Ideas to Create Tasks

- Always, Sometimes, Never

- Open Middle Problems

- Justify your solution

- Notice & Wonder

Algebra 1 2016 SOL

Share these tasks using this link:

https://tinyurl.com/alg1btc

Algebra 1 2023 SOL Tasks:

https://tinyurl.com/alg1btc2023SOL

Provide the answer. Ask for the question.

Example 1: Instead of, “Round 5.94 to the nearest tenth,” try, “A number was rounded to 6. What could be the number?”

Example 2: Instead of, “Find the sum of 3,6, and 8,” try, “The sum of three numbers is 17. What could be the numbers?”

Example 3: Instead of, “What is the perimeter of a pool whose length is 50 yards and width is 25 yards?” try, “The distance around the rectangular swimming pool at the park is 150 yards. How long and how wide could the pool be?”

Ask students to choose the numbers in a task.

Example 4: Instead of a problem with all but one of the quantities given, try multiple quantities unknown, such as: “Taylor walked ☐ blocks to school. After school she walked ☐ blocks to the store, and then ☐ blocks to get home. She walked a total of ☐ blocks.”

Example 5: Use any digits between 0-9 in the boxes to make a correct equation. You may only use a digit once in the equation ☐☐ + ☐ = ☐☐ – ☐ What is the smallest value that could be on each side of the equation? What is the largest value?

Ask for similarities or differences.

Example 6: Instead of, “Name 3 numbers that are multiples of 5, and three that are not,” try, “How are 5 and 100 alike? How are they different? Find as many ways as you can.”

Example 7: Instead of, “Describe the characteristics of right triangles,” try, “How are these shapes alike? ◤▲ How are they different?”

Ask for contexts for numerical expressions.

Example 8: Instead of “Find the number of plants in a garden with 6 rows of 4 plants each,” try, “Create a real-world question where you might have to find 6×4 to answer the question. Find the product and answer your question.”

Ask for a mathematical sentence that includes certain numbers and words.

Example 9: Create a sentence that includes the numbers 3 and 4 along with the words “more” and “and.” You’ll have to use some other words too.

Provide a real-world situation that requires mathematics. Provide areas of ambiguity so students can make choices.

Example 10: Instead of, “Use the menu to find the cost of 2 hot dogs and a soda,” try, “You and 3 friends have $50 to spend on lunch. Use the menu to decide what to buy and how much it will cost.”

Links to Other Tasks

Non-curricular:

https://docs.google.com/spreadsheets/d/11U5TqWgHXZOSGTCto0DCpxHOabxS5PxQnTcNBLtl20w/edit#gid=1244453073

https://mathequalslove.net/puzzles/

Curricular:

https://www.openmiddle.com/

https://mathmedic.com/course/Algebra-1

https://docs.google.com/spreadsheets/d/1-tJ2DzGJ0JXpmcRJoJxsVBA3d0_2ygxfjH3c1s2GqLM/edit#gid=0

https://variationtheory.com/category/algebra/

https://www.doe.virginia.gov/teaching-learning-assessment/k-12-standards-instruction/mathematics/instructional-resources/rich-mathematical-task#Alg1

Quick Links to Units

Unit 0 - Day 1 - Non-Curricular (Simplify Expressions)

Team Venn Diagram (3 people) - Create a Venn Diagram as a class with two topics. Expand to three topics. Have students create a Venn Diagram in their groups with each team member in a circle.

1-100 Number Search (3 people): https://www.saravanderwerf.com/100-numbers-to-get-students-talking/?scrlybrkr=b92f5634

Create Group Work Rules & Procedures

Simplify Expressions Thin Slicing
$4x - 2y + 6y - x$
$11y + 10 + 5y^2 - 4$
$2(3x - 1)$
$5 + 3(x + 2)$
$-(4x + 3)$
$7 - (2x - 1)$
$2x + 3(x + 3)$
$6(x + 2) + 5(2x + 6)$
$4(x + 1) - 3(5x - 1)$

Extensions:
Can 30x - 12 be the result of using the distributive property? If it is, find the possible combinations of factors whose product would be 30x - 12.

Possible solutions include:

$1(30x - 12)$

$2(15x - 6)$

$3(10x - 4)$

$6(5x - 2)$

considering negatives:

$-1(-30x + 12)$

$-2(-15x + 6)$

$-3(-10x + 4)$

$-6(-5x + 2)$

Unit 0 - Day 2 - Non-Curricular (Evaluate Expressions)

Four 4’s
Use exactly four 4's to form every integer from 0 to 20. Can use: + − × / () . √ ² !

Evaluate Expressions Notice & Wonder
Is there a difference between -3^2 and $(-3)^2$? Explain.

$\sqrt{81} + (-2)^2$
$\sqrt{a} + b^2$ if a = 25 and b = -4
(-5)(3) + 6/3
xy + x/2 if x = 2 and y = 7
$\sqrt[3]{27}/(-5)^2$
$\sqrt[3]{p}/t^2$ if p = 125 and t = -1

Unit 0 - Day 3 - Non-Curricular (Translating & Prime Factorization)

100 Lockers (Prime Numbers)
Imagine 100 lockers numbered 1 to 100 with 100 students lined up in front of those 100 lockers:
The first student opens every locker.
The second student closes every 2nd locker.
The 3rd student changes every 3rd locker; if it's closed, she opens it; if it's open, she closes it.
The 4th student changes every fourth locker.
The 5th student changes every 5th locker.
That same pattern continues for all 100 students.
Here's the question: "Which lockers are left open after all 100 students have walked the row of lockers?"

Answer: The perfect square lockers (1, 4, 9, 16, 25, 36, 49, 64, 81, and 100) are the only lockers left open.

Make a Cake (Prime Factorization)
Pick numbers and show students how to factor to prime factorization using the tree method and cake method.

Unit 0 - Day 4 - Simplify Numerical Radicals

Square Artist: Toni Ravioli is an artist who really likes squares. I mean, he is obsessed with them. He refuses to create any other shape in his art. During a trip to his home town in Italy, he purchased a beautiful collection of small square pieces of colorful glass tiles that are all the same size from a small thrift store on Main Street. He wants to design some square mosaic art pieces using the tiles. How many tiles does he need to make a completely filled in square design? What is the smallest number of tiles? Biggest? Is there a pattern to the amounts?

Toni decides to use 64 tiles. What are the lengths of the sides of the design? What if he used 100 tiles? His niece comes to visit and decides that she will create a design using 125 tiles. What are the lengths of her piece?

Discuss.

$\sqrt{25}$ together
$\sqrt{72}$ together
$\sqrt{125}$
$\sqrt{20}$
$\sqrt{50}$
$\sqrt{224}$
$\sqrt{360}$
$\sqrt{100}$
$\sqrt[3]{120}$
$\sqrt[3]{54}$
$\sqrt[3]{432}$
$\sqrt[3]{875}$
$\sqrt[3]{1000}$

Discuss negative roots.

$\sqrt{-25}$
$\sqrt[3]{-24}$

Discuss coefficients.
$5\sqrt{40}$
$2\sqrt[3]{108}$

Extensions:
What was the original question if $4\sqrt{10}$ is the solution?
Create a problem so that when simplified, the number outside is the same as the number inside. What is the smallest value this works for? Largest?

Alternate Thin-Slicing:
https://docs.google.com/document/d/1rLNGdRKRIfElnjliwHgKlCtKXp3hbl8PV6QGVdA0Cf4/edit

Unit 1 - Day 1 - One- and Two-Step Equations

We are going to play “Guess My Number.” I will give you one hint. When you add 3 to my number, you get 15. Thumbs up when you know my number. How can you prove that’s my number?

I have another number. My hint is when you double my number and add 1, you get 17. Prove it.

