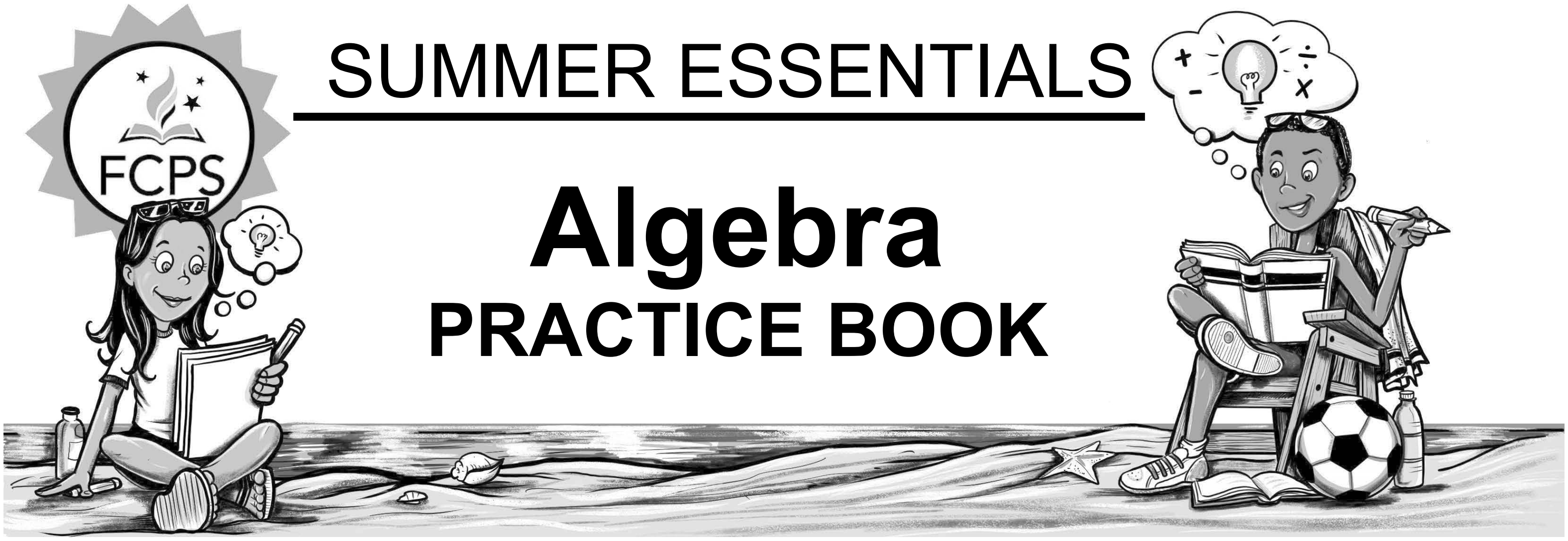
SUMMER ESSENTIALS

Algebra

PRACTICE BOOK



Name: ______________________________________

Welcome to your Summer Essentials Practice Book! This book is designed to support your learning this summer during the weeks of June 29 - July 31. In this book you will have opportunities to:

- Practice and apply mathematics skills from the past school year
- Engage in open-ended creative tasks through Learning Quests

This practice book provides suggested mathematics learning activities for you to complete each weekday over the next five weeks. Take a few moments to look at the calendar on page 3 and explore the book with your family. An answer key is provided at the end of each week so that you can check your answers. Learning Quests are included for you at the end of the book. You can complete the quests and share your learning with family and friends. As you use this book, keep in mind:

- Practice books reinforce the most important skills needed for your next math course. It is recommended that you engage in this review this summer; practice books will not be collected or graded.
- Practice books are posted to FCPS 24/7 Learning Blackboard for families.
- You have the opportunity to attend one virtual office hour each week with a teacher from your school. Office hours are optional and give you the chance to receive help with the content in this practice book. Please contact your school if you have questions about office hour details.

Usen este enlace para obtener la información en español.

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إستخدم هذا الرابط للوصول إلى المعلومات باللغة العربية.

请使用本链接获得中文信息。

از طریق لینک زیر برای دسترسی به این اطلاعات به زبان فارسی استفاده کنید.

이러한 정보를 한국어로 확인하려면 다음 링크를 이용하기 바랍니다.

اردو زبان میں معلومات حاصل کرنے کے لئے، یہ لنک استعمال کریں

Hãy dùng liên kết này để truy cập thông tin này bằng tiếng Việt :

Message to families: https://www.fcps.edu/node/41224

	Learning Opportunities	Pages
Mathematics		
Week 1	• Use variables in algebraic expressions • Determine algebraic solutions to equations or inequalities	4-10
Week 2	• Determine information from different forms of linear equations • Understand how linear functions represent real-world situations	11-18
Week 3	• Use the laws of exponents to simplify expressions • Understand how to simplify radical expressions	19-23
Week 4	• Simplify polynomial expressions through adding, subtracting, multiplying, factoring, and dividing	24-29
Week 5	• Solve quadratic equations • Use quadratic equations to model data	30-36
Learning Quests		
Weeks 1-5	• Create a paper airplane and revise to fly as far as possible • Create unique characters from simple shapes	37-39
COVID-19 Education		
Weeks 1-5	• Understand COVID-19 can make you sick and how you may feel • Identify that COVID-19 is spread from one person to another and how to help stop the spread	40

Weekly Calendar

This calendar suggests practice activities for students to do each day. Every student works at a different pace. Please customize to meet the needs of your child and consider participating in Office Hours provided by your school as an additional support.

Monday	Tuesday	Wednesday	Thursday	Friday
Week 1: Expressions, Equations, and Inequalities				
June 29 Evaluating Expressions Page 4	June 30 Solving Multi-step Equations Pages 5-6	July 1 Solving Inequalities Pages 6-8	July 2 Application Pages 8-10	July 3 Weekly Reflection Page 10
Week 2: Linear Equations				
July 6 Analyzing Linear Functions Pages 11-12	July 7 Slope & Graphing Linear Functions Pages 12-14	July 8 Writing Linear Equations Pages 14-15	July 9 Line of Best Fit Pages 15-16	July 10 Weekly Reflection Page 16
Week 3: Exponents and Radicals				
July 13 Simplifying Expressions with Radicals Pages 18-19	July 14 Simplifying Square Roots Pages 19-20	July 15 Simplifying Cube Roots Pages 20-21	July 16 Application Pages 21-22	July 17 Weekly Reflection Page 22
Week 4: Polynomials				
July 20 Adding, Subtracting, and Multiplying Polynomials Pages 23-24	July 21 Factoring Polynomials when a = 1 and Factoring Special Cases Pages 24-26	July 22 Factoring Polynomials When a ≠1 Pages 26-27	July 23 Dividing Polynomials Page 27	July 24 Weekly Reflection Page 28
Week 5: Quadratic Functions				
July 27 Analyzing Quadratic Functions Pages 29-30	July 28 Solving Quadratic Equations by Factoring Pages 30-31	July 29 Solving Quadratic Equations by Using the Quadratic Formula Pages 32-33	July 30 Curve of Best Fit Pages 33-34	July 31 Weekly Reflection Pages 34-35

Expressions, Equations, and Inequalities

Weekly Learning Outcome/Essential Question:

- **How are variables used in algebraic representations?**
- **How can the solution to an equation or inequality be determined algebraically?**

Day 1: Evaluating Expressions

Number Sense Routine

Use grouping symbols to make the equation true.

$$4^2 - 5 \cdot 2 + 1 = 1$$

Remember! Grouping symbols include: ( ), [ ], | |, $\sqrt{\square}$

Teaching

Today, we will review evaluating algebraic expressions. Remember, you evaluate an algebraic expression by **replacing** each variable with a given number. Then, **simplify** the expression using the rules of **order of operations**. Video Lesson on Evaluating Expressions: **https://bit.ly/2TJ8ZIB**

Example 1: What is the value of the expression $6\sqrt{x^2 - y} + z^3$ when x = 5, y = 9, and z = -4?	
$6\sqrt{5^2 - 9} + (-4)^3$	Substitute the values for the variables
$6\sqrt{25 - 9} + (-64)$	Simplify grouping symbols
$6\sqrt{16} + (-64)$	Simplify grouping symbol
$6 \cdot 4 + (-64)$	Multiply
$24 + (-64) = -40$	Add

Practice. Evaluate the following expressions.

1. $2a^2 + (2b)^2$ when a = -4, b = 3

2. $-4|a + b| - c$ when a = -4, b = -8, c = -9

3. $a^2 - b^3 + 8c$ when a = -8, b = -3, c = -10

4. $-4x - \sqrt{x^2 + y^2}$ when x = -8, y = 6

5. $\frac{\sqrt[3]{20 - x} + y}{z^2 - 11}$ when x = -7, y = 15, and z = 6

6. $-x^2 - \frac{1}{2}|2x - 4|$ when x = 11

Check & Reflect: Use page 10 to check your answers. What did you get correct? Can you work it a different way? What was incorrect? Can you find your mistake? What can you do differently?

Day 2: Solving Multi-step Equations

Number Sense Routine: Which One Doesn't Belong?

$y = 4x + 3$	$y = -4x + 5$
$5x - 9 = 7$	$4x + 5 = 6x - 11$

Teaching

Today, we will review solving multi-step equations. To solve an equation, use properties of **equality** and **inverse operations** to isolate the variable. Solving Equations Video: **https://bit.ly/2zymTGE**

Example 1: Solve the equation for x.

Equation	What am I thinking about when solving?
$-(8x-2) = 3+10(1-3x)$	I notice that I can simplify both sides of the equation. I will **distribute** -1 on the left side and 10 on the right side.
$-8x+2 = 3+10-30x$	I now notice that I can simplify the right side of the equation by **combining like terms**. $+3$ and $+10$
$-8x+2 = 13-30x$	Since there are variables and constants on both sides, I will use the properties of equality to move them. I will first **add 30x** to each side.
$-8x+2 = 13-30x$ $+30x \qquad\qquad +30x$	I will **simplify** each side of the equation.
$22x+2 = 13$	Since the left side shows two terms, I will **subtract 2** from each side.
$22x+2 = 13$ $-2 \quad -2$	I will **simplify** each side of the equation.
$22x = 11$	Since the left side shows $22 \cdot x$, I will **divide by 22** on both sides.
$\frac{22x}{22} = \frac{11}{22}$	I will **simplify** each side of the equation.
$x = \frac{1}{2}$ or $x = 0.5$	You may also leave your answer as a decimal, 0.5.

Example 2: Let's consider another example. What is the solution to the equation below?

Equation	What am I thinking about when solving?
$\frac{5x-1}{3} = \frac{x+11}{2}$	I notice that this equation is a proportion. I am going to **cross multiply** to eliminate the fractions.

$2(5x-1)=3(x+11)$	I notice that I can simplify both sides. I will **distribute** 2 on the left and 3 on the right.
$10x-2=3x+33$	I will use the properties of equality to get the variables on one side and the constants on the other. I will first **subtract 3x** from both sides.
$10x-2=3x+33$ $-3x \quad\quad -3x$	I will **simplify** each side of the equation.
$7x-2=33$	Since the left side shows two terms, $7x$ and -2, I will **add 2** to both sides.
$7x-2=33$ $+2 \quad +2$	I will **simplify** each side of the equation.
$7x=35$	Since the left side shows $7 \cdot x$, I will **divide by 7** on both sides.
$\frac{7x}{7}=\frac{35}{7}$	I will **simplify** each side of the equation.
$x=5$	

Practice: Solve each equation.

1. $2x-7=14-x$
2. $2(x-1)=\frac{3}{5}(10+5x)$
3. $-5n-2(2n+3)=14+n$
4. $\frac{5}{m-8}=\frac{6}{m-6}$
5. $2a+3=\frac{1}{2}(6+4a)$
6. $7h-(3h+1)=4(3+h)$

Checkpoint: Use page 10 to check your answers. What did you get correct? Can you work it a different way? What was incorrect? Can you find your mistake? What can you do differently?

Day 3: Solving Inequalities

Number Sense Routine: Which One Doesn't Belong?

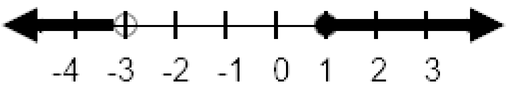
$x+7<-15$	$-5y-2\le 8$
$-3\le m-4<-1$	$3t+2<-7 \text{ or } 4t+5>1$

Teaching

Today, we will review **solving inequalities**. Solving inequalities is like solving equations. However, an inequality is a mathematical sentence that uses an inequality symbol to compare the values of two expressions. You can use a number line to visually represent the values that satisfy an inequality.

A **compound inequality** consists of two distinct inequalities joined by the word **and** or the word **or**. Video on OR Inequalities: **https://bit.ly/2XE9Coa** Video on AND Inequalities: **https://bit.ly/3d73ond**

What are the solutions of each compound inequality? Graph the solutions.

Example 1: Compound Inequality: OR	**Steps**
$3x + 2 < -7$ OR $-4x + 5 \leq 1$	Solve each inequality separately.
$3x + 2 < -7$ OR $-4x + 5 \leq 1$ $-2 \quad -2$ OR $-5 \quad -5$	Use **properties of inequalities** and **inverse operations** to solve just like equations
$3x < -9$ OR $-4x \leq -4$	
$\frac{3x}{3} < \frac{-9}{3}$ OR $\frac{-4x}{-4} \leq \frac{-4}{-4}$	Remember when you divide or multiply by a negative number you need to **flip the inequality symbol**.
$x < -3$ OR $x \geq 1$	Now graph your solution on a number line.
	Remember, use an open circle○ for < or > and a closed circle ● for ≤ or ≥. Also, you should have at least 3 numbers labeled on your number line. Since this is an **OR** inequality, the solutions will make either inequality true.

