \( w \) is the number of words that have three or more syllables in a sample of 30 sentences from a given text, the SMOG grade for that text is given by the formula \( G = \sqrt{w} + 3 \). Use the SMOG grade formula to answer the following questions.

b. If a text must have a tenth-grade reading level, then how many words with three or more syllables would be needed in the sample of 30 sentences?
**Metacognitive Skills: MDEV 099 Exam 5**

Use the following scale to complete the ‘Before Studying’ column and then the ‘After Studying’ column once you study.

5  I am confident I can do any problems in this category correctly.
4  I am confident I can do most of the problems in this category correctly.
3  I understand how to do the problems in this category, but I still make a lot of mistakes.
2  I feel unsure about how to do these problems.
1  I know I don’t understand how to do these problems.

Refer to this assessment after your test and circle any of the ratings you would change – this identifies the “disconnects” between what you thought you knew well and what you actually knew well.

<table>
<thead>
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<th>Topic or Skill</th>
<th>Before Studying</th>
<th>After Studying</th>
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<tbody>
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<td>18.1 Find Square Roots of Perfect Squares</td>
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<tr>
<td>18.1 Approximate Square Roots</td>
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<tr>
<td>18.1 Simplify Radical Expressions of the Form $\sqrt{a^2}$</td>
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<td>18.1 Find Cube Roots</td>
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<td>18.1 Find and Approximate $n$th Roots</td>
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<td>18.2 Evaluate Radical Functions</td>
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<td>18.2 Find the Domain of a Radical Function</td>
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<td>18.2 Graph Functions That Contain Square Roots or Cube Roots</td>
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<td>18.3 Use the Definition for Rational Exponents of the Form $\frac{m}{a^n}$</td>
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Exam 5 Topics
Topic 19.1 Guided Notebook
Topic 19.1 Solving Quadratic Equations

**Topic 19.1 Objective 1**: Solve Quadratic Equations Using The Square Root Property

What is a quadratic equation?

What is the Square Root Property?

**Example 1:**
Study and record the solutions for Example 1 parts a and b on page 19.1-4. See how to check your answers by clicking on the link.

Use the square root property to solve each quadratic equation. Write each answer in simplest form.

a. \( x^2 = 144 \)  
   b. \( x^2 = 48 \)

What is the four-step process for Solving Quadratic Equations Using the Square Root Property?

1. 

2. 

3. 

4.
Example 2:  
Study the solutions for Example 2 parts a and b on page 19.1-6. Part b results in a negative radicand for an even root. Since we did not cover the complex numbers in Section 18.6, if you get a negative radicand for an even root, you may state there is a non-real root.

Complete parts c and d on your own and check your answers by clicking on the link. If your answers are incorrect watch the video to find your error.

Solve

c. \((x-1)^2 = 9\)  
d. \(2(x+1)^2 - 17 = 23\)

Topic 19.1 Objective 2: Solve Quadratic Equations by Completing the Square

What does it mean to complete the square? How do you find the appropriate constant to add?

Example 3:  
Study and record the solutions for Example 3 parts a and b on page 19.1-10. Complete part c on your own and check your answer by clicking on the link.

What number must be added to make the binomial a perfect square trinomial?

a. \(x^2 - 12x\)  
b. \(x^2 + 5x\)  
c. \(x^2 - \frac{3}{2}x\)

Write down the steps for Solving \(ax^2 + bx + c = 0, a \neq 0\) by Completing the Square

1. 
2. 
3. 
4. 
5.
Example 4:
Study Example 4 on page 19.1-12 and record the answer below.

Solve $x^2 - 8x + 2 = 0$ by completing the square.

Example 5:
Study the solution for Example 5 on page 19.1-13 and record the answer below.

Solve $2x^2 - 10x - 6 = 0$ by completing the square.

**Topic 19.1 Objective 3:** Solve Quadratic Equations Using the Quadratic Formula

Write down the Quadratic Formula.
Example 8:
Review Example 7 and complete Example 8 on page 19.1-17 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Solve $3x^2 + 2x - 2 = 0$ using the quadratic formula.

Example 9:
In reviewing Example 9, notice the radicand is negative. For this course, you may just state that there are ‘no real solutions’ if the radicand of square root is negative.

Example 10:
Complete Example 10 on page 19.1-20 on your own. Check your answer by clicking on the link. If your answer is incorrect, watch the video to find your error.

Solve $14x^2 - 5x = 5x^2 + 7x - 4$ using the quadratic formula.

We will not be covering the objectives 4 and 5 in this course.