Now solve $x + 6.13 = 18.59$.

$x - 7 = 10$
$x + 3 = 10$
$-2 = x - 7$
$3x = 54$
$-121 = -11x$
$x/4 = 12$
$x/-7 = 7$
$1/2x = 8$
$3/4x = 27$
$2x - 5 = 15$
$1/3x + 6 = 9$
$8 = 3x - 1$
$7 - 2x = -13$
$x/5 + 7 = 2$
$(x - 1)/5 = 2$
$(6 + x)/3 = 4$
20 more than a number is 92
6 less than a number is 18
$d = tx$
$b = a + x$
$m + x = 16$
$v = 2x - y$
$y = mx + b$
$x + 4y = 5$ (solve for y)

Extensions:
$\square x + \square = \square$
Create an equation such that the solution is your age.
Create an equation that has a solution of zero.

Unit 1 - Day 2 - Multi-Step Equations (Variables One Side)

Moving in with Friends: Sophia is a fashionista finishing up a paid internship at a very well known clothing brand company. She is looking forward to moving to Atlanta with her friends because she has always admired the fashion forward styles she sees there. During her internship, she saved up $5,000 so she can share an apartment with her friends in Atlanta. She'll be interviewing and looking for a job once she gets down there. How long can she live there before she really needs to get paid?

Her portion of the one-time deposit for the apartment is $400. She will need to pay $600 a month to cover her portion of the rent and utilities. She thinks she'll need $300 for groceries and other needs.

Discuss. (Students will round down to 5. Ask them what if the solution is 5.999? Would you round up or down?)

$5x + 3 + 2x + 1 = 32$
$x + x + 6 + 2 = -2$
$3x + x + 1 + 4 = 9$
$7x - 4x + 6 - 1 = 2$
$2(4x - 1) = 22$
$-5(2 + 3x) = 80$
$4(x - 9) + 3 = 47$
$2 + 3(x - 5) = -19$
$8 - 2(x - 4) = 14$
$5 - 6(2x + 4) = 5$
$4x + y + 2x = z$
$5(2x - y) = 10$

Extensions:
Create a multi-step equation that has a solution of zero. $\square(\square x + \square) = \square$

Unit 1 - Day 3 - Review (Error Analysis and Writing)

Non-curricular Task: Znorlian Alien Language (promotes knowledge mobility):
https://www.eeps.com/pdfs/Znorlian.pdf

Error Analysis and Writing:

1. $-6t = 30$

$\frac{-6}{-6} \quad \frac{t}{-6}$

$t = 5$

2. $\frac{3}{4} \cdot \frac{3}{4}x = 12 \cdot \frac{3}{4}$

$x = 9$

3. $8 - 5c = -37$

$-8 \quad -8$

$\frac{-5c}{-5} = \frac{-45}{-5}$

$c = 9$

4. $\frac{x+1-1}{3} = 2-1$

$3 \cdot \frac{x}{3} = 1 \cdot 3$

$x = 3$

5. $4x - 3 = 17$

$+3 \quad +3$

$\frac{4x}{4} = \frac{20}{4}$

$x = 16$

6. $3(2x - 4) = 8$

$6x - 4 = 8$

$+4 \quad +4$

$\frac{6x}{6} = \frac{12}{6}$

$x = 2$

7. $3x + 2x - 6 = 24$

$-2x \quad -2x$

$x - 6 = 24$

$+6 \quad +6$

$x = 30$

8. $5x + 1 = -2x - 8$

$3x + 1 = -8$

$-1 \quad -1$

$\frac{3x}{3} = \frac{-9}{3}$

$x = -3$

9. $-2(x - 2) = 14$

$-2x - 4 = 14$

$+4 \quad +4$

$\frac{-2x}{-2} = \frac{18}{-2}$

$x = -9$

10. $3(2x + 1) + 4 = 10$

$6x + 3 + 4 = 10$

$9x + 4 = 10$

$-4 \quad -4$

$\frac{9x}{9} = \frac{6}{9}$

$x = \frac{6}{9} = \frac{2}{3}$

Intro to Multi-Step Equations with Variables on Both Sides:
Zacari spends the same amount of money each morning. On Sundays, he buys a newspaper for $1.25 and two donuts. On Mondays, he buys a newspaper for fifty cents and five donuts. What is the cost of one donut?

Unit 1 - Day 4 - Multi-Step Equations (Variables on Both Sides)

Always, Sometimes, or Never True:
Birds can fly.
❤❤ = ❤❤
☺☺ = ☺☺☺
3 = 3
4 = 2
x = 5
2x = 10
x + 2 = x + 1
2x - 3 = 3 - 2x
x + 2 = x + 16
3 + 2x = 5x
4(x - 2) = 4x - 8
6x - 4 = 3(2x - 4)
3x - 4 = 3x + 8

Extension: x/4 = y + 4

Discuss.

Solve:
6x - 4 = x - 9
-33x + 1 = 2x - 6
4 + 7x = 24 - 2x - x
5(2x - 2) = 9x - 10
8(1 - x) + 3 = -5
2x - 5y = 3x + 10
4m + 2(x - 1) = 5x

3(x + 1) = 3x - 2
5x + 7 = 2x + 3x + 7
2x + 7 = 7

Unit 1 - Day 5 - Translate & Solve (Word Problems)

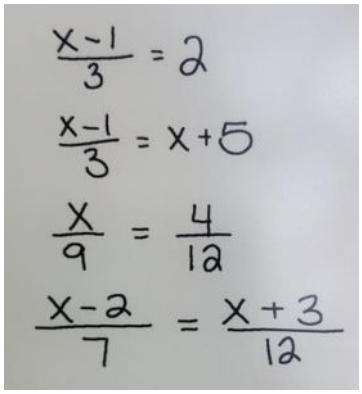
YouTube Subscribers: Ahmad and JR are competing for YouTube subscribers. They make a deal that whoever has the least amount of subscribers in 6 months will wash the winner's car. Ahmad starts with 215 subscribers and gains 25 every month. JR starts with 140 subscribers and gains 40 a month.

Who wins?
When did they have the same number of subscribers?

Word Problems Walkabout:
https://docs.google.com/presentation/d/16_Bh_yAaVYJLORqV4PQlwXUZ3hb5XwEyV9XCmssqBLw/edit?usp=sharing

Unit 1 - Day 6 - Proportions

Thin-Slicing:



Extension: Why does cross multiplication work? (What are we really doing when we cross multiply?)

Use the integers 1 - 9 only once to create a solution as close to zero as possible.

$$\frac{x + \square}{\square} = \frac{x - \square}{\square}$$

Unit 1 - Day 7 - Literal Equations

Formula Sheet: [Give students a geometry formula sheet.] What do you notice and wonder about the equations that you see on the formula sheet? (Hopefully someone will notice that all of the equations are solved for area or volume.) Why are they like that? Discuss. There are situations where we need to know a different piece of information like length or height.

How can I manipulate this formula to solve for the missing length instead of the area?

$A = lw$ (solve together)

Now, solve this formula for m: $T = m + n$

$p = r - t$ (for r)
$a = b/c$ (for b)
$V = lwh$ (for h)
$T = 2p + r$ (for p)
$M = n - 3x$ (for x)
$x - 2y = 5$ (for y)
$ax + by = c$ (for y)

Extension: Make up your own literal equation that has 3 or more variables and two or more operations. Solve it for a chosen variable.

Unit 1 - Day 8 - Unit Review

Nate is going to order new jerseys for his baseball team. The jerseys will have the team logo printed on the front. Nate asks 2 local companies to give him a price.

1. ‘Print It’ will charge $21.50 each for the jerseys.

Using n for the number of jerseys ordered, write an expression to show the total cost of jerseys from ‘Print It’.