Example 2: Compound Inequality: AND	**Steps**
$-3 \leq -\frac{x}{3} - 2 < 1$	Isolate the variable in the middle by using properties of inequalities and inverse operations. Remember, to keep the inequality balanced, we must perform the same operation on **all three sides** of the inequality.
$\mathbf{-3 \leq -\frac{x}{3} - 2 < 1}$ $\mathbf{+2 \quad +2 \quad +2}$	Simplify every side of the inequality.

$-1 \leq -\frac{x}{3} < 3$	
$-1 \leq -\frac{x}{3} < 3$ $\bullet(-3) \quad \bullet(-3) \quad \bullet(-3)$	Multiply all sides by -3 and remember to **flip the inequality symbol** since the number is negative.
$3 \geq x > -9$	Rewrite the inequality so that the numbers are in numerical order by flipping the equation around.
$-9 < x \leq 3$	Now graph your solution on a number line.
	Since this is an **AND** inequality, the solutions are <u>between</u> the two numbers.

Practice: Solve each inequality. Graph your solutions.

1. $4 - 3x \geq 7$

2. $2x - 3 > x + 6$

3. $-1 < \frac{1}{2}x + 4 \leq 7$

4. $\frac{2x+6}{8} < 1$ or $3(4x - 5) > 21$

Check & Reflect: Use page 10 to check your answers. What did you get correct? Can you work it a different way? What was incorrect? Can you find your mistake? What can you do differently?

Day 4 – Application: Today, we will apply our skills and knowledge to real-world applications.

Example 1: The length of a rectangle is 3 less than twice the width. If the perimeter is 48 ft, what are the length and width of the rectangle?	
$w = width \qquad l = 2w - 3$	Assign a variable for the unknowns
$P = 2l + 2w$	Write the equation using a known formula
$48 = 2(2w - 3) + 2w$	Substitute the variables within the formula

$48 = 4w - 6 + 2w$	Use the Distributive Property
$48 = 6w - 6$	Combine Like Terms
$54 = 6w$	Apply Addition Property of Equality
$9\,ft = w$	Apply Division Property of Equality
$l = 2(9) - 3 = 18 - 3 = 15\,ft$	Substitute your answer to find other unknown. Check your solutions.

Example 2: Skate Land charges a $50 flat fee for a birthday party rental and $5.50 per person. Eliza can spend no more than $125 on a birthday party. How many people can she invite?

$x = \#\ of\ people\ Eliza\ can\ invite$	Assign a variable for the unknown
$5.50x + 50 \leq 125$	Write an inequality
$5.50x \leq 75$	Apply Subtraction Property of Inequality
$x \leq 13.6$ Eliza may invite 13 or fewer people.	Apply Division Property of Inequality

Practice

1. A delivery person uses an elevator to bring boxes of books up to an office. The delivery person weighs 200 lbs. and each box of books weighs 50 lbs. The maximum capacity of the elevator is 1,000 lbs. How many boxes of books can the delivery person bring up at one time?

$\#\ of\ boxes\ of\ books =$ ____________________

2. The 8th grade class is selling granola bars to raise money. They purchased 1,200 granola bars and paid a delivery fee of $65. The total cost, including the delivery fee, was $800. What was the cost of each granola bar?

$cost\ of\ a\ granola\ bar =$ ____________________

3. The perimeter of a triangle is 60 feet. One leg is 12 feet long. Of the two unknown sides, one of them is twice as long as the other. Find the lengths of the two unknown sides.

$length =$ ___________ $width =$ ___________

4. A waiter earned $8.50 per hour plus and earned an additional $112 in tips at work Saturday night. He wants to earn more than $180 in all. What is the least number of hours he must work to earn this amount of money?

$\#\ of\ hours =$ ____________________

Check & Reflect: See below to check your answers. What did you get correct? Can you work it a different way? What was incorrect? Can you find your mistake? What can you do differently?

Day 5 - Today you will reflect on and summarize your learning over the week.

Weekly Reflection

1. Expressions: When evaluating an expression, can you perform the operations in different orders and still get the correct answer? Explain.

2. Equations: Describe two ways in which you can solve $\frac{-1}{2}(5x - 12) = 15$.

3. Inequalities: How can you tell that the inequality $3t + 1 > 3t + 2$ has no solution just by looking at the terms in the inequality?

4. Overall: What did you learn from this week's mathematical concepts that will make you a better mathematician?

Answer Guide

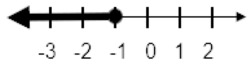
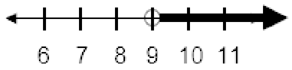
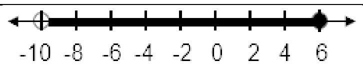
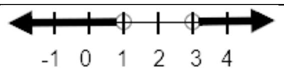
Day 1: Number Sense Routine $4^2 - 5 \cdot (2 + 1) = 1$

Practice: 1. 68 2. -39 3. 11 4. 22 5. $\frac{18}{25}$ 6. -130

Day 2: Number Sense Routine: The first equation has no solution. The second equation has infinitely many solutions. The third equation has a variable on one side only or fraction for an answer. The fourth equation has a natural number for a solution.

Practice: 1. x=7 2. x=-8 3. n=-2 4. m=18 5. All Real Numbers 6. No Solution

Day 3: Number Sense Routine First inequality is a one-step. Second inequality is a two-step and symbol will reverse. Third inequality is a conjunction ("and"-overlapping of the graphs). Fourth inequality is a disjunction ("or"-outward graphs).

1. $x \leq -1$	2. $x > 9$	3. $-10 < x \leq 6$	4. $x < 1$ or $x > 3$
			

Day 4: 1. x = 16 boxes 2. x = $0.61 3. One Side = 16 ft; Second Side = 32 ft 4. x > 8 hours

Day 5: 1. No, you cannot perform the operations in different orders and still get the correct answer. When evaluating an expression, you must follow the rules for order of operations, GEM/DA/S. 2. You can solve the equation by either multiplying each side of the equation by 2 or -2 OR by using the distributive property first. 3. You can easily subtract $3t$ from both sides of the equation and see that the variable will be eliminated. This means that you will have $1 > 2$ and that is a false statement; therefore, no solutions exist. 4. Answers will be different for each student.

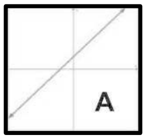
Linear Equations

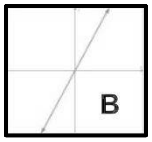
Weekly Learning Outcome/Essential Question:

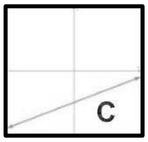
- **What information is given in the different forms of linear equations?**
- **How do linear functions represent real-world situations?**

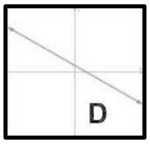
Day 1: Analyzing Linear Functions

Number Sense Routine: Which graph does not belong?



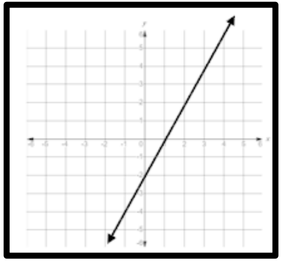


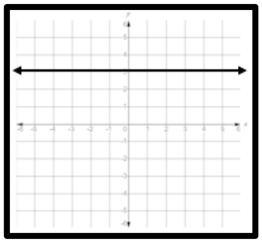


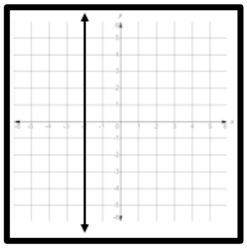


Teaching

Today we will analyze linear functions and their characteristics. Video link: **https://bit.ly/2XO50eW**



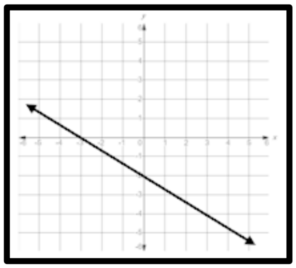
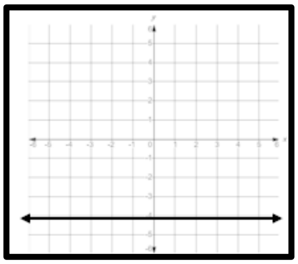
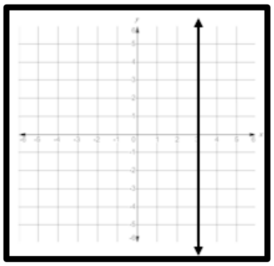




The **domain** is the set of x −values and the **range** is the set of y −values. The $\boldsymbol{x}$ −**intercept** is the x −coordinate of a point where a graph crosses the x −axis. The $\boldsymbol{y}$ −**intercept** is the y −coordinate of a point where a graph crosses the y −axis.

Domain:$\{x\|\ x\ =\ R\}; (-\infty, \infty)$	**Domain**:$\{x\|\ x\ =\ R\}; (-\infty, \infty)$	**Domain**:$\{x\|\ x\ =\ -2\}$
Range:$\{y\|\ y\ =\ R\}; (-\infty, \infty)$	**Range**:$\{y\|\ y\ =\ 3\}$	**Range**:$\{y\|\ y\ =\ R\}; (-\infty, \infty)$
x-intercept: 1 or (1, 0)	**x-intercept**: None	**x-intercept**: -2 or (-2, 0)
y-intercept: -2 or (0, -2)	**y-intercept**: 3 or (0, 3)	**y-intercept**: None

Practice: Determine the domain, range, x − intercept and y −intercept for each graph.

1. 	**2.** 	**3.** 
Domain:	**Domain**:	**Domain**:
Range:	**Range**:	**Range**:
x-intercept:	**x-intercept**:	**x-intercept**:
y-intercept:	**y-intercept**:	**y-intercept**:

Finding intercepts from an equation. Remember, equations should be written in **standard form**, $Ax + By = C$, where A, B, and C are real numbers, and A and B are not both zero. Video on Intercepts: **https://bit.ly/2AIlCBF**

Example 1: What are the $x-$ and $y-$intercepts of the graph of $3x + 4y = 24$?	
To find the $x-$intercept, substitute 0 for y. Solve for x.	To find the $y-$intercept, substitute 0 for x. Solve for y.
$3x + 4y = 24$	$3x + 4y = 24$
$3x + 4(0) = 24$	$3(0) + 4y = 24$
$3x = 24$	$4y = 24$
$x = 8$	$y = 6$
The $x-$intercept is 8.	The $y-$intercept is 6.

Practice: Find the $x-$ and $y-$intercepts of the graph of each equation.

4. $7x - y = 21$
5. $-5y = -3x - 20$
6. $x = -4$
7. $y - 4 = -2(x - 3)$
8. $-3x + 3y = 7$
9. $y = 2$

Check & Reflect: Use page 17 to check your answers. What did you get correct? Can you work it a different way? What was incorrect? Can you find your mistake? What can you do differently?

Day 2: Slope and Graphing Linear Functions

Number Sense Routine

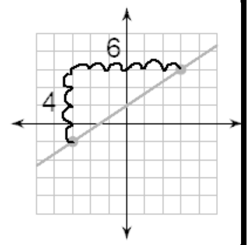
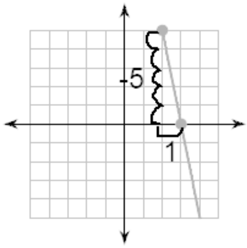
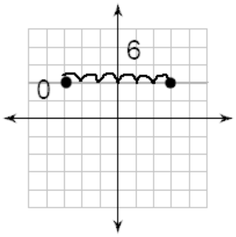
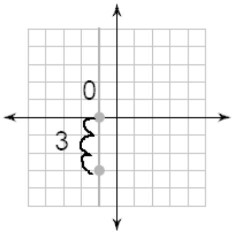
Use the digits 0 - 9 to fill in the blanks to create two points whose slope would equal the given slope.

$m = \frac{-7}{5}$ (☐, ☐) **AND** (☐, ☐)

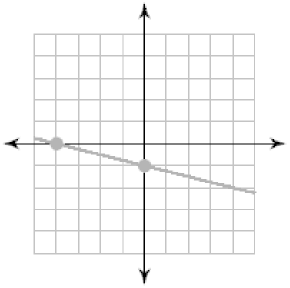
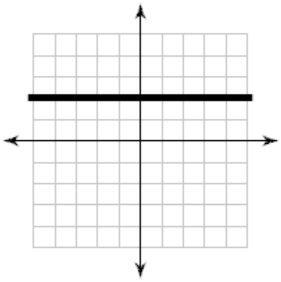
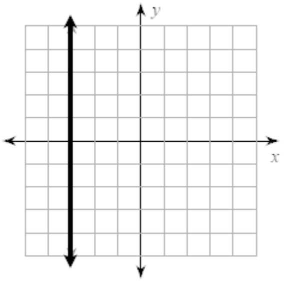
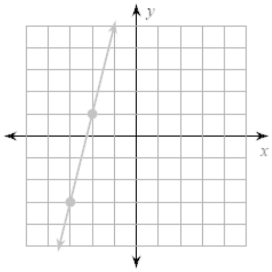
Teaching

Today we are going to review slope and how to graph lines. The **slope** of a line is a number that measures its “steepness”, represented by the letter ***m***. The slope of a line is defined as the **ratio** of the vertical change (**rise**), *y*, to the horizontal change (**run**), *x*.

Finding the slope from a graph: Slope from a Graph Video: **https://bit.ly/2yNfbrT**

Steps	Example 1	Example 2	Example 3	Example 4
1. Identify **2 points** on the line. 2. Start with the **left point**. 3. Count the units **up/down** to get to the other point. (rise) 4. Count the units **right** to the other point. (run) 5. Write the slope as a ratio: $m = \frac{rise}{run}$				
	$m = \frac{4}{6} = \frac{2}{3}$ This line has a **positive** slope.	$m = \frac{-5}{1} = -5$ This line has a **negative** slope.	$m = \frac{0}{6} = 0$ The slope for all **horizontal** lines is **zero**.	$m = \frac{3}{0} = undefined$ The slope for all vertical lines is **undefined**.

Practice: Find the slope of each line.

			
1. $m =$ __________	2. $m =$ __________	3. $m =$ __________	4. $m =$ __________

Finding the slope from two points: Slope from Two Points Video: **https://bit.ly/2yLxTQw**

Steps	Example 1	Example 2	Example 3	Example 4
To find the slope of a line from two points, use the **slope formula**: $m = \frac{rise}{run} = \frac{y_2 - y_1}{x_2 - x_1}$ Where the points are given in the form of: (x_1, y_1) and (x_2, y_2)	$(6, 9)$ & $(4, 3)$	$(-1, -5)$ & $(-5, -2)$	$(5,10)$ & $(5, -4)$	$(-2,5)$ & $(3, 5)$
	Substitute the values into the slope formula and then simplify.			
	$m = \frac{3-9}{4-6} = \frac{-6}{-2} = 3$ $m = 3$	$m = \frac{-2-(-5)}{-5-(-1)} = \frac{3}{-4}$ $m = -\frac{3}{4}$	$m = \frac{-1-10}{5-5} = \frac{-14}{0}$ $m = undefined$ This is a **vertical** line.	$m = \frac{5-5}{3-(-2)} = \frac{0}{5}$ $m = 0$ This is a **horizontal** line.

Practice: Find the slope of each line given the two points.

5. $(2, -9)$ & $(0, -3)$

6. $(-8,2)$ & $(-3,2)$

7. $(-3,10)$ & $(-3, -2)$

8. $(3,0)$ & $(-1,6)$

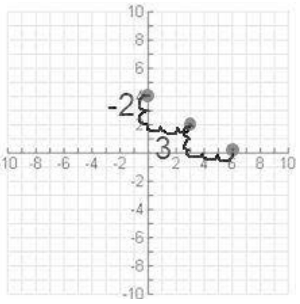
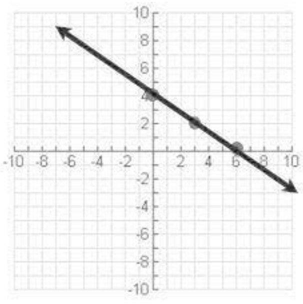
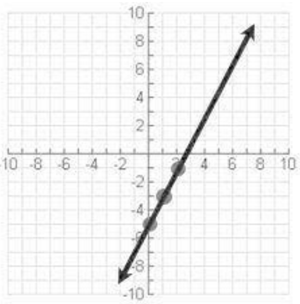
$m =$ __________

$m =$ __________

$m =$ __________

$m =$ __________

Graphing linear functions: Graphing Lines Video: **https://bit.ly/2XMZM3h**
We can use the **slope** and **y-intercept** to graph a linear equation in the form of $y = mx + b$,where ***b*** is the y-intercept (where we will **begin**) and ***m*** is the slope (how we will **move**).

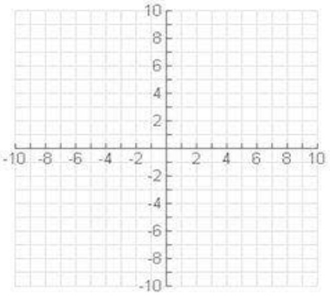
<table>
<tr><th colspan="2">Example 1: Graph $\boldsymbol{y = -\frac{2}{3}x + 4}$</th><th colspan="2">Example 2: Graph $\boldsymbol{4x - 2y = -10}$</th></tr>
<tr><td colspan="2">Step 1: Identify the slope and y-intercept.
$m = -\frac{2}{3}$ (move down 2 and right 3)
$b = 4$ (start at the point $(0, 4)$)</td><td colspan="2">Step 1: Rewrite the equation in slope-intercept form ($y = mx + b$) by solving for y.</td></tr>
<tr><td colspan="2">Step 2: Plot the y-intercept, $(0, 4)$ and use the slope, $-\frac{2}{3}$, to move (down 2, right 3) and mark two more points.
Step 3: Finally, draw a straight line through the three points.</td><td>$\boldsymbol{4x - 2y = 10}$
$\boldsymbol{-2y = -4x + 10}$
$\boldsymbol{y = 2x - 5}$</td><td>1. Subtract $4x$ from both sides.
2. Divide ALL terms on each side by -2.</td></tr>
<tr><td> </td><td> </td><td>Step 2: Now just repeat the process from Example 1.
$m = 2 \ or \ \frac{2}{1}$, up 2, right 1
$b = -5$, start at $(0, -5)$</td><td> </td></tr>
</table>

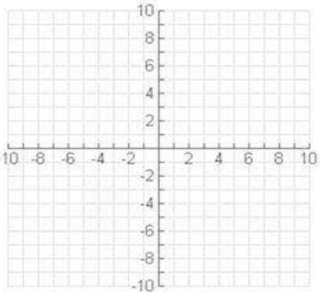
Practice: Graph the following equations.

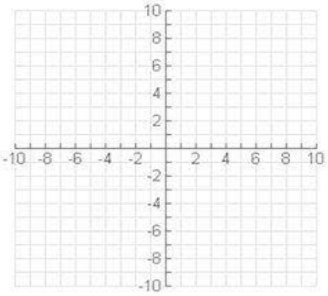
9. $y = -3x + 3$

10. $-x + 2y = -8$

11. $x = -7$







Check & Reflect: Use page 17 to check your answers. What did you get correct? Can you work it a different way? What was incorrect? Can you find your mistake? What can you do differently?

Day 3: Writing Linear Equations

Number Sense Routine: Which One Doesn't Belong?

$y = 4x + 3$	$y = -4x + 5$
$y = \frac{1}{4}x + 5$	$y = 4x - 5$

Teaching

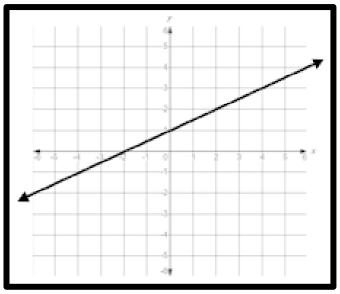
Example: What equation in slope-intercept form represents the line that passes through the points (2, 1) and (5, -8)? There are two methods you can use: **slope-intercept form:** $y = mx + b$ or **point-slope form:** $y - y_1 = m(x - x_1)$.

Point and Slope Video: **https://bit.ly/2MabXBI** Point-Slope Form Video: **https://bit.ly/3er1pKG**

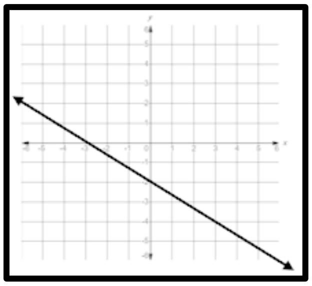
Method 1: $m = \frac{-8-1}{5-2} = \frac{-9}{3} = -3$	Use the two points to find the slope.	**Method 2:** $m = \frac{-8 - 1}{5 - 2} = \frac{-9}{3} = -3$	Use the two points to find the slope.
$y = mx + b$ $1 = -3(2) + b$ $7 = b$	Use the slope and the coordinates of one of the points to find b, the y –intercept.	$y - y_1 = m(x - x_1)$ $y - 1 = -3(x - 2)$	Use the point-slope form. You may use either ordered pair for (x_1, y_1).
$y = mx + b$ $y = -3x + 7$	Substitute the slope and y –intercept into slope-intercept form.	$y - 1 = -3x + 6$ $y = -3x + 7$	Solve the equation for slope-intercept form.

Practice: Write the equation of the line in slope-intercept form.

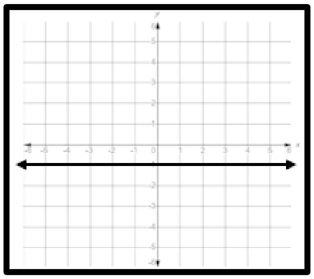
1.



2.



3.



4. $m = 3$and $b = \frac{-1}{4}$

5. $m = \frac{-3}{2}$and $(2, -2)$

6. $(-2, -1)$ and $(4, 2)$

Check & Reflect: Use page 17 to check your answers. What did you get correct? Can you work it a different way? What was incorrect? Can you find your mistake? What can you do differently?

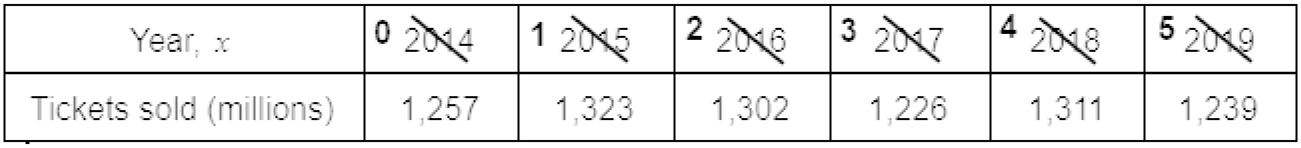
Day 4: Application - Line of Best Fit

Today we are going to look at an example problem’s data and determine the line of best fit. The **line of best fit**, or **trend line**, is a line that follows the general trend of the data. We can use this line to help us interpret and make predictions about the data. Video Line of Best Fit: **https://bit.ly/36V8wsp**

The table shows the number of tickets sold (in millions) in the United States as a function of each given year. Let year 2014 be Year 0. Use the table to answer the following questions.					
Year, x	2014	2015	2016	2017	2018
Tickets sold, y (millions)	1,257	1,323	1,302	1,226	1,311

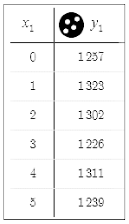
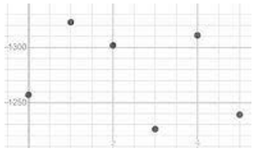
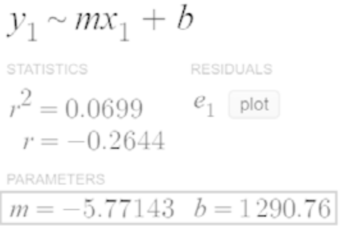
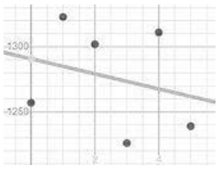
a. **Determine the line of best fit that represents the data. (Round to the nearest tenth)**
b. **Predict the number of movie tickets sold in 2024. (Round to the nearest whole number)**
c. **Determine in which year 1,198 million tickets were sold.**

First, notice that the x value is measuring **time** and the directions state to use year 2014 as year 0. This means that year 2015 is 1.



Year, x	0 ~~2014~~	1 ~~2015~~	2 ~~2016~~	3 ~~2017~~	4 ~~2018~~	5 ~~2019~~
Tickets sold (millions)	1,257	1,323	1,302	1,226	1,311	1,239

Now, to find the line of best fit (question a), we will review how to use the Desmos calculator.

1.  2.  x_1 y_1 0 1257 1 1323 2 1302 3 1226 4 1311 5 1239	Put the data into a table in **Desmos**. https://www.desmos.com/calculator 1. Click the + button in the top left corner and select **table**. 2. Enter the data into the table.
	Use the magnifying glass button, 🔍, to the **left of the table** on Desmos for the graph to zoom fit to the data.
 $y_1 \sim mx_1 + b$ STATISTICS RESIDUALS $r^2 = 0.0699$ e_1 plot $r = -0.2644$ PARAMETERS $m = -5.77143$ $b = 1290.76$	- We are finding the **linear regression,** so the line of best fit is in the form of $y = mx + b$. - Instead of =, we use ~. In this context, a ~ means **approximate**. Enter $y_1 \sim mx_1 + b$ into line 2. - Notice x and y are labeled as x_1 and y_1. We are using the data in the table, where columns are labeled x_1 and y_1
	Here is the graph for the line of best fit. Notice the line of best fit does not go through all of the points but through approximately the middle of the data.

Now that we have created the graph and found the line of best fit, we can answer questions a-c.

a. **Determine the line of best fit that represents the data. (Round to the nearest tenth)**
Use the m and b values from the above, round each number to the nearest tenth, and substitute the values into $y = mx + b$.