2. ‘Top Print’ has a one time setting up cost of $70 and then charges $18 for each jersey.

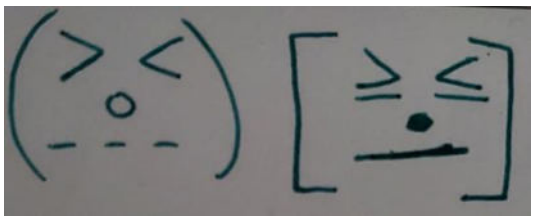
Using n to stand for the number of jerseys ordered, write an expression to show the total cost of jerseys from ‘Top Print’.

3. Use the two expressions from questions 1 and 2 to figure out how many jerseys Nate would need to order for the price from ‘Top Print’ to be the same as ‘Print It’.
Explain (in detail - each step) how you figured it out.

4. Nate decides to order 30 jerseys from ‘Top Print’.
How much more would the jerseys have cost if he had bought them from ‘Print It’?

Unit 2 - Day 1 - One- & Two-Step Inequalities

Notice & Wonder: Inequality Faces



Graph:
$x \geq 2$
$5 > x$
$x \leq -1$
$-3 < x$

Discuss. (You should rewrite the inequality so that the variable is on the left before graphing.)

Solve and graph.

$\frac{v}{3} \geq -14$

$-30 \geq n - 14$

$13m > 195$

$8 - n < 22$

$-7 \geq 3r - 4$

$\frac{r}{15} + 4 \geq 3$

$35 \leq -10 + 5x$

$-4 \geq 6 - 10b$

$3 > \frac{-8 + x}{2}$

$\frac{v}{10} + 10 < 11$

$-27 \leq 1 + 2x$

$\frac{-6 + m}{10} \leq -1$

Extension:

13) $3(2 + 5x) \leq 81$

14) $4(1 - 6k) \geq 100$

15) $3(1 + 5n) < 108$

16) $-145 > 5(3x - 5)$

Unit 2 - Day 2 - Multi-Step Inequalities

Always, Sometimes, Never True: Cereal is soup.

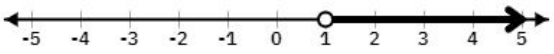
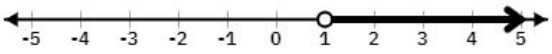
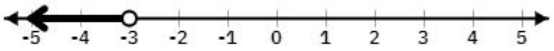
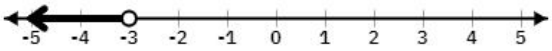
$2x + 1 + 2x < 3x - 5$	$(x < -6)$	Sometimes
$5(x + 3) \geq x + 15 + 4x$	(All Real Numbers)	Always
$6 - 3x > -(3x - 6)$	(No Solution)	Never
$2x + 8 \leq 2(x + 5) + 3$	(All Real Numbers)	Always
$x - 5 > x + 4$	(No Solution)	Never

Solve:

$-180 \geq -4(3+7n)$	$n \geq 6$
$4(7-8k) < 220$	$k > -6$
$-328 > 8(1+7n)$	$n < -6$
$240 > 6(6x+4)$	$x < 6$
$5+2x+3x < -15$	$x < -4$
$n+n < -10$	$n < -5$
$15 > 2(-7r+6)-3(-7r-8)$	$r < -3$
$8 \geq 2(4a+8)-8(a-7)$	no solution
$2x+3x \leq 5+6x$	$x \geq -5$
$-8v-3 \geq 12+7v$	$v \leq -1$
$-7-4x \geq x+3$	$x \leq -2$
$-2n > -2(n+1)$	all real numbers
$16-4n \geq -8(-7n-2)$	$n \leq 0$
$-1+5v > -(v+7)+3v$	$v > -2$

Unit 2 - Day 3 - Set & Interval Notation

Notice & Wonder:

Set Notation	Interval Notation
 {x | x > 1}	 (1, ∞)
 {x | x ≥ -2}	 [-2, ∞)
 {x | x ≤ 0}	 (-∞, 0]
 {x | x < -3}	 (-∞, -3)
 {x | x ϵ ℝ}	 (-∞, ∞)

X < -5
GRAPH:
SET NOTATION:
INTERVAL NOTATION:

X ≥ 1
GRAPH:
SET NOTATION:
INTERVAL NOTATION:

X > -7
GRAPH:
SET NOTATION:
INTERVAL NOTATION:

X ≤ 9
GRAPH:
SET NOTATION:
INTERVAL NOTATION:

X > -12
GRAPH:
SET NOTATION:
INTERVAL NOTATION:

X ≤ -4
GRAPH:
SET NOTATION:
INTERVAL NOTATION:

ALL REAL NUMBERS
GRAPH:
SET NOTATION:
INTERVAL NOTATION:

X ≥ 8
GRAPH:
SET NOTATION:
INTERVAL NOTATION:

X < 2
GRAPH:
SET NOTATION:
INTERVAL NOTATION:

Unit 2 - Day 4 - Inequality Word Problems

Sebastian is planning a movie night for his friends at his house. He wants to buy everyone (including himself) their own bag of popcorn, bottle of soda, and small box of candy. He also has to pay $12 to buy the movie on Amazon. Sebastian wants to spend no more than $30. How many friends can he have over?

(Students must decide how much the popcorn, soda, and candy costs.)

Discuss.

Walkabout: https://docs.google.com/presentation/d/1iXxZVz-NhGoSyFdvyhzsy8UYhLtRLl5_uPIGGDZtCNU/edit#slide=id.p

Unit 3 - Day 1 - Relations & Functions

People Watching: Ms. Noseypants is a retired journalist who loves to go to the mall to people watch! She likes to find a nice cozy bench to cuddle up with her handmade blanket. One day, she was really curious about what people were buying from the vending machine next to her bench. Keep track of what she sees.

Someone pushed B and got a Coke. Another person pushed C and got a Sprite. A, Coke. C, Sprite. A, Coke. E, Water

Can you find different ways to represent this information? (Students work together.)

Discuss: List of ordered pairs, table, mapping, graph, domain & range. Does the machine seem to be functioning?

Ms. Noseypants goes back to the same bench a week later and watches again, except this time one of the customers was upset about what they received.
A, Coke. B, Coke. A, Coke. C, Sprite. B, Water. C, Sprite

Why was the person upset? Is this machine functioning? What is a rule that we can write that would describe when something is a function and when it is not?

Give practice worksheet identifying functions.
Discuss how to determine if the graph of a relation is a function or not.

Extensions:

Ask students to create examples of functions/not functions. (tables, mappings, graphs.)

Ask students to create a relation with a domain of {1, 4, 5} and a range of {2, 3}. (multiple representations.)

Unit 3 - Day 2 - Functions, Domain, & Range (from a graph)

Quick Practice: Give students a few graphs of inequalities on a number line to write the inequality statements. Make some horizontal (domain) and some vertical (range). Also make some have two endpoints.

The Floor Is Lava: (Once all students come in - sit on a chair or table) Don't be alarmed, but the floor is now lava. However, this only applies to your teacher! I do have these few pieces of paper with me that could help me to not step on the lava, but I need your help to figure out the best path to make it out of the classroom. On your boards, draw the situation and show me where I should place the papers so I can safely cross the lava to get out of the room.

(Hopefully, students put the papers down in a discrete pattern.)
Oh my! There is a snail next to me! He won't let me pick him up. How can I put the paper down to help the snail escape the classroom? (Continuous)

Discuss the difference in the paths.