Line of best fit equation: $y = -5.8x + 1{,}290.8$

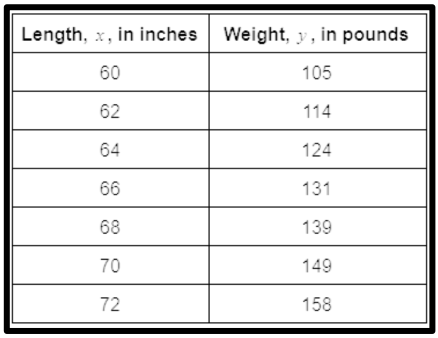
b. Predict the number of movie tickets sold in 2024. (Round to the nearest whole number)

$y = -5.8\,x + 1{,}290.8$ $y = -5.8\,(10) + 1{,}290.8$ $y = -58 + 1{,}290.8$ $y = 1{,}232.8$	● Years is the x value, so we have to substitute x to find the number of movie tickets, y. ● Year 2024 is 10 years after 2014 (Year 0) ● Substitute 10 for x and solve for y.
1,233 million	**In 2024, 1,233 million movie tickets will be sold.**

c. Determine in which year 1,198 million tickets were sold.

$1198 = -5.8\,x + 1{,}290.8$ $-92.8 = -5.8x$ $y = -58 + 1{,}290.8$ $x = 16$	● Number of tickets sold is the y value, so we have to substitute y to find the years, x. ● Substitute 1198 for y and solve for x.
16 years **Year 2030**	If Year 0 is 2014, then Year 16 is 2030. **So, 1,198 million movie tickets will be sold in 2030.**

Practice



Length, x, in inches	Weight, y, in pounds
60	105
62	114
64	124
66	131
68	139
70	149
72	158

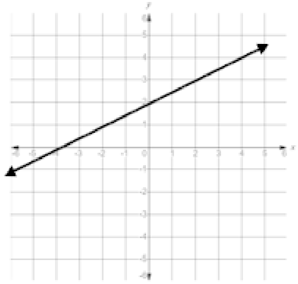
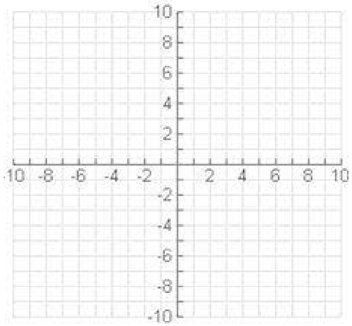
Sand Sharks - The table shows the lengths and corresponding ideal weight of sand sharks.

1. Find the equation for the line of best fit for the data in the table. Round to the nearest tenth.
2. Predict the weight of the sand shark whose length is 75 inches. Round to the nearest whole number.
3. Determine the length of a sand shark that weighs 200 pounds. Round to the nearest whole number.

Check & Reflect: Use page 17 to check your answers. What did you get correct? Can you work it a different way? What was incorrect? Can you find your mistake? What can you do differently?

Day 5: Today you will reflect on and summarize your learning over the week.

Weekly Reflection

1. **Error Analysis**: A student calculated the slope of the line below to be 2. Explain the mistake. What is the correct slope? 	2. Write your own linear equation. Identify the slope and the y –intercept. Then graph your equation. 
3. When is it most useful to use slope-intercept form? When is it most useful to use point-slope form?	

Answer Guide

Day 1: Number Sense Routine**:** (sample answers) A has a negative x –intercept. B has the same x – and y –intercepts; graph goes through the origin. C has a negative y –intercept. D has a negative slope.

Practice:

1. Domain:$\{x \mid x = R\}; (-\infty, \infty)$ Range: $\{y \mid y = R\}; (-\infty, \infty)$ x-intercept: -3 or (-3, 0) y-intercept: -2 or (0, -2)	**2.**Domain: $\{x \mid x = R\}; (-\infty, \infty)$ Range: $\{y \mid y = -4\}$ x-intercept: None y-intercept: -4 or (0, -4)	**3**.Domain: $\{x \mid x = 3\}$ Range:$\{y \mid y = R\}; (-\infty, \infty)$ x-intercept: 3 or (3, 0) y-intercept: None

4. x-intercept: 3 or (3, 0)
y-intercept: -21 or (0, -21)

5. x-intercept: $\frac{-20}{3}$ or ($\frac{-20}{3}$, 0)
y-intercept: 4 or (0, 4)

6. x-intercept: -4 or (-4, 0)
y-intercept: None

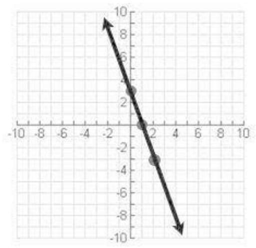
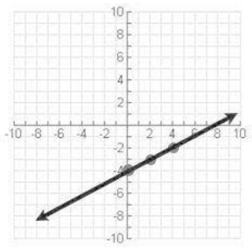
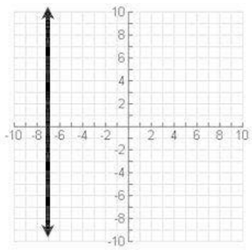
7. x-intercept: 5 or (5, 0)
y-intercept: 10 or (0, 10)

8. x-intercept: $\frac{-7}{3}$ or ($\frac{-7}{3}$, 0)
y-intercept: $\frac{7}{3}$ or (0, $\frac{7}{3}$)

9. x-intercept: None
y-intercept: 2 or (0, 2)

Day 2: Number Sense Routine: Many solutions; here are two: (1, 9) and (6, 2) and (0, 8) and (5, 1)

1. $m = -\frac{1}{4}$ **2.** $m = 0$ **3.** $m = undef$ **4.** $m = 4$ **5.** $m = -3$ **6.** $m = 0$ **7.** $m = undef$ **8.** $m = -\frac{3}{2}$

 **9.**	 **10.**	 **11.**

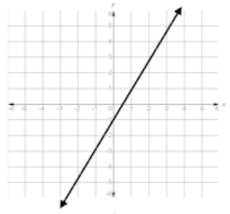
Day 3: Number Sense Routine (sample answers): $y = -4x + 5$ because there is a negative slope. $y = \frac{1}{4}x + 5$ because there is a fractional slope. $y = 4x - 5$ has a negative y –intercept.

1. $y = \frac{1}{2}x + 1$ **2.** $y = \frac{-2}{3}x - 2$ **3.** $y = -1$ **4.** $y = 3x - \frac{1}{4}$ **5.** $y = \frac{-3}{2}x + 1$ **6.** $y = \frac{1}{2}x$

Day 4: 1. $y = 4.4x - 156.1$ **2.** 174 pounds **3.** 81 inches

Day 5: Reflection 1: The student thought slope was $\frac{run}{rise}$when it is $\frac{rise}{run}$. The correct slope is $\frac{1}{2}$.

Reflection 2: (answers vary) $y = 2x - 1$; $m = 2$ and $b = -1$



Reflection 3: (sample answers) It is most useful to use slope-intercept form when given a graph where you can identify the slope and y –intercept. It is most useful to use point-slope form when given 2 points.

Exponents and Radicals

Weekly Learning Outcome/Essential Question:

- **How do you simplify expressions using the laws of exponents?**
- **What is a radical and how can radical expressions be simplified?**

Day 1: Simplifying Expressions with Exponents

Number Sense Routine: How many different ways can you represent this number: **3^4**

I can represent this number by…

Teaching

Today we are going to be simplifying expressions with exponents. We do this by following different exponent properties. Simplifying Exponential Expressions Video: **https://bit.ly/2TODCMT**

Name	Property	Example 1 (Basic)	Example 2 (Harder)
Multiplication Property Add the exponents	$x^a \cdot x^b = x^{a+b}$	$x^7 \cdot x \cdot x^4 = x^{12}$	$(3x^5y^4z)(10xy^2z) = 30x^6y^6z^2$
Division Property Subtract the exponents	$\frac{x^a}{x^b} = x^{a-b}$	$\frac{x^{11}}{x^{13}} = \frac{1}{x^2}$	$\frac{9x^{10}y^2}{6x^{15}y} = \frac{3y}{2x^5}$
Power Property Multiply the exponents	$(x^a)^b = x^{a \cdot b}$	$(x^7)^3 = x^{21}$	$\left[(x^4)^6\right]^2 = x^{48}$
Product Property Apply power to all parts	$(xy)^a = x^a \cdot y^a$	$(5x)^3 = (5)^3(x^1)^3 = 125x^3$	$(-3x^6yz^2)^2 = 9x^{12}y^2z^4$
Quotient Property Apply power to all parts	$\left(\frac{x}{y}\right)^a = \frac{x^a}{y^a}$	$\left(\frac{2}{7}\right)^2 = \frac{4}{49}$	$\left(\frac{2x^3y}{3xy^4}\right)^2 = \left(\frac{2x^2}{3y^3}\right)^2 = \frac{4x^4}{9y^6}$
Zero Property Any term raised to the zero power equals 1	$x^0 = 1$	$5^0 = 1$ $5x^0 = 5 \cdot 1 = 5$	$\frac{(2x^3y^{-4})^0}{(3y^9)^2} = \frac{1}{9y^{18}}$
Negative Exponent Property The negative exponent means the reciprocal; move to the opposite side of the fraction	$x^{-1} = \frac{1}{x}$	$x^{-7} = \frac{1}{x^7}$ $6x^{-7} = \frac{6}{x^7}$	$-\frac{8x^{-4}z^2}{2x^2y^{-5}} = -\frac{8z^2y^5}{2x^2x^4} = -\frac{4y^5z^2}{x^6}$

Practice: Simplify each exponential expression.

1. $x^8 \cdot x^2 \cdot x$
2. $(-2x^3y^5)(-4xy^2)$
3. $(5x^4y^6)^3$
4. $\frac{x^{10}y^7}{x^7y^{12}}$

5. $\dfrac{(5x^3y)^2}{10x^3y}$

6. $-2x^0y^{14}$

7. $(6x^5y^9)^2(5x^{10}y^3z)^0$

8. $(5x)^{-1}$

9. $\dfrac{16x^{-12}y^5}{6z^{-2}}$

10. $\dfrac{6x^{-5}y^2}{9x^5y^{-8}}$

11. $\dfrac{2x^2y}{6x^0y} \cdot \dfrac{4x^2y^3z}{2x^2y}$

Check & Reflect: Use page 22 to check your answers. What did you get correct? Can you work it a different way? What was incorrect? Can you find your mistake? What can you do differently?

Day 2: Simplifying Square Roots

Number Sense Routine: Describe how these two expressions are alike and different: $\mathbf{x^4x^3}$ and $\mathbf{(x^4)^3}$

These two expressions are similar/alike because…
These two expressions are different because...

Teaching

Today we will review how to simplify square roots. A **radical expression** is an expression containing a radical symbol, $\sqrt{\ }$. A **perfect square** is the square of an integer.

Practice: Simplify.

1. $\sqrt{100}$	2. $-\sqrt{49}$	3. $\sqrt{289}$	4. $\sqrt{196}$	5. $\sqrt{\frac{16}{25}}$

Teaching

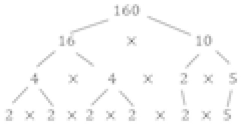
A **non-perfect square** is an integer whose square root is not a whole number. There are two methods you can use to simplify a non-perfect square.

Method 1: Simplifying Square Roots of Non-Perfect Squares Video: **https://bit.ly/2XQ1YHh**

Method 2: Simplifying Monomial Square Roots Video: **https://bit.ly/36N21Yf**

Example: What is the simplified form of $\sqrt{160}$?

Method 1: Find the **greatest perfect square** of the number you are simplifying.	
$\sqrt{160} = \sqrt{16 \cdot 10}$	16 is the greatest perfect square of 160.
$= \sqrt{16} \cdot \sqrt{10}$	Multiplication Property of Square Roots
$= 4\sqrt{10}$	Simplify the square root of 16.

Method 2: Use **prime factorization**.	
 $\sqrt{160} = 2\cdot2\cdot2\cdot2\cdot2\cdot5$	Simplify using **factor trees.**
$= \sqrt{\boxed{2\cdot2}\boxed{2\cdot2}\,2\cdot5}$ $= \sqrt{4\cdot4\cdot2\cdot5}$ $= \sqrt{4}\cdot\sqrt{4}\cdot\sqrt{2\cdot5}$	**Circle** the **common pair(s)** and bring **one** of each pair outside the radical symbol and leave all other remaining numbers inside the radical symbol.
$= 2\cdot2\sqrt{2\cdot5}$ $= 4\sqrt{10}$	Simplify.

Practice: Simplify each radical expression.

6. $\sqrt{24}$	7. $\sqrt{72}$	8. $\sqrt{90}$	9. $3\sqrt{162}$

Teaching

Monomial Square Roots - These are radical expressions that contain variables. A variable with an **even exponent** is a perfect square. A variable with an **odd exponent** is the product of a perfect square and the variable. For example, $x^3 = x^2\cdot x$, so $\sqrt{x^3} = \sqrt{x^2\cdot x} = x\sqrt{x}$. Use the same method(s) as shown above.

Practice: Simplify each radical expression.

10. $\sqrt{16x^5}$	11. $\sqrt{a^3b^5c^3}$	12. $4\sqrt{50x^6}$	13. $\sqrt{200x^4y^7z}$

Check & Reflect: Use page 22 to check your answers. What did you get correct? Can you work it a different way? What was incorrect? Can you find your mistake? What can you do differently?

Day 3: Simplifying Cube Roots

Number Sense Routine: Which One Doesn't Belong?

$\sqrt{5}$	$\sqrt{36}$
$\sqrt{18}$	$\sqrt[3]{8}$

Teaching

Today we will review how to simplify cube roots. A **cube root** is the number that multiplies by itself three times in order to create a cubic value. Use the same methods as shown above for square roots, but this time you are looking for **triples (3)** of numbers **instead of pairs (2)**.

Simplifying Cube Roots of Non-Perfect Cubes Video: **https://bit.ly/3gI9WKW**

Example Using Method 2, Prime Factorization: What is the simplified form of $\sqrt[3]{40}$?	
$\sqrt[3]{40} = \sqrt[3]{2\cdot2\cdot2\cdot5}$	Simplify using factor trees.
$= \sqrt[3]{\boxed{2\cdot2\cdot2}\cdot5}$	**Circle** the **common triple(s)** and bring **one** of each triple outside the radical symbol and leave all other remaining numbers inside the radical symbol.
$= 2\sqrt[3]{5}$	Simplify.

Practice: Simplify each radical expression.

1. $\sqrt[3]{54}$	2. $\sqrt[3]{81}$	3. $\sqrt[3]{96}$
4. $\sqrt[3]{120}$	5. $\sqrt[3]{320}$	6. $\sqrt[3]{500}$

Check & Reflect: Use page 22 to check your answers. What did you get correct? Can you work it a different way? What was incorrect? Can you find your mistake? What can you do differently?

Day 4: Application: Exponent Help!

Ms. Wilson splattered her coffee all over the latest Algebra test! You are her teaching assistant and must help her figure out what the problems were before the test tomorrow.

Practice - Analyze each of the problems. Determine what variables or constants could go in the boxes to achieve the final answer given. Then explain the thought process you used to achieve the answer. Some questions can have multiple answers.

Problem	**Final Answer**	**Your Thought Process**
$\left(\frac{xy^3}{z}\right)^{\square}$	$\frac{z}{xy^3}$	I solved this problem by...
$\frac{56x^3y^{\square}}{\square x^{\square}y^{-5}}$	$\frac{8}{x^8y^2}$	I solved this problem by...
$\sqrt{48\square}$	$4x^2y\sqrt{3x}$	I solved this problem by...
$\sqrt{\square x^{\square}y^{\square}z^{\square}}$	$2x^4yz^2\sqrt{6xz}$	I solved this problem by...

Check & Reflect: See below to check your answers. What did you get correct? Can you work it a different way? What was incorrect? Can you find your mistake? What can you do differently?

Day 5 - Today you will reflect on and summarize your learning over the week.

Weekly Reflection: Simplify each expression.

1. $(8x^4y^2)(-3x^3y^6)$	2. $(-2x^3y^5)^3$	3. $\frac{32x^5y^{-3}}{8x^{-2}y^6}$	4. $\frac{(10xy)^2(2x^4y^3)}{4x^5y}$	5. $\frac{(-6x^4y^6)^2}{(-4x^{-3}y^5)^3}$
6. $\sqrt{32}$	7. $\sqrt{27x^3y}$	8. $4\sqrt{20x^6y^5}$	9. $\sqrt[3]{250}$	10. $\sqrt[3]{72}$

Compare exponent rules and simplifying radicals.

Exponent rules and simplifying radicals are similar because...

Exponent rules and simplifying radicals are different because…

Answer Guide

Day 1: Number Sense Routine: (sample answers) $(3^2)^2$; 81; 9^2; $3^3 \cdot 3$; $\frac{162}{2}$

1. x^{11} **2.** $8x^4y^7$ **3.** $125x^{12}y^{18}$ **4.** $\frac{x^3}{y^5}$ **5.** $\frac{5x^3y}{2}$ **6.** $-2y^{14}$ **7.** $36x^{10}y^{18}$ **8.** $\frac{1}{5x}$ **9.** $\frac{8y^5z^2}{3x^{12}}$ **10.** $\frac{2y^{10}}{3x^{10}}$ **11.** $\frac{2x^2y^2z}{3}$

Day 2: Number Sense Routine: Alike: You can write the expressions in factored form and add the exponents. Different: Multiplying like bases you add the exponents. A power to a power means to multiply the exponents.

1. 10 **2.** -7 **3.** 17 **4.** 14 **5.** $\frac{4}{5}$ **6.** $2\sqrt{6}$

7. $6\sqrt{2}$ **8.** $3\sqrt{10}$ **9.** $27\sqrt{2}$ **10.** $4x^2\sqrt{x}$ **11.** $ab^2c\sqrt{abc}$ **12.** $20x^3\sqrt{2}$ **13.** $10x^2y^3\sqrt{2yz}$

Day 3: Number Sense Routine (sample answers) $\sqrt{5}$ because it is already simplified. $\sqrt{36} = 6$ because 36 is a perfect square. $\sqrt{18} = 3\sqrt{2}$ since 18 is not a perfect square but can be simplified. $\sqrt[3]{8} = 2$ since 8 is a perfect cube.

1. $3\sqrt[3]{2}$ **2.** $3\sqrt[3]{3}$ **3.** $2\sqrt[3]{12}$ **4.** $2\sqrt[3]{15}$ **5.** $4\sqrt[3]{5}$ **6.** $5\sqrt[3]{4}$

Day 4: Practice: Answers may vary for these. Below is an example of one possible answer.

1. $\left(\frac{xy^3}{z}\right)^{\boxed{-1}}$	2. $\frac{56x^3y^{\boxed{-7}}}{\boxed{7}x^{\boxed{11}}y^{-5}}$ x	3. $\sqrt{48\boxed{x^5y^2}}$	4. $\sqrt{\boxed{24}x^{\boxed{9}}y^{\boxed{2}}z^{\boxed{5}}}$

Day 5: 1. $-24x^7y^8$ **2.** $-8x^9y^{15}$ **3.** $\frac{4x^7}{y^9}$ **4.** $50xy^4$ **5.** $\frac{-9x^{17}}{16y^3}$ **6.** $4\sqrt{2}$ **7.** $3x\sqrt{3y}$ **8.** $8x^3y^2\sqrt{5y}$ **9.** $5\sqrt[3]{2}$ **10.** $2\sqrt[3]{9}$

Reflection 1: (sample response) They are alike because they both involve multiplication. They are different because the exponent rules also use addition and subtraction and radicals do not.

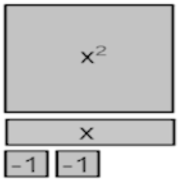
Polynomials

Weekly Learning Outcome/Essential Question:

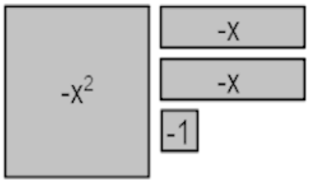
- **How can polynomial expressions be simplified?**
- **Can two algebraic expressions that appear to be different be equivalent?**

Day 1: Adding, Subtracting, and Multiplying Polynomials

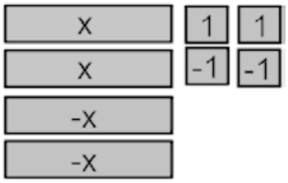
Number Sense Routine: Which One Does Not Belong? Try to find a reason for each to not belong.



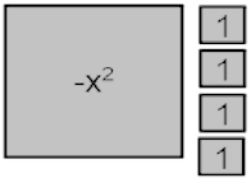
A.



B.



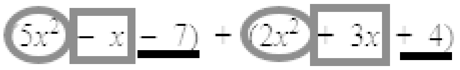
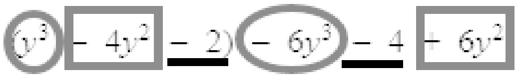
C.



D.

Teaching

When **adding and subtracting**, **combine like terms**. Like terms have the same variable and exponent. Adding Video: **https://bit.ly/2MnBdED** Subtracting Video: **https://bit.ly/2zV945h**

Example 1: **Simplify** $(5x^2 - x - 7) + (2x^2 + 3x + 4)$	
	Identify the like terms. It helps to circle, underline, or highlight them.
$5x^2 + 2x^2 - x + 3x - 7 + 4$	You can also rewrite the polynomial with like terms next to each other.
$7x^2 + 2x - 3$	Then **combine like terms**. Remember that a subtraction sign is the same as a negative term.
Example 2: Simplify $(y^3 - 4y^2 - 2) - (6y^3 + 4 - 6y^2)$	
 $(y^3 - 4y^2 - 2) - 6y^3 - 4 + 6y^2$	Since this is subtraction, before we can combine like terms, we need to **distribute the** − **(negative)** on the outside of the second polynomial. Notice how each term becomes its inverse (opposite).
	**Identify** the **like terms**.
$-5y^3 + 2y^2 - 6$	**Combine like terms**.

When **multiplying polynomials**, you can use the **box method**. Here are videos with additional information about **multiplying binomials**: **https://bit.ly/2XQtsMS** and **multiplying a binomial by a trinomial video**: **https://bit.ly/2XT8IcR**

Example 3: Find the product of: $(2x + 5)\ (3x - 1)$

	3x	-1
2x		
5		

Since this is a **binomial** (two terms) times another **binomial** (two terms), make a **2 by 2 box** and **write the terms on the outside of the box.**

	3x	-1
2x	**$6x^2$**	**-2x**
5	**15x**	**-5**

Now fill in the box by **multiplying** each column by each row. Remember, when you multiply and ***x* by another *x*, it becomes *x^2*.**

$\mathbf{6x^2 + 13x - 5}$

Lastly, **combine the like terms** and write as a polynomial. Combine $15x$ and $-2x$ (highlighted in the box above).

Example 4: Find the product of: $(2x + 3)\ (x^2 - 4x - 1)$

	x^2	-4x	-1
2x			
3			

This is now a **binomial** (two terms) times a **trinomial** (three terms) so make a **2 by 3** box this time and write the terms on the outside of the box.

	x^2	-4x	-1
2x	**$2x^3$**	**$-8x^2$**	**-2x**
3	**$3x^2$**	**-12x**	**-3**

Again, fill in the box by multiplying all rows by each column. Remember, when you multiply an ***x^2* by *x*, it becomes *x^3***. The box is highlighted to show each pair of like terms.

$\mathbf{2x^3 - 5x^2 - 14x - 3}$

Lastly, **combine like terms**. This time there are two sets. The highlighted boxes show each pair of like terms.

Practice: Simplify the expressions below by adding, subtracting, or multiplying.

1. $(5x^2 - 3x + 4) + (3x^3 - 2x^2 - 5x + 8)$
2. $(x^2 + 2x - 4) - (4x^2 - x + 6)$
3. $-4x\ (2x^2 - 5x + 8)$
4. $(3x + 7)\ (4x - 9)$
5. $(2x - 1)^2$
6. $(5x - 7)\ (5x + 7)$
7. $(x - 6)(3x^2 - 5x + 4)$

Check & Reflect: Use page 28 to check your answers. What did you get correct? Can you work it a different way? What was incorrect? Can you find your mistake? What can you do differently?

Day 2 - Factoring Polynomials when a = 1 and Factoring Special Cases like Difference of Squares

Number Sense Routine

Describe how these two expressions are alike and different: **$(x + 2)(x + 3)$** and **$(x^2 + 5x + 6)$**

These two expressions are alike/similar because…

They are different because...

Teaching

Factoring Trinomials: A trinomial is in the form $ax^2 + bx + c$. For today's lesson, we will focus on $a = 1$.To factor a trinomial in this form, you must find **two** integers whose **product** is c and whose **sum** is b . Factoring Trinomials Video: **https://bit.ly/2Xp4tkO**

<table>
<tr><th colspan="2">Example: What is the factored form of $x^2 + 7x + 12$?</th></tr>
<tr><td><table><tr><td>x^2</td><td></td></tr><tr><td></td><td>12</td></tr></table></td><td>Since this will be factored to two binomials, make a 2 by 2 box and write the first and last terms of the trinomial in the upper left-hand and bottom right-hand corners of the box.</td></tr>
<tr><td><table><tr><th>Product</th><th>Sum</th></tr><tr><td>1×12</td><td>$1 + 12 = 13$</td></tr><tr><td>2×6</td><td>$2 + 6 = 8$</td></tr><tr><td>3×4</td><td>$3 + 4 = 7$ ✓</td></tr></table></td><td>Find the factors of 12 that also give you the sum of the coefficient of b, which is 7.</td></tr>
<tr><td><table><tr><td>x^2</td><td>$4x$</td></tr><tr><td>$3x$</td><td>12</td></tr></table></td><td>Once you find your two factors, enter those values, along with the variable x, into the two remaining boxes. The order doesn't matter.</td></tr>
<tr><td><table><tr><td></td><td>x</td><td>4</td></tr><tr><td>x</td><td>x^2</td><td>$4x$</td></tr><tr><td>3</td><td>$3x$</td><td>12</td></tr></table></td><td>Factor each row and column. You must take the sign of the first term in each row and column.</td></tr>
<tr><td>$(x + 3)(x + 4)$
$x^2 + 4x + 3x + 12$
$x^2 + 7x + 12$</td><td>Write your answer and check your answer by multiplying.</td></tr>
</table>

Factoring Difference of Squares: We will use the same method as shown above.