Thin-Slicing: Can print and cut out each row. Have students state the domain and range and determine if it is a function for 3 graphs at a time. Tell students that when they look for domain, they are only allowed to say left and right (not up or down). When they look for range, they are only allowed to say up and down. Stop to discuss as needed. For example, stopping to discuss after 2A is necessary to show students that instead of listing numbers, they should write all real numbers.

https://docs.google.com/presentation/d/1S5kTCos4MPh9AJBIbI_co69XGEll4hVqW-gtlJ_0ur0/edit?usp=sharing

Unit 3 - Day 3 - Review

Curated Work of Substance

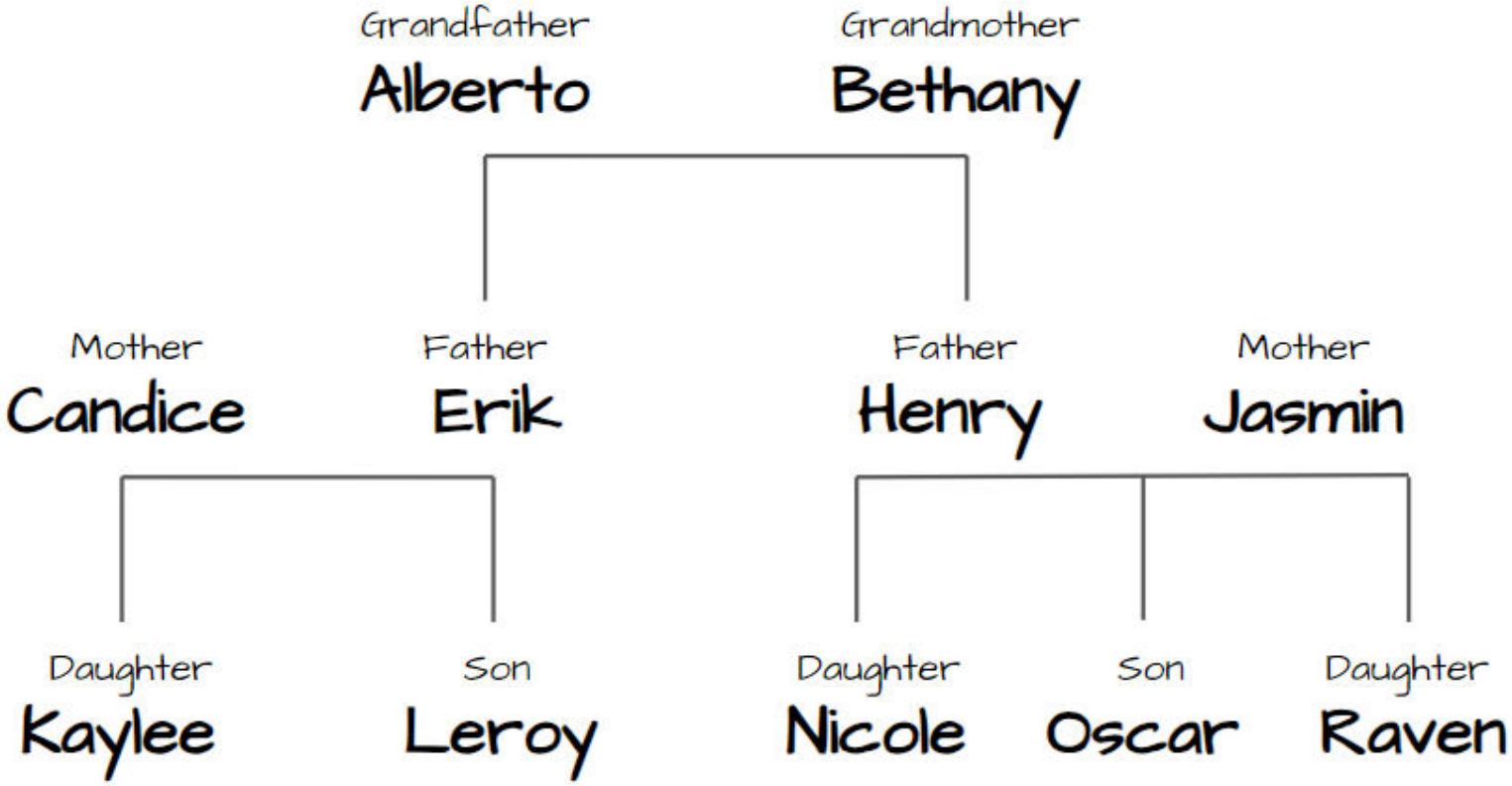
https://docs.google.com/document/d/1buMLTQ4kxsonlZNNO053UGuKzpD-RTpy3VH1yWHKXH8/edit?usp=sharing

Reflection Template

https://docs.google.com/document/d/1L1d7Kbc2ONrTSiFtIvSM-G41zIciXLWHjivCinv7z1w/edit?usp=sharing

Unit 3 - Day 4 - Function Notation

Family Tree



If f(N) = H, what does f(K) = ? How do you know?
If s(C) = L, what does s(J) = ? How do you know?
How could you write “Who is the mother of Henry?” in function notation?
How could you write “Who is the daughter of Erik?” in function notation?
m(K) =
s(A) =
d(J) =
f(H) =
s(B) =

Extension: Create your own family tree and write some statements in this format about it.

We can use this same type of notation in math to represent functions. (Put the following equations on the board, but explain that we will replace the y with f(x), g(x), and h(x).

$y = 2x + 1$ $y = x^2 - x + 1$ $y = 5 - x$

Find:
f(4) =
g(-2) =
h(-3) =
f(1) =
g(5) =
h(7) =

Find x if f(x) = -15
Find x if f(x) = 11
Find x if h(x) = 7

***Need to practice from a graph.

Unit 3 - Day 5 - Slope (Two Points & Graph)

Halloween Candy: Little Brandon dressed up as Spider-Man for Halloween and got a ton of candy when he went trick-or-treating! He starts eating 2 pieces of candy every 4 minutes. Make a table and a graph that represents the situation if x represents minutes and y represents total pieces of candy eaten.

Discuss.
What is the rate of change? (How much candy is he eating vs. how many minutes?)
What would the graph look like if the rate of change was negative?
Discuss Rise/Run.

Give graphs. Find slope.
With points: https://www.mathworksheets4kids.com/slope/rise-run-level1-1.pdf
Without points and zero & undefined: (The last one does not have two good points.)
https://www.mathworksheets4kids.com/slope/type-of-slope1.pdf

Ask students to find the slope of the line passing through the points (1, 3) and (4, 8). (Students should graph the points and count slope.) Ask them if they can also prove their work algebraically and come up with a rule/formula that would always work to find the slope algebraically.

(14,8)	(-2,2)	$\frac{3}{8}$
(7,19)	(7,7)	undefined
(-5,-5)	(13,-5)	0
(3,1)	(19,9)	$\frac{1}{2}$
(16,-3)	(8,-19)	2
(10,-5)	(19,-11)	$-\frac{2}{3}$
(-3,-2)	(4,-4)	$-\frac{2}{7}$
(-1,20)	(-5,20)	0
(8,3)	(-10,1)	$\frac{1}{9}$
(-16,-5)	(-9,0)	$\frac{5}{7}$

Unit 3 - Day 6 - Slope (Equation & Missing Value)

Vanessa starts a sticker company and designs and prints out 12 big water bottle stickers to pass out for free to get people interested. She is able to pass out 2 stickers every minute as people walk by. Write an equation, create a table, and graph the line if x represents minutes and y represents the total number of stickers Vanessa has.

Discuss what the slope is and how to find it from the equation (slope-intercept form).

Ask students: what is the slope of the line 2x + 4y = 4? Discuss.

Find the slope:

$x+2y=-16$
$6x-7y=35$
$4x+7y=7$
$8x+5y=0$
$11x+5y=30$
$-x=12+3y$
$-6x-y=-3$
$1=x-y$

$8x+5y=-30$
$x+y=6$
$x+2y=4$
$6x+7y=-14$
$x-y=0$
$4x-6y=-12$
$-10x+5y=20$
$2x+4y=16$

Discuss.