<table>
<tr><th colspan="2">Example: What is the factored form of $x^2 - 49$?</th></tr>
<tr><td><table><tr><td>x^2</td><td></td></tr><tr><td></td><td>-49</td></tr></table></td><td>Draw a 2 x 2 box and write the first and last terms of the binomial in the box.</td></tr>
<tr><td><table><tr><th>Product</th><th>Sum</th></tr><tr><td>1×-49</td><td>$1 + (-49) = -48$</td></tr><tr><td>-1×49</td><td>$(-1) + 49 = 48$</td></tr><tr><td>7×-7</td><td>$7 + (-7) = 0$ ✓</td></tr></table></td><td>Find the factors of -49 and also give you the sum of the coefficient of b, which is 0. There is no middle term.</td></tr>
<tr><td><table><tr><td>x^2</td><td>$-7x$</td></tr><tr><td>$7x$</td><td>-49</td></tr></table></td><td>Once you find your two factors, enter those values, along with the variable x, into the two remaining boxes. The order doesn't matter.</td></tr>
<tr><td><table><tr><td></td><td>x</td><td>-7</td></tr><tr><td>x</td><td>x^2</td><td>$-7x$</td></tr><tr><td>7</td><td>$7x$</td><td>-49</td></tr></table></td><td>Factor each row and column. You must take the sign of the first term in each row and column.</td></tr>
</table>

$(x+7)(x-7)$ $x^2-7x+7x-49$ x^2-49	Write your answer and **check** your answer by multiplying.

Another method of factoring quadratics is using the grouping method. Video at **https://bit.ly/3cDMprB**
Practice: Factor completely.

1. $x^2+8x+15$	2. $x^2-11x+24$	3. $x^2+2x-15$	4. $x^2-4x-21$
5. x^2-9	6. x^2-121	7. $x^2-12x+36$	8. $x^2-16x+64$

Check & Reflect: Use page 28 to check your answers. What did you get correct? Can you work it a different way? What was incorrect? Can you find your mistake? What can you do differently?

Day 3: Factoring Polynomials when a ≠1
Number Sense Routine: Which One Doesn't Belong?

$(x-2)(x+2)$	$(2x-1)(x+4)$
$(x+4)(x+1)$	$(m-4)(m+1)$

Teaching
For today's lesson, we will focus on factoring trinomials ax^2+bx+c where $a \neq 1$.We will use the same method as yesterday. Factoring Trinomials by Grouping Video: **https://bit.ly/2yXm1ei**

<table>
<tr><th colspan="2">Example: What is the factored form of $5x^2-17x+6$?</th></tr>
<tr><td><table><tr><td>$5x^2$</td><td></td></tr><tr><td></td><td>6</td></tr></table></td><td>Draw a 2 x 2 box and write the first and last terms of the trinomial in the box.</td></tr>
<tr><td><table><tr><th>Product</th><th>Sum</th></tr><tr><td>-1×-30</td><td>$(-1)+(-30)=-31$</td></tr><tr><td>-2×-15</td><td>$(-2)+(-15)=-17$ ✓</td></tr></table></td><td>Multiply the coefficient of the first term, a, by the constant, c. In this example, multiply $5 \cdot 6 = 30$. Find the factors of 30 and that also give you the sum of the coefficient of b, which is -17.</td></tr>
<tr><td><table><tr><td>$5x^2$</td><td>$-15x$</td></tr><tr><td>$-2x$</td><td>6</td></tr></table></td><td>Once you find your two factors, enter those values, along with the variable x, into the two remaining boxes. The order doesn't matter.</td></tr>
<tr><td><table><tr><td></td><td>x</td><td>-3</td></tr><tr><td>$5x$</td><td>$5x^2$</td><td>$-15x$</td></tr><tr><td>-2</td><td>$-2x$</td><td>6</td></tr></table></td><td>Factor each row and column. You must take the sign of the first term in each row and column.</td></tr>
<tr><td>$(5x-2)(x-3)$
$5x^2-15x-2x+6$
$5x^2-17x+6$</td><td>Write your answer and check your answer by multiplying.</td></tr>
</table>

Practice: Factor completely.

1. $2x^2+5x+3$	2. $6x^2-5x-4$	3. $8x^2-10x-3$	4. $12x^2+11x-5$
5. $4x^2-4x+1$	6. $2x^2+17x-9$	7. $6x^2+7x+2$	8. $3x^2-7x+2$

Check & Reflect: Use page 28 to check your answers. What did you get correct? Can you work it a different way? What was incorrect? Can you find your mistake? What can you do differently?

Day 4: Dividing Polynomials

When we divide polynomials, it is the same as **simplifying a rational expression** or fraction.

Dividing Polynomials Video: **https://bit.ly/2U7k6v2**

Teaching

Example: What is the quotient of: $(3x^2-5x-2)\ \div\ (3x+1)$?	
$\frac{(3x^2-5x-2)}{(3x+1)}$	**Rewrite** the division problem as a fraction.
$\frac{(3x+1)(x-2)}{(3x+1)}$	**Simplify** both the numerator and denominator (if needed) **by factoring**. Use the same box method to factor that you did on Day 2 and Day 3 above.
$\frac{\cancel{(3x+1)}(x-2)}{\cancel{(3x+1)}}$	Divide out/**cancel common factors** (factors that are in both the numerator and denominator.
$x-2$	**Simplify**.

Practice: Simplify by dividing.

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

2. $(x^2+2x-8)\div(x-2)$

3. $\frac{(x^2-36)}{(x-6)(x+6)}$

4. $\frac{(x^2-10x-39)}{(x^2+6x+9)}$

5. $(2x^2+7x+6)\div(x+2)$

6. $\frac{(2x^2-17x+30)}{(3x^2-16x-12)}$

Check & Reflect: Use page 28 to check your answers. What did you get correct? Can you work it a different way? What was incorrect? Can you find your mistake? What can you do differently?

Day 5: Weekly Reflection - Today you will reflect on and summarize your learning over the week.
Simplify the following expressions:

1. $(x^2 - 4x + 3) + (3x^2 - 3x - 5)$	2. $(7x^2 - 3) - (5x^2 - 9)$	3. $(4x - 7)(x + 3)$
4. $(x - 5)(x^2 - x - 8)$	5. $\frac{(x^2 - 10x + 21)}{(x - 7)}$	6. $(4x^2 - 3x - 10) \div (x - 2)$

Factor completely.

7. $x^2 - 144$	8. $x^2 - 6x - 16$
9. $9x^2 - 12x + 4$	10. $8x^2 + 2x - 3$

Reflection 1: Two students simplified the following expression: $x^3 + x^3$. One student stated the answer: x^6. The other student stated the answer: $2x^3$. Which student is correct? Explain.

Reflection 2: Describe and correct the error. $\boldsymbol{x^2 - 10x - 24} = (\boldsymbol{x - 6})(\boldsymbol{x - 4})$

Reflection 3: What did you find challenging about this week's lessons?

Answer Guide: Day 1: Number Sense Routine: (sample answers) First one has a positive coefficient for the first term. Second one has a negative coefficient for the first and second term and subtraction and the constant. Third one simplifies to 0. Fourth one simplifies to a binomial. **Practice: 1.** $3x^3 + 3x^2 - 8x + 12$ **2.** $-3x^2 + 3x - 10$ **3.** $-8x^3 + 20x^2 + 32x$ **4.** $12x^2 + x - 63$ **5.** $4x^2 - 4x + 1$ **6**. $25x^2 - 49$ **7.** $3x^3 - 23x^2 + 34x - 24$

Day 2: Number Sense Routine: (sample answers) Alike: The two binomials multiplied equal the trinomial or when the trinomial is factored it equals the two binomials. Different: The two binomials need to be multiplied and the trinomial is already simplified. The trinomial is addition. **Practice: 1.** $(x + 3)(x + 5)$ **2.** $(x - 3)(x - 8)$ **3.** $(x - 3)(x + 5)$ **4.** $(x - 7)(x + 3)$ **5.** $(x - 3)(x + 3)$ **6.** $(x - 11)(x + 11)$ **7.** $(x - 6)^2$ **8.** $(x - 8)^2$

Day 3: Number Sense Routine: (sample answers) First one simplifies to a binomial; there is no middle term. Second one (bottom left corner) simplifies to a trinomial with all positive coefficients and constant. Third one (upper right-hand corner) simplifies to a trinomial with the first term coefficient greater than 1; other than 1. Fourth one (lower right-hand corner) simplifies to a trinomial and has the middle and last term as negative.
Practice: 1. $(x + 1)(2x + 3)$ **2.** $(3x - 4)(2x + 1)$ **3.** $(2x - 3)(4x + 1)$ **4.** $(4x + 5)(3x - 1)$ **5.** $(2x - 1)^2$ **6.** $(x + 9)(2x - 1)$ **7.** $(2x + 1)(3x + 2)$ **8.** $(x - 2)(3x - 1)$

Day 4: Practice: **1.** $\frac{(x + 3)}{(x + 2)}$ **2.** $(x + 4)$ **3.** 1 **4.** $\frac{(x - 13)}{(x + 3)}$ **5.** $(2x + 3)$ **6.** $\frac{(2x - 5)}{(3x + 2)}$

Day 5: Practice: **1**. $4x^2 - 7x - 2$ **2**. $2x^2 + 6$ **3.** $4x^2 + 5x - 21$ **4.** $x^3 - 6x^2 - 3x + 40$ **5.** $x - 3$ **6.** $4x + 5$ **7**. $(x - 12)(x + 12)$ **8.** $(x - 8)(x + 2)$ **9.** $(3x - 2)^2$ **10.** $(4x + 3)(2x - 1)$
Reflection 1: The second student is correct. When adding polynomials, you add the coefficients of the like terms, not the exponents. You add the exponents when multiplying like bases. **Reflection 2:** The two factors, -4 and -6, when multiplied, equal 24. You need to find two factors of -24. The two correct factors are -12 and 2. The correct solution is $(x - 12)(x + 2)$.

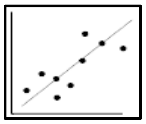
Quadratic Functions

Weekly Learning Outcome/Essential Question:
- **What are the different methods to solve quadratic equations?**
- **How can we use quadratic functions to model data?**

Day 1: Analyzing Quadratic Functions

Number Sense Routine: Which One Doesn't Belong? Why?

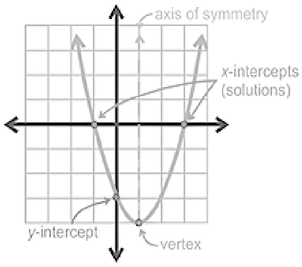
A. $y = -2x + 1$ **B.** $x^2 + 2x - 3$ **C.** $(x-1)(x+3)$ **D.**



Teaching

A **quadratic function** can be written in **standard form**, $ax^2 + bx + c$, where $a \neq 0$. The graph of a quadratic function is a **U-shaped curve** called a **parabola.** You can fold a parabola so that the two sides match exactly. This property is called **symmetry**. This fold or line that divides the parabola into two matching halves is called the **axis of symmetry**. The **highest** or **lowest** point of a parabola is its **vertex**, which is on the **axis of symmetry**. If $a > 0$ (positive), the parabola **opens upward** and the vertex is the **minimum** point. If $a < 0$ (negative), the parabola **opens downward** and the vertex is the **maximum** point. Characteristics of Parabolas Video: **https://bit.ly/3cEOK5t**

Example 1:



Up or Down: $\boldsymbol{a > 0}$ so up

Max or Min: minimum

Axis of symmetry: $x = 1$

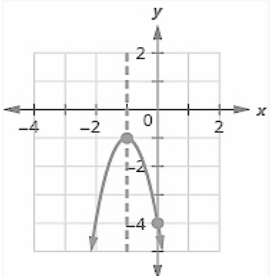
Vertex: $(1, -4)$

Domain: $\{x|x = R\}$

Range: $\{y|y \geq -4\}$

Solutions: x = {-1, 3}

Example 2:



Up or Down: $a < 0$ so down

Max or Min: maximum

Axis of symmetry: $x = -1$

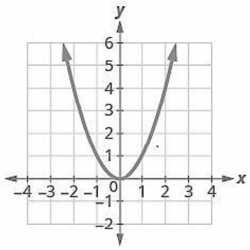
Vertex: $(-1, -1)$

Domain: $\{x|x = R\}$

Range: $\{y|y \leq -1\}$

Solutions: x = no solution

Example 3:



Up or Down: $\boldsymbol{a > 0}$ so up

Max or Min: minimum

Axis of symmetry: $x = 0$

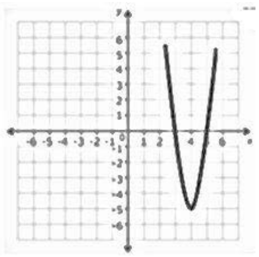
Vertex: $(0, 0)$

Domain: $\{x|x = R\}$

Range: $\{y|y \geq 0\}$

Solutions: x = {0}

Practice



1.

Up or Down: ____________

Max or Min: _____________

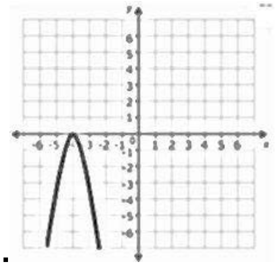
Axis of symmetry: _______

Vertex:_________________

Domain: _______________

Range: ________________

Solutions: ______________



2.

Up or Down: ____________

Max or Min: ____________

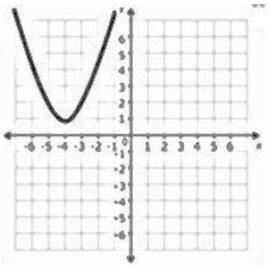
Axis of symmetry: _______

Vertex:_________________

Domain: _______________

Range: ________________

Solutions: _____________



3.