Find the slope: (5, -1) and (3, 3).
Find the slope: (4, 2) and (n, 5). (Tell students to do as much as they can.) Then, Oh! I forgot, I do know the slope of this line is 1/2. What is the value of n?

$(x,-7)(-6,-8)\ m=\frac{1}{8}\ (2)$
$(x,-1)(4,0)\ m=-\frac{1}{2}\ (6)$
$(3,8)(-6,y)\ m=1\ (-1)$
$(8,y)(6,-5)\ m=-1\ (-7)$
$(x,8)(-8,-5)\ m=\text{und.}\ (-8)$

$(-3,y)(-5,-4)\ m=0\ (-4)$
$(-9,-3)(x,9)\ m=3\ (-5)$
$(x,8)(-5,2)\ m=-2\ (-8)$
$(-3,1)(4,y)\ m=-\frac{6}{7}\ (-5)$
$(6,7)(x,-7)\ m=\frac{7}{5}\ (-4)$

Unit 3 - Day 7 - Intercepts

Graph the Line: One student in the group has a graph. (Don't show it to the others!) They must describe in words how to graph the line. The other partners graph what they describe.
https://docs.google.com/presentation/d/1C6BuhmHvs4eWr-CStAWzDsv2jaR1w333ZZSZz5IC_QM/edit?usp=sharing

Discuss the methods used after each round and introduce intercepts.

Ask the groups to graph a line with an x-intercept of 2 and y-intercept of -5.
x-intercept: -3 and y-intercept: 1.

Give graphs. Ask to identify x- and y-intercepts (write as ordered pairs.)

Give 3x - 4y = 12. Can you find the intercepts algebraically?

Discuss.

$x + 4y = -8$
$2x + 3y = 12$
$5x - 2y = -10$
$x + y = 4$
$4x - 5y = 0$
$x + y = -1$
$3x + y = 2$
$2x + 5y = -15$
$2x - y = -4$

Extension: Create an equation that has an x-intercept of 7 and a y-intercept of -2.

**Zeros are x-intercepts!

Unit 3 - Day 8 - Variation

Give half of the groups a direct variation example, and the other half an inverse variation example below.

Ask students to make an equation, a table, and a graph of their situation.

Gallery walk. Students find what the direct variations have in common and the inverse variations.

Direct Variation

1. Charlie makes $12 an hour at her job. Use x to represent hours and y to represent total pay.

2. A baker needs 4 eggs for each batch of cookies. Use x to represent batches of cookies and y to represent total eggs.

3. Each school bus can hold 32 students. Use x to represent buses and y to represent total students.

4. Joshua reads 20 pages of a book each day. Use x to represent days and y to represent total pages.

5. Gas costs $4 per gallon. Use x to represent gallons and y to represent total cost.

Inverse Variation

1. To paint an entire house, there is 72 hours of work. Use x to represent the number of people and y to represent the amount of hours each person works.

2. A jewelry maker has 120 beads. Use x to represent the number of bracelets and y to represent the number of beads on each bracelet.

3. My teacher brought a bag of candy with 64 pieces. Use x to represent the number of students and y to represent the number of pieces of candy each student receives.

4. A company is looking to evenly give some grant money to schools. They have $4000. Use x to represent the number of schools and y to represent the amount of money for each school.

5. A pack of gum has 12 pieces. Use x to represent the number of friends and y to represent the number of pieces of gum each friend will receive.

① Create a function with a domain of $\{4, 0, 2\}$

② Create a graph that satisfies the following:
$f(2) = -3$
slope $= -\frac{1}{3}$

③ Draw a graph with zeros of -2 and 2 and a range of $y \geq -4$.

④ Find the value of y that will create a line with zero slope. $(5, y)$ $(-1, 2)$

⑤ For what value of b will $6x + by = 10$ have a slope of $\frac{3}{5}$?

① Create a function with a domain of $\{4, 0, 2\}$

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⑤ For what value of b will $6x + by = 10$ have a slope of $\frac{3}{5}$?

Unit 4 - Day 1 - Graph Linear Equations

https://docs.google.com/document/d/1vN2qetPSm52TRfJXqE-4xsAbzPtCN1CXYGMNFtW_K4A/edit?usp=sharing

You start with 15 Smarties and eat 3 every minute. Create an equation using x and y, a table, and a graph.

A) What is the beginning value? Where is that value in the situation? The equation? The table? The graph?

B) What is the slope? Where is that value in the situation? The equation? The table? The graph?

Discuss.

Write a situation for this equation: y = 5 + 2x. Graph this line using only the equation.

Graph:
y = 4x + 1
y = x - 2
y = x
y = 1/2x - 6
y = 1/3x + 3
y = -1/2x + 4
y = -3/4x - 5
y = -2x + 1
y = 3x

$5x + 2y = 10$
$3x - 5y = -10$
$6x + y = 4$
$x + 3y = 9$
$2x - 4y = 8$
$2x - y = -5$

y = 5
y = -2
x = 3
x = -1

Extensions:
Write the equation of a line that has an x-intercept of -3 and a y-intercept of 5.
Write the equation of a line that has a slope of zero and passes through the point (-2, -4).
Write the equation of a line that has an undefined slope and passes through the point (1, 7).

Unit 4 - Day 2 - Graph Linear Inequalities

https://docs.google.com/document/d/1e2kAvcaQGzP8Qk8fT8iYNF7ElLnIwDE6kBHBn6F7L78/edit?usp=sharing

Taco Shop Menu

Food $2 each	Drink $1.50 each
Soft Taco	Sprite
Hard Taco	Coke
Quesadilla	Mt. Dew
Nachos	Slushy

You are picking up lunch. You only have $10. Select what you would like to order. Create an ordered pair for your order where x is the number of food items and y is the number of drinks. Graph your ordered pair on your board.

Write an equation that represents this situation. Put it in slope-intercept form and graph it.

Why aren't all the points on the line? (We really need an inequality! Change it!)
Where do we shade?

Let's test it. You graph: $4x - 2y < 6$
Choose an ordered pair above, below, and on the line to test it algebraically.

$y \leq 2x - 5$
$y < \frac{3}{4}x + 2$
$y > -\frac{3}{5}x - 2$
$y \leq -\frac{5}{3}x + 1$
$x + y < -5$
$2x - y \leq 3$
$x \geq -3$
$x < 4$

Unit 4 - Day 3 - Write Equations & Inequalities From Graphs

Contain the Forest Fires:
https://docs.google.com/document/d/1Z9nwCFhV7zQ05Jqlp5AVfJXSnItw_hpBKRGLmyxk7oQ/edit?usp=sharing

Or

https://docs.google.com/document/d/1mHBf-8XYyATpn_ivJIYTK4AV6RYz8rwFjfEIOhYctKE/edit?usp=sharing

Unit 4 - Day 4 - Write Equations in Point-Slope, Slope-Intercept, Standard Form

Find the slope of the line passing through (4, -1) and (2, -5).

Given point-slope form equation, ask students to substitute the information into the formula.

1) A line with a slope of 1/2 that passes through the point (6, -1)
2) A line with the slope of -3/4 that passes through the point (8, -2)
3) A line that passes through the points (2, -3) and (4, 7)
Keep all of these up on their boards.

Now, manipulate each equation so that it is in slope-intercept form.

If standard form is Ax + By = C, where A, B, and C are integers and A is not negative, put your equations in standard form.

(-4,1) slope = $-\frac{3}{2}$
(3,1) slope = $\frac{1}{3}$
(4,2) slope = 1
(2,-5) slope = 7
(-8,-3) slope = $\frac{5}{4}$

(-1,4) (0,-2)
(0,-2) (4,2)
(0,3) (4,5)
(4,2) (0,-1)
(2,2) (-4,-2)

**Thoughts for the future: Spend more time on each form. Focus on point-slope and how that relates to the graph as well. Standard form might only be for an extension.

Unit 4 - Day 5 - Write Equations in Slope-Intercept Form

1) Does (3, 7) lie on the line y = 2x + 1? Prove it graphically and algebraically.

2) Is (-3, -5) on the line y = 1/3x - 4?

3) If (1, 3) is on the line y = -2x + b, What is the missing y-intercept?

4) If a line has a slope of 1/2 and passes through the point (-4, -1), what is the equation of the line in slope-intercept form?

$(-3,2)$ slope $= -\frac{5}{3}$
$(3,-4)$ slope $= -1$
$(5,1)$ slope $= -\frac{3}{5}$
$(4,-1)$ slope $= \frac{3}{4}$
$(3,-3)$ slope $= \frac{8}{3}$
$(-1,1)$ slope $= -2$

$(-3,2)$ $(0,-2)$
$(4,-3)$ $(2,3)$
$(0,-3)$ $(2,-1)$
$(0,4)$ $(-2,1)$
$(-5,2)$ $(4,-1)$
$(-1,2)$ $(3,1)$

Unit 4 - Day 6 - Parallel & Perpendicular Lines

Write the equation of each new line. Give each group a different set.
https://docs.google.com/presentation/d/1-OnUCD5HmMdTWIxqBRW08RrgfTM4NBpGmzEHD49Riws/edit?usp=sharing

Gallery walk. Ask students to find patterns/rules for parallel and perpendicular equations. Discuss.

What is the slope of the line parallel to y = 3/4x - 4?
What is the slope of the line perpendicular to y = 3x + 9?

Remember: Write the equation of the line with a slope of -5/2 passing through the point (4,1).

Now: Write the equation of the line parallel to y = 4/3x + 2 passing through the point (9, 5).

…perpendicular to y = -6x - 1 through (12, -3).

…parallel to y = x - 3 through (-4, 2).

…perpendicular to y = x + 9 through (-7, -5).

…parallel to x = 2 through (4, 5).

…perpendicular to x = -1 through (-3, -6).

Unit 4 - Day 7 - Transformations

Starting with the equation $y = 2x + 3$, what can you change to move the line up?
Can you move the line down?
Can you make the line more steep?
Less steep?
Can you flip the line?

The linear parent function is $y = x$. Describe the changes (transformations.)

$y = 3x$

$y = 1/3x$

$y = x + 5$

$y = x - 4$

$y = -x$

Create the equation of the line after the linear parent function has been transformed in the following way.
Less steep by a factor of 2/5 and shifted down 3.

Reflected and shifted up 2.

Shifted down 6 and more steep by a factor of 4/3.

Graph the parent function $y = x$.
Choose two transformations and apply them to the parent function. Graph the new line.
Every group moves to the right. Describe the transformations that occurred.
Every group moves to the right. Check the work.

Unit 4 - Day 8 - Linear Regression

https://docs.google.com/document/d/10wfMN0E8-tWAkKtyc8BekiiOS9bMvEq1dLncg5-6mJE/edit?usp=sharing

Unit 4 - Day 9 - Unit Review

Unit 5 - Day 1 - Solve Systems by Graphing

Person A: Paid $20 plus $22 per hour. Person B: Paid $80 plus $20 per hour.

1) Write an equation for each person where x represents hours and y represents total pay.
2) Create a table with at least 5 ordered pairs for each person.
3) Graph both lines on the same coordinate plane.

When will both people be paid the same amount and how much will they get paid?
Where is that information in the tables and in the graph?

Find the solutions.

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

$\begin{cases} y = -\frac{2}{3}x - 1 \\ y = \frac{2}{3}x + 3 \end{cases}$ (-3,1)

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

$\begin{cases} y = \frac{2}{3}x - 4 \\ y = -\frac{1}{3}x - 1 \end{cases}$ (3,-2)

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

$\begin{cases} x + 2y = 6 \\ 3x + 2y = 2 \end{cases}$ (-2,4)

$\begin{cases} x - 3y = -12 \\ x - 3y = 3 \end{cases}$ $\varnothing$

$\begin{cases} 6x - 2y = 4 \\ 3x - y = 2 \end{cases}$ ∞

$\begin{cases} x + 2y = -2 \\ x - 2y = -6 \end{cases}$ (-4,1)

$\begin{cases} -x = 3 + 3y \\ -6 = -4x - 3y \end{cases}$ (3,-2)

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

Extension:

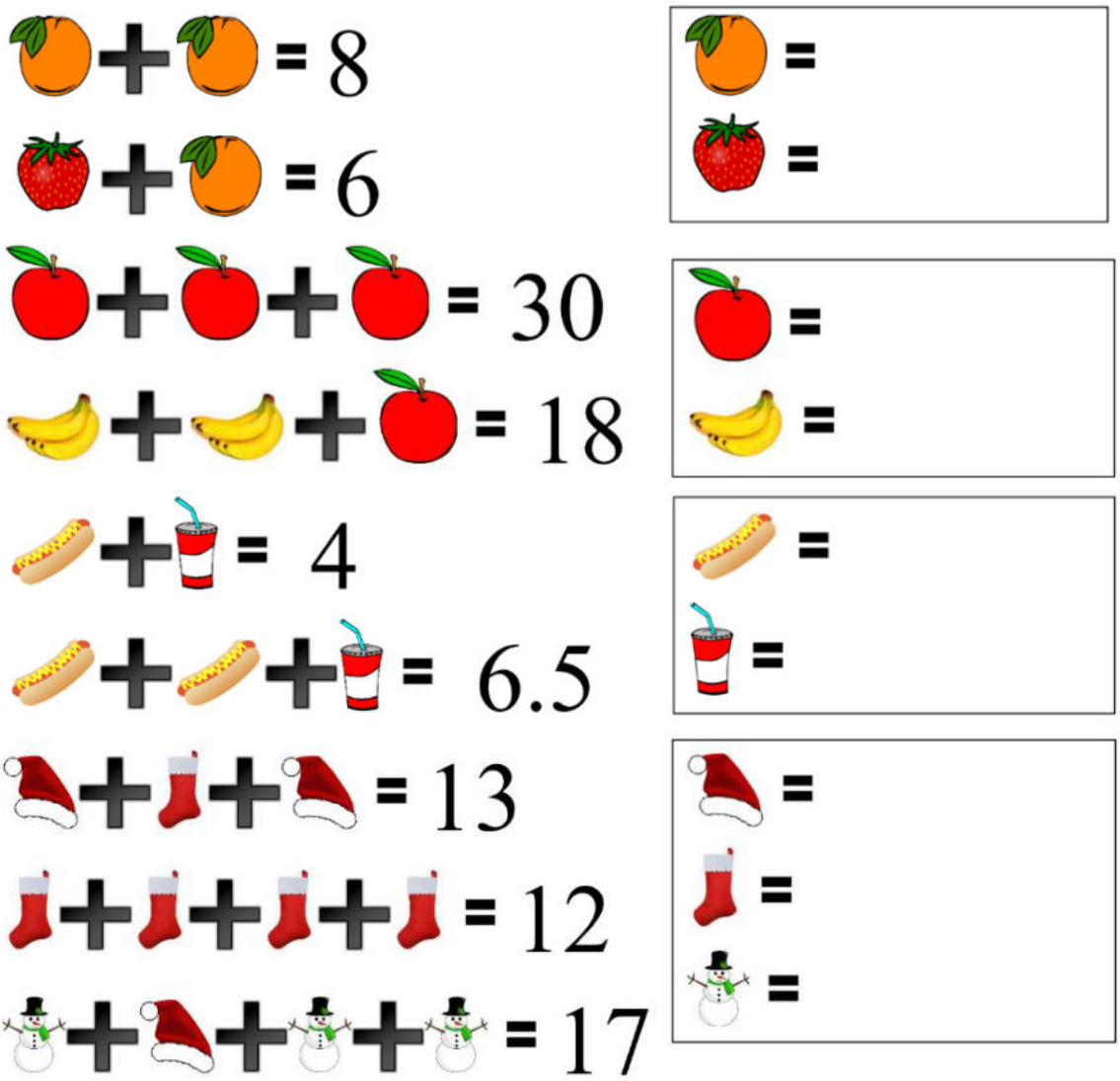
□x + □y = □

□x + □y = □

Create a system of equations that has no solutions.
Create a system that has infinite solutions.
Create a system that has a solution at (5, -2).