Up or Down:____________

Max or Min: ____________

Axis of symmetry: ______

Vertex:________________

Domain: _______________

Range: _______________

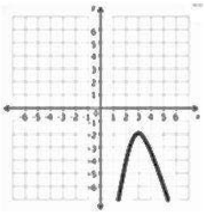
Solutions: _____________

Check & Reflect: Use page 35 to check your answers. What did you get correct? Can you work it a different way? What was incorrect? Can you find your mistake? What can you do differently?

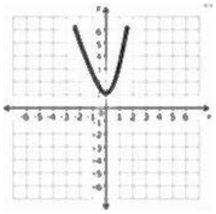
Day 2 : Solving Quadratic Equations by Factoring

Number Sense Routine: Which One Doesn't Belong? Why?

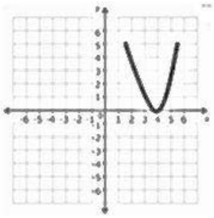
A.



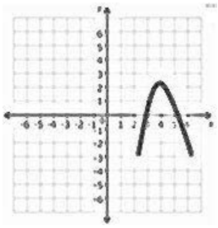
B.



C.



D.



Teaching

Today we will review how to solve quadratic equations by factoring and using the **zero-product property.** The **zero-product property** states that for any real numbers a and b, if $ab = 0$ then either $a = 0$ or $b = 0$. Solving Quadratics by Factoring Video: https://bit.ly/3eVn79N

Zero-Product Property Video: **https://bit.ly/2AGNhhV**

Desmos Calculator: https://www.desmos.com/calculator

<table>
<tr><th colspan="2">Example 1: What are the solutions of the equation $x^2 + 3x - 10$?</th></tr>
<tr><td>$x^2 + 3x - 10 = 0$</td><td>All equations must be written in standard form.
Set the equation equal to 0.</td></tr>
<tr><td>
1.
<table>
<tr><td>x^2</td><td></td></tr>
<tr><td></td><td>-10</td></tr>
</table>
2.
<table>
<tr><th>Product</th><th>Sum</th></tr>
<tr><td>-1×10</td><td>$(-1) + 10 = 9$</td></tr>
<tr><td>-2×5</td><td>$(-2) + 5 = 3$ ✓</td></tr>
</table>
3.
<table>
<tr><td>x^2</td><td>$5x$</td></tr>
<tr><td>$-2x$</td><td>-10</td></tr>
</table>
4.
<table>
<tr><td></td><td>x</td><td>5</td></tr>
<tr><td>x</td><td>x^2</td><td>$5x$</td></tr>
<tr><td>-2</td><td>$-2x$</td><td>-10</td></tr>
</table>
$(x + 5)(x - 2) = 0$
</td><td>Factor the trinomial. Remember to first look for the GCF. Next, remember the factoring method used.

Hint: Look back to week 4 in you need a reminder about how to factor the trinomial</td></tr>
<tr><td>$(x + 5) = 0$ or $(x - 2) = 0$
$x = -5$ $x = 2$</td><td>Set each factor equal to zero and solve for each for x.
(This is the zero-product property.)</td></tr>
<tr><td>$x = \{-5, 2\}$</td><td>Write your answer in set notation. These are the two solutions (also called roots, zeroes, or x-intercepts) where the parabola crosses the x –axis. Check your solution with the Desmos calculator.</td></tr>
</table>

Example 2	Example 3
$\boldsymbol{x^2 + 6x + 10 = 0}$ This equation cannot be factored. It is a prime polynomial; therefore, there is **no (real-number) solution**. This means that the parabola does not cross the x-axis. **Check** your solution with the Desmos calculator.	$\boldsymbol{x^2 - 2x + 1 = 0}$ $(x - 1)(x - 1) = 0$ $x - 1 = 0$ or $x - 1 = 0$ $x = 1$ or $x = 1$ $x = \{1\}$This means that the equation has **one solution** and therefore intersects the x –axis at one point. **Check** your solution with the Desmos calculator.

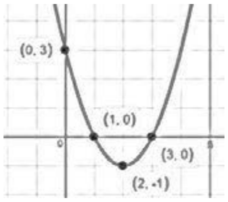
Practice: Solve by factoring.

1. $x^2 + 10x + 25 = 0$
2. $x^2 + 6x - 27 = 0$
3. $x^2 - 64 = 0$
4. $x^2 - 2x = 5$
5. $2x^2 + 7x - 5 = 4x$
6. $8x^2 - 22x + 5 = 0$

Check & Reflect: Use page 35 to check your answers. What did you get correct? Can you work it a different way? What was incorrect? Can you find your mistake? What can you do differently?

Day 3: Solving Quadratic Equations by Using the Quadratic Formula
Number Sense Routine: Which one does not belong? Why?

A.



B. $y = x^2 - 4x + 3$

C. $y = (x-2)^2 - 1$

D. $y = (x-1)(x-3)$

Teaching
When a quadratic equation cannot be solved by factoring, use the **Quadratic Formula**. In fact, you can use the Quadratic Formula to **solve ANY quadratic equation**. Video: https://bit.ly/3cxcAAb

Quadratic Formula:
If $ax^2 + bx + c = 0$, then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Example 1: What are the solutions of $2x^2 - 20 = -3x$? Use the quadratic formula to solve.	
$2x^2 + 3x - 20 = 0$	Write the equation in **standard form** ($ax^2 + bx + c = 0$)
$a = 2, b = 3, c = -20$	**Identify** a, b, and c.
$x = \frac{-3 \pm \sqrt{(3)^2 - 4(2)(-20)}}{2(2)}$	**Substitute** the values of a, b, and c into the quadratic formula
$x = \frac{-3 \pm \sqrt{169}}{4} = \frac{-3 \pm 13}{4}$	**Simplify**.
$x = \frac{-3+13}{4}$ *and* $x = \frac{-3-13}{4}$	Write as **two equations**.
$x = \frac{5}{2}$ *and* $x = -4$	**Simplify**.

Example 2: What are the solutions of $x^2 - 2x - 7 = 0$? Use the quadratic formula to solve.	
$a = 1, b = -2, c = -7$	The equation is in standard form, so just **identify a, b, & c**.
$x = \frac{2 \pm \sqrt{(-2)^2 - 4(1)(-7)}}{2(1)}$	**Substitute** the values of a, b, and c into the quadratic formula
$x = \frac{2 \pm \sqrt{32}}{2} = \frac{2 \pm 4\sqrt{2}}{2}$	**Simplify**. For this problem you will need to **simplify the radical**.
$x = 1 \pm 2\sqrt{2}$	Then, simplify the fraction because all terms are divisible by 2.

Practice: Use the **quadratic formula** to solve each equation.

1. $x^2 + 11x + 10 = 0$
2. $4x^2 - 13x = -3$
3. $x^2 + 16 = 11x$

4. $2x^2 - 9 = 0$
5. $-2x^2 + 6x + 9 = 0$
6. $6x^2 - 7x = 5$

Check & Reflect: Use page 35 to check your answers. What did you get correct? Can you work it a different way? What was incorrect? Can you find your mistake? What can you do differently?

Day 4: Application - Curve of Best Fit

Today we will review the **curve of best fit**. The **curve of best fit** is used with **quadratic functions** to show the relationship among a set of data points, and it can be used to interpret and make predictions. Curve of Best Fit Video: **https://bit.ly/3cCBXkb**

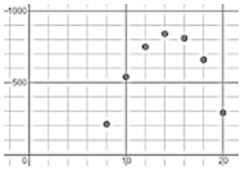
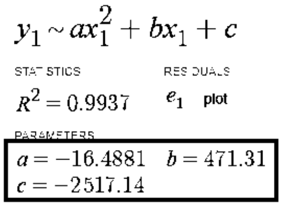
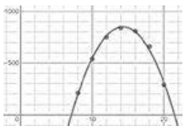
Example Problem

The table shows how a hair stylist's weekly profit (dollars is related to the price per haircut (dollars. Use the table to answer the following questions.

Price per Haircut, x(dollars)	8	10	12	14	16	18	20
Weekly Profit, y (dollars)	210	540	750	840	810	660	290

a. **Determine the curve of best fit that represents the data. (Round to the nearest tenth)**
b. **Predict the profit if the price per haircut is $15. (Round to the nearest whole number)**
c. **At what price per haircut is the weekly profit $700?(Round to the nearest whole number)**

To find the **curve of best fit**, start like the line of best fit problem from Week 2 Day 4.

	Put the data into a table in Desmos. Then, use the magnifying glass button to zoom fit to the data. *Notice this is a **quadratic regression** because it is in the shape of a parabola. The curve of best fit will be in the form of $y = ax^2 + bx + c$
$y_1 \sim ax_1^2 + bx_1 + c$ STATISTICS RESIDUALS $R^2 = 0.9937$ e_1 plot PARAMETERS $a = -16.4881$ $b = 471.31$ $c = -2517.14$	We again will use **~** because the curve of best fit is an **approximation**. **Enter $y_1 \sim ax_1^2 + bx_1 + c$ into line 2**. Again, notice x and y are labeled as x_1 and y_1 because we are using data in the table which is labeled x_1 and y_1.
	Here is the graph for the curve of best fit. Notice the curve of best fit does not go through all of the points but is an approximation of the trend of the data.

Now that we have created the graph and found the curve of best fit, we can answer questions a-c.

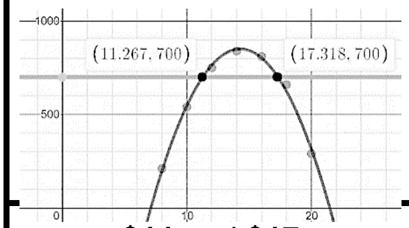
a. **Determine the curve of best fit that represents the data. (Round to the nearest tenth)**
   Use the $a, b,$ and c values from above, round each number to the nearest tenth, and substitute the values into $y = ax^2 + bx + c$.

$$y = -16.5x^2 + 471.3x - 2,517.1$$ **Curve of best fit equation**

b. Predict the profit if the price per haircut is \$15. (Round to the nearest whole number)

$y = -16.5x^2 + 471.3x - 2{,}517.1$ $y = -16.5(15)^2 + 471.3(15) - 2{,}517.1$ $y = -3{,}712.5 + 7{,}069.5 - 2{,}517.1$ $y = 839.9$	● Price per haircut is the $x$value so we have to substitute x to find the profit, y. ● Substitute 15 for x and solve for y.
\$840 profit	**If a haircut is \$15, the weekly profit will be \$840.**

c. At what price per haircut is the weekly profit \$700? (Round to the nearest whole number)

	● We want to find the price, x, for when the profit, y, is \$700 ($y = 700$) ● **Enter y = 700 into line 3 of Desmos.** ● The line will intersect the curve. Click on the points of intersection. ● The x-values for those points are your answers. Notice how the y-values are both 700.
\$11 and **\$17**	**The weekly profit will be \$700 if a haircut is \$11 or \$17.**

Practice: Bouncy Ball The table shows the height of a ball bouncing over time.

Time, x, in seconds	Height, y, in inches
1	10.8
2	11.4
5	9.6
6	7.8
7	5.4
8	2.4

1. **Find the equation for the curve of best fit for the data in the table. Round to the nearest tenth.**
2. **Predict what the height of the ball will be after 4 seconds. Round to the nearest tenth.**
3. **When will the ball hit the ground? ($y = 0$) Round to the nearest tenth.**

Check & Reflect: Use page 35 to check your answers. What did you get correct? Can you work it a different way? What was incorrect? Can you find your mistake? What can you do differently?

Day 5 – **Weekly Reflection:** Today you will reflect on and summarize your learning over the week.
Solve by factoring.

1. $x^2 + 18x = 4x - 49$
2. $4x^2 - 24 = 20x$

Solve using the quadratic formula.

3. $x^2 + 7x - 10 = 0$
4. $2x^2 - 5x = 0$

Reflection 1: When is it best to choose factoring or the quadratic formula? Which method do you prefer?

Reflection 2: Are there any topics covered in this workbook you now feel you have a better understanding? Are there any topics covered in this workbook you are having a difficult time understanding? What can you do to get help?

Reflection 3: With moving to distance learning and having to finish the school year online, what topics do you still find challenging? What are some ideas for how you can improve your understanding?

Answer Key

Day 1: Number Sense Routine: $\boldsymbol{y = -2x + 1}$because it is a linear equation. $x^2 + 2x - 3$ because it is a quadratic equation. $(x-1)(x+3)$ because it is the factored form of the quadratic equation. The graph because it is a scatter plot with a line of best fit. **Practice:**

1. Up or Down: $\boldsymbol{a > 0}$ so up	**2. Up or Down:** $\boldsymbol{a > 0}$ so down	**3. Up or Down:** $\boldsymbol{a > 0}$ so up
Max or Min: minimum	**Max or Min:** maximum	**Max or Min:** minimum
Axis of symmetry: $x = 4$	**Axis of symmetry:** $x = -4$	**Axis of symmetry:** $x = -4$
Vertex: $(4, -5)$	**Vertex:** $(-4, 0)$	**Vertex:** $(-4, 1)$
Domain: $\{x \mid x = R\}$	**Domain:** $\{x \mid x = R\}$	**Domain:** $\{x \mid x = R\}$
Range: $\{y \mid y \geq -5\}$	**Range:** $\{y \mid y \leq 0\}$	**Range:** $\{y \mid y \geq 1\}$
Solutions: x = {3, 5}	**Solutions:** x = {-4}	**Solutions:** x = no solution

Day 2: Number Sense Routine: 1. Graph has a negative first term coefficient and has no solution. **2.** Graph has a positive first term coefficient, has no solution, and a y-intercept of 1. **3.** Graph has a positive first term coefficient and one solution. **4.** Graph has a negative first term coefficient and two solutions.