Unit 5 - Day 2 - Solve Systems Using Substitution

How much is each item worth?



Discuss strategies used. (Which equation was easier to solve in the group? Why is the hotdog and drink more difficult?)

$\begin{cases} x=2 \\ -5x-4y=-6 \end{cases}$ (2,-1)

$\begin{cases} y=-4 \\ -5x+6y=1 \end{cases}$ (-5,-4)

$\begin{cases} 6x-5y=24 \\ y=0 \end{cases}$ (4,0)

$\begin{cases} y=-5x-13 \\ 7x+8y=-5 \end{cases}$ (-3,2)

$\begin{cases} -3x+5y=-11 \\ y=-2x+3 \end{cases}$ (2,-1)

$\begin{cases} -x-y=8 \\ y=-4x-23 \end{cases}$ (-5,-3)

$\begin{cases} y=x+8 \\ y=7x+20 \end{cases}$ (-2,6)

$\begin{cases} x=5 \\ y=x+1 \end{cases}$ (5,6)

$\begin{cases} y=-6x+15 \\ y=6x-21 \end{cases}$ (3,-3)

$\begin{cases} y=3x-5 \\ y=2x-6 \end{cases}$ (-1,-8)

$\begin{cases} x+7y=0 \\ 6x+3y=0 \end{cases}$ (0,0)

$\begin{cases} -4x-5y=12 \\ 5x+y=6 \end{cases}$ (2,-4)

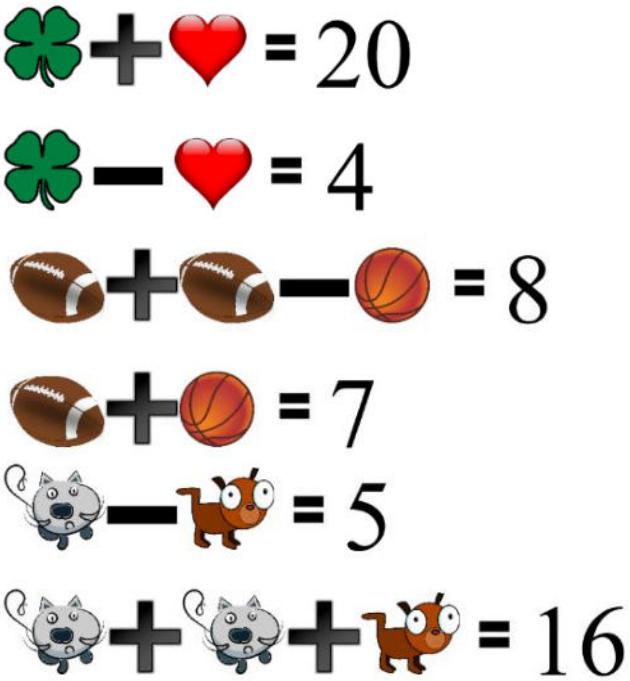
$\begin{cases} 6x-2y=6 \\ 6x-3y=0 \end{cases}$ (3,6)

$\begin{cases} 3x-4y=8 \\ y=\frac{3}{4}x-2 \end{cases}$ ∞

$\begin{cases} y=5x+6 \\ 10x-2y=6 \end{cases}$ $\emptyset$

Unit 5 - Day 3 - Solve Systems Using Elimination

How much is each item worth?



Discuss. Ask students to represent how they solved the problem using variables instead of images.

$\begin{cases} -9x+3y=15 \\ 3x-3y=15 \end{cases}$ $(-5,-10)$

$\begin{cases} 5x+4y=-16 \\ -x-4y=0 \end{cases}$ $(-4,1)$

$\begin{cases} -9x-5y=21 \\ 8x+5y=-22 \end{cases}$ $(1,-6)$

$\begin{cases} 2x-y=24 \\ 2x-y=28 \end{cases}$ $\emptyset$

$\begin{cases} 3x-y=-5 \\ 3x-8y=2 \end{cases}$ $(-2,-1)$

$\begin{cases} 4x+3y=1 \\ -x+9y=29 \end{cases}$ $(-2,-3)$

$\begin{cases} 6x+14y=24 \\ 3x-7y=-12 \end{cases}$ ∞

$\begin{cases} 5x-3y=6 \\ 6x+4y=30 \end{cases}$ $(3,3)$

$\begin{cases} 4x+3y=-13 \\ -3x+2y=-20 \end{cases}$ $(2,-7)$

$\begin{cases} -18y=48+6x \\ -12y+24=18x \end{cases}$ $(4,-4)$

Unit 5 - Day 4 - Systems Word Problems

In a spooky haunted house, there are 48 legs. How many spiders and black cats are inside the house?
(There are multiple answers.)

Unit 5 - Day 5 - Systems of Inequalities Day 1

Use page 1:
https://docs.google.com/document/d/1n6D_4EiDhe4tA2deDwj9MFlApnuB3iMB/edit?usp=sharing&ouid=117238913179451892000&rtpof=true&sd=true

Unit 5 - Day 6 - Systems of Inequalities Day 2

Use page 2:
https://docs.google.com/document/d/1n6D_4EiDhe4tA2deDwj9MFlApnuB3iMB/edit?usp=sharing&ouid=117238913179451892000&rtpof=true&sd=true

Unit 5 - Day 7 - Review

Unit 6 - Day 1 - Multiply Monomials

What do you know about exponents? Where are exponents used in the real world?
https://passyworldofmathematics.com/exponents-in-the-real-world/

Expand:

$3^2 =$

$3^3 =$

$3^2 \cdot 3^3 =$

$x^3 =$

$x^5 =$

$x^3 \cdot x^5 =$

Discuss. You can add the exponents when the bases are the same.

$4x \cdot 3x^2$

$(6x^5)(5x^5)$

$(-2x^7)(-x^4)$

$3xy^4 \cdot 2x^3y^6$

$4n^4 \cdot -2n^2$

$x \cdot -x^2$

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

$u^0v^3(uv)$

$-3y^4 \cdot 4xy^2$

$2x^4y^3 \cdot 4x^5y^0$

Discuss if needed.

$(☺)^2 =$

$(x^4)^2 =$

$(3x^3)^2 =$

$(-2x^4)^2$

$(-3vu^4)^3$

$(4x^0y^3)^3$

$(2m^4n^4)^2$

$(3x^4y)^2$

$(-2m^3y^2)^3$

Discuss if needed.