Practice: 1. $x = \{-5\}$ **2.** $x = \{-9, 3\}$ **3.** $x = \{-8, 8\}$ **4.** $x = \textit{no solution}$ **5.** $x = \{\frac{-5}{2}, 1\}$ **6.** $x = \{\frac{1}{4}, \frac{5}{2}\}$

Day 3: Number Sense Routine: 1. It is a graph of the quadratic equation. **2.** It is a quadratic equation written in standard form. **3.** The equation needs to be simplified to standard form. **4.** The equation is in factored form.

Practice: 1. $x = \{-10, -1\}$ **2.** $x = \{\frac{1}{4}, 3\}$ **3.** $x = \{\frac{11 \pm \sqrt{57}}{2}\}$ **4.** $x = \{\pm \frac{3\sqrt{2}}{2}\}$ **5.** $x = \{\frac{3 \pm 3\sqrt{3}}{2}\}$ **6.** $x = \{-\frac{1}{2}, \frac{5}{3}\}$

Day 4: Practice: 1. $y = -0.3x^2 + 1.5x + 9.6$ **2.** $y = 10.8$ inches **3.** $x = 8.7$ seconds

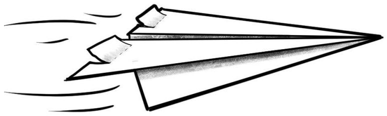
Day 5: Practice: 1. $x = \{-7\}$ **2.** $x = \{-1, 6\}$ **3.** $x = \frac{-7 \pm \sqrt{89}}{2}$ **4.** $x = \{0, 2.5\}$

Reflection 1: It is best to use factoring when you can easily factor the quadratic equation. The quadratic formula works 100% of the time but should be used when you have a prime polynomial.

SUMMER LEARNING QUEST:

Paper Airplane Challenge

For centuries, scientists and engineers watched birds fly and hoped to mimic flight. First attempts to design "flying machines" looked very much like birds; current airplanes still have some similarities.

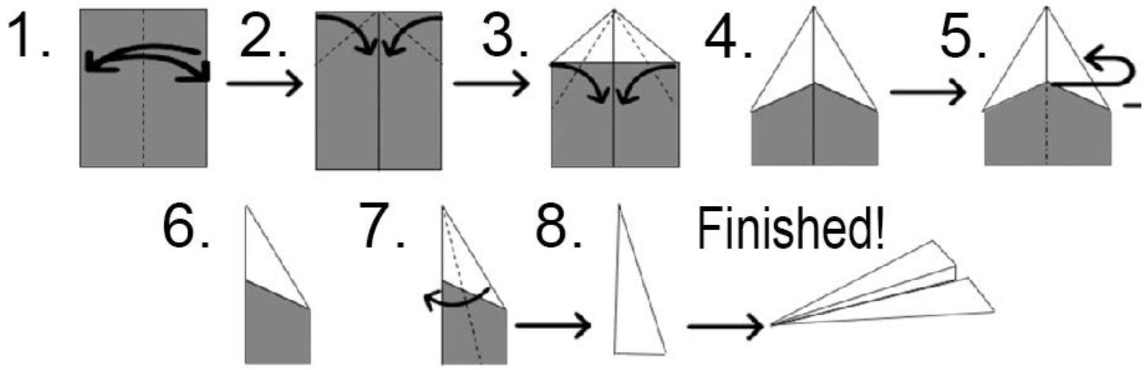


How can you design a paper airplane based on a bird's design that will fly the furthest distance?

Task Guidelines:

- Use one piece of paper per design.
- Experiment with paper airplane designs. Try at least two designs.
- Consider using the steps below for your first design, then experiment on your second idea.

DESIGN: If you need a sample, follow the steps to make a simple paper airplane.
Take your time and make nice folds like you are in art class!
If you already have experience, design your own from the start



Plan: Make a detailed drawing of your airplane or designs. Consider the steps and folds you made to create your best airplane design. Use the space below.

Go to the next page to test and revise your airplane design!

Test: Find a place to test your airplane. A sidewalk with adult permission works great.

- Measure the distance in steps or count sidewalk blocks.
- Adjust how hard or soft you throw the plane.
- Try your test several more times. Did you get the same results? Which design worked best?

How Far does it go?

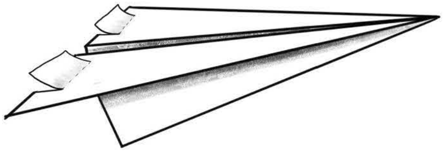
Test 1	Test 2	Test 3
On the first try, it went :	One the second try, it went:	On the third try, it went:

Improve: Use this chart to think about your ideas

What worked well?	What didn't work?

My ideas to make my design better

- When you change your design, how many more blocks or inches do you think it will fly or sail?
- Did your plane fly straight down the sidewalk?
- What changes can you make for it to fly more straight?



Share your work

☐ Family ☐ Friend ☐ Someone else

Ask about designs they may know or think of.

What makes them think of that idea?

Think about your work:

What did you like best?

What could you make better?

What is unique about your design?

Questions and ideas to take this project further:

- Learn more about flight at: https://howthingsfly.si.edu/ and examples from nature: https://www.audubon.org/news/these-paper-airplanes-fly-birds
- What was the average distance of each plane design? Graph your data.
- Observe birds and airplanes in flight. Make notes about the differences in how they fly.
- Design and test more complex designs! See additional ideas at: https://howthingsfly.si.edu/activities/paper-airplane.

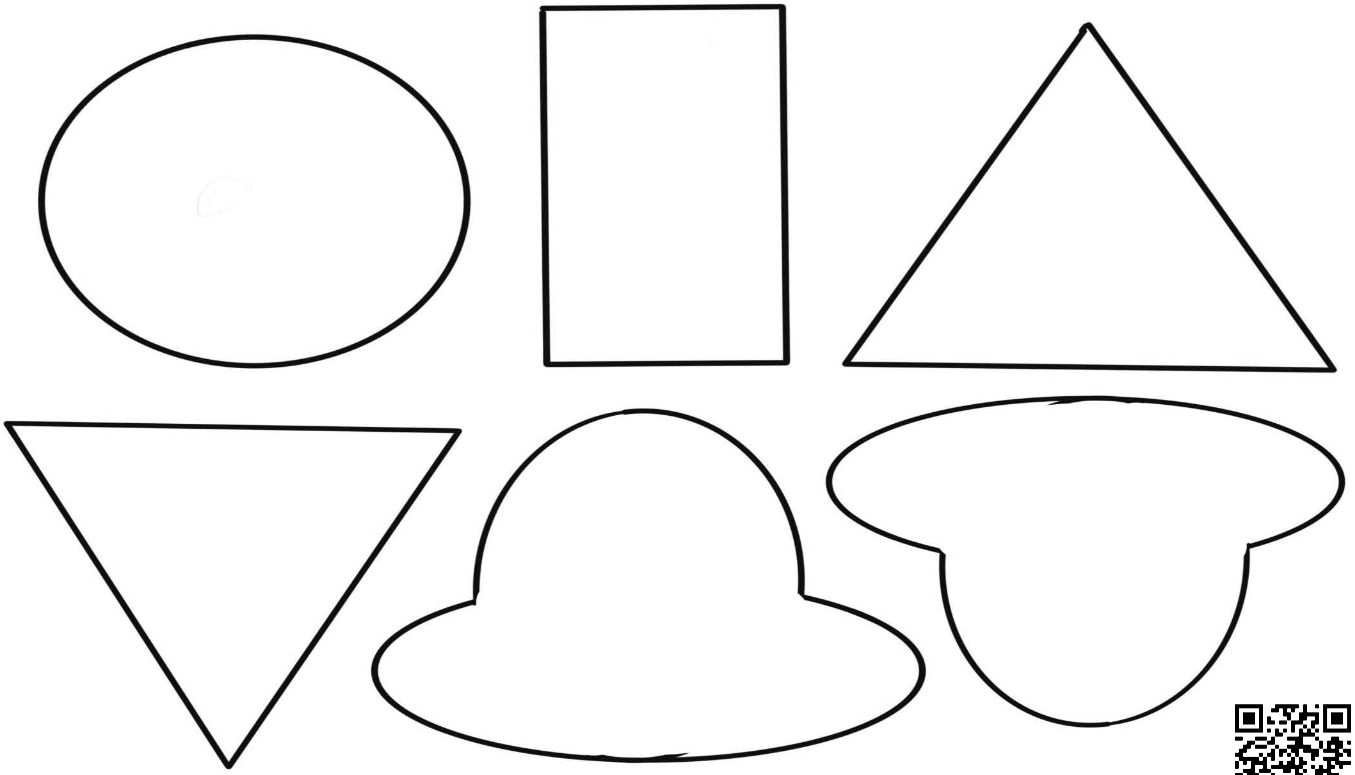
SUMMER LEARNING QUEST:
CARTOONING WITH SIMPLE SHAPES

Today: you're a critical and creative thinker who can create unique ideas

Take a look around! What shapes do you see?
Most things are made up of simple shapes– from tables,
to televisions, and even our iphones and ipads.
Today we're going to use the simple shapes to build
creativity and have fun!

How can you, as a cartoonist, create unique characters from simple shapes?

Your task: Use the shapes below to create characters. Be creative and draw light!

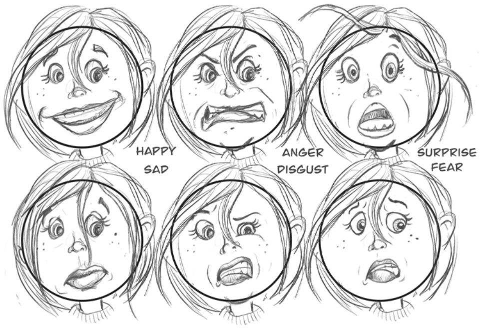


To go even deeper into cartooning with shapes, visit: https://bit.ly/shapecartooning

Reflect: Which of your designs is best? Why? What could you do to make it even better?

Ideas to take it further:

- Give your favorite design a name
- Now that you know your design is made from a basic shape, consider making the same character again. This time, add emotion by changing the eyebrows, eyes and mouth! →
  (Try happy, angry, surprise, sadness, disgust and scared)
- Remember– you can do this anytime! Just draw shapes and start creating!



SUMMER LEARNING QUEST:
WHAT SHOULD YOU KNOW ABOUT COVID-19?

What can I do to prevent spreading COVID-19?

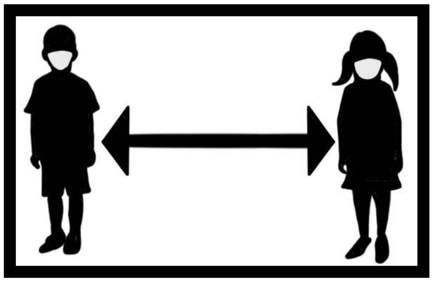
WASH YOUR HANDS:

Wash your hands with warm water and soap for 20 seconds (sing Happy Birthday twice), especially:

- After being in public places and touching door handles, shopping carts, elevator buttons, etc.
- After using the bathroom
- Before preparing food

If soap and water are not available, use hand sanitizer with at least 60% alcohol.

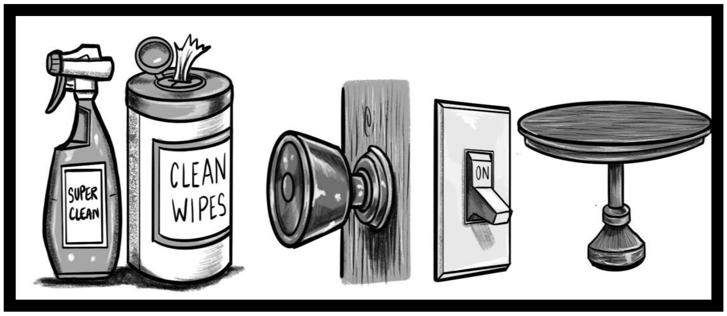
SOCIAL DISTANCE:



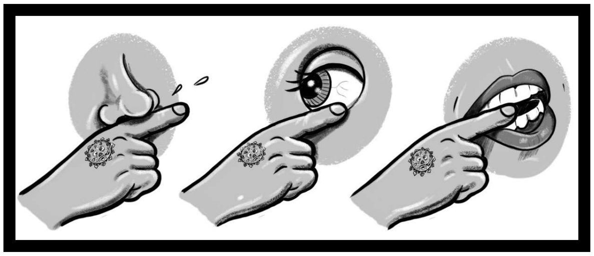
- Stay at least six feet away from others in public places.
- Stay home as much as possible and reduce visitors.
- Call friends and family or visit by video.

DO YOUR PART TO NOT SPREAD GERMS:

Clean and disinfect all counters, knobs, and other surfaces you and your family touch several times a day.



If you cough or sneeze, do so in the bend of your elbow. If you use a tissue, throw it away immediately.



Avoid touching your eyes, nose, or mouth, especially with unwashed hands.

Look at the back cover of the English Language Arts Practice Book to learn more about COVID-19!

Information Sources: Centers for Disease Control and Prevention, Mayo Clinic, Nemours Children's Hospital