$(x^3x^3)^2$

$(-2m^3)^2 \cdot (-m^4)^3$

$(-2m^0 \cdot m)^2$

$((2x^2)^3 \cdot -x^2)^2$

$2a^2b^0 \cdot (b^2)^4$

$(-2m)^3 \cdot (-mn)^4$

$(a^2b^3 \cdot 3b)^2$

$u^2(u^3v^4)^3$

$(2x^4y^4z^3)^2 \cdot y^4z^3 \cdot y^5$

$(-x^2y^2 \cdot y^6z^3 \cdot 2)^2$

Extension: Directions: Using the digits 0 to 9 at most one time each, fill in the boxes to generate equivalent numerical expressions:

$7^{\square} \times 7^{\square} = 7^{\square} \times 7^{\square} = 7^{\square} \times 7^{\square} = 7^{\square} \times 7^{\square} = 7^{\square} \times 7^{\square}$

Unit 6 - Day 2 - Dividing Monomials

Simplify:
2/2
2*2/2
2*3/2
2*4/2
2*x/2
x*x/x
x^2/x
x^5/x^3
x^7/x^4
Discuss.

x^2y^7/x^2y^4
$6x^3y^9/3y^2$
x^5y^3/x^7y^2
Discuss negative exponents.

$\frac{4x^2y^4}{4x^2y^2}$

$\frac{-3m^3n^2}{-m^3n^2}$

$\frac{3x^2}{-6yx^2}$

$\frac{4u^3v^0}{6u^4v^4}$

$\frac{10m^6n}{5n^2m^3}$

$\frac{12x^5y^2}{9y^2x}$

$\frac{mn^{-2}}{3m^{-4}n}$

$\frac{6xy}{4x^3y^{-2}}$

$\frac{4n^2}{-n^{-3}m^2}$

$\frac{2a^2b^{-3}}{3a^{-1}b^{-4}}$

Discuss.

$\frac{3xy \cdot 2x^{-1}y^2}{x^{-2}y^{-1}}$

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

$\frac{2a^2b^{-3}}{(2a^0b)^3}$

$\left(\frac{xy^{-4}}{xy^{-2}}\right)^{-2}$

$\left(\frac{2n^4}{mn}\right)^2$

$\left(\frac{b^4}{a^2b^3 \cdot b^7}\right)^{-3}$

Unit 6 - Day 3 - Review

Unit 6 - Day 4 - Simplify Monomial Radicals

Simplify:
$\sqrt{25}$
$\sqrt{72}$
$\sqrt[3]{54}$

Discuss.

$\sqrt{50r^2}$

$-\sqrt{100v^4}$

$\sqrt{180xy^3}$

$8\sqrt{24x^4}$

$\sqrt[3]{216x^7}$

$2\sqrt{343n^2m}$

$\sqrt[3]{-40x^5y}$

$\sqrt[3]{54x^8y^2}$

$6\sqrt[3]{250n}$

$3\sqrt{50n^3}$

Extensions:

$\sqrt[4]{567u^5v}$

$\sqrt[5]{-64xy^7}$

$\sqrt[6]{128x^3y^6}$

$\sqrt[5]{96u^8v^4}$

Are these completely simplified?

$\sqrt{14a^2}$

$20\sqrt{10xy}$

$3\sqrt{6x^3}$

$2x^2\sqrt{3xy}$

$4\sqrt{90a^4b}$

$6x^3\sqrt{114}$

$\sqrt{30xy}$

$\sqrt[3]{144xy^2}$

Unit 6 - Day 5 - Operations With Radicals

Multiplication
Simplify:
$5 \cdot 3$
$\sqrt{20} \cdot \sqrt{10}$
$2\sqrt{4} \cdot 3\sqrt{50}$
$\sqrt[3]{28} \cdot 2\sqrt[3]{12}$

$-2\sqrt{5} \cdot \sqrt{4}$

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

$\sqrt[3]{50} \cdot 3\sqrt[3]{15}$

$\sqrt{15} \cdot 5\sqrt{15}$

$-3\sqrt{2} \cdot -3\sqrt{6}$

$\sqrt[3]{36} \cdot \sqrt[3]{6}$

$\sqrt[3]{-15} \cdot \sqrt[3]{-50}$

$n\sqrt{5} \cdot n\sqrt{10}$

$2p\sqrt{15p} \cdot p\sqrt{6p^3}$

Addition and Subtraction
Simplify:
$13 + 9 + (-4) - 1$
$2x + 5y - y + 6x$
$2\sqrt{3} + 5\sqrt{7} + 6\sqrt{3} - \sqrt{7}$

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

$-3\sqrt[3]{-5} - \sqrt[3]{5}$

$2\sqrt{27} + 2\sqrt{27}$

$-3\sqrt{18} + 3\sqrt{2}$

$-2\sqrt{45} - 3\sqrt{45}$

$3\sqrt[3]{108} - 2\sqrt[3]{4}$

$-\sqrt{12} + 2\sqrt{27} + 3\sqrt{2}$

$\sqrt[3]{3} + 3\sqrt[3]{24} - \sqrt[3]{54}$

Unit 6 - Day 6 - Review

Unit 7 - Day 1 - Add & Subtract Polynomials

Perimeter and Area Side Quests (This requires adding and multiplying polynomials.)
https://docs.google.com/presentation/d/1W-wsKEE8xtrL6BdrPbdrEJZ707dK5b-PDj9nPA0iyzo/edit?usp=sharing

Vocabulary: Using the expressions, label the following vocabulary.

$6x^2y$

Constant

$5x^3 + 2xy - y^2$

Binomial

$14x - 8$

Variable

Exponent

Coefficient

Leading Coefficient

Monomial

Trinomial

Polynomial

$(2x+x^a)-(x^3+4x^a+3x)$

$(7+4r^a)+(-8r^a-7+2r)$

$(-5b+5b^a+6)+(-7b^a-2+b)$

$(-4b^3+2+8b)-(4+2b+8b^3)$

Simplify:

$11x - 9y + 14x + 6y$

$3x^2 + 10xy + x^2 - 4xy + 8$

$(x^2 + 2x - 1) + (-7x - 2)$

$2(x^2 + 3)$

$3(x^2 - 1) + 4(x + 4)$

$4(2x + 9) - 2(5x - 3)$

$(x^2 - 5x + 4) - (2x^2 - 2x + 7)$

Unit 7 - Day 2 - Multiply Polynomials

Simplify:

$6(5x^2 - 4x + 2)$

$2x(3x^2 + x - 9)$

$5xy(8x^2 - 4y)$

$3x^5y^2(x^2 + 3xy + 7x)$

$4xy(2x-y)$

$-5x(-4x-7y)$

$6y^4(7x+5y)$

$-4xy^3(7x-2y)$

$6mn^2(-3m+8n)$

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

$(x - 3)(x - 1)$

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

$(2x - 1)(5x + 6)$

$(4a+6)(4a-6)$

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

$(n-2)(n+2)$

$(x+8)^2$

$(x-4)^2$

$(3x+6)^2$

$(6p+2)(p-1)$

$(4x-9)(3x+2)$

$(5x+1)(2x-4)$

$(7x-3)(x-5)$

$(8x-5y)(2x+3y)$

$(4m+2n)(2m+5n)$

$(x + 5)(x^2 - 2x + 3)$

$(7x+5)(3x^2+2x-4)$

$(3x-2)(5x^2-6x-1)$

$(6k-1)(3k^2-3k+8)$

$(5a+3)(6a^2-2a-5)$

$(3m+4)(2m^2+5m+4)$

Unit 7 - Day 3 - Divide Polynomials by Monomials

The area of a rectangle is represented by $12x^4 - 4x^2 + 8x$. The width of the rectangle is 4x. What is the length?

Divide:

$4x^5y/2x^2$

$8y^7x/16x^3y^9$

$(2x^3 - 14x^2 + 8x)/2x$

$(9p^5 + 18p^4 + 18p^3) \div 9p^3$

$(20a^4 + 50a^3 + 50a^2) \div 10a^2$

$(2p^3 + 8p^2 + 16p) \div 4p^3$

$(4x^4 + 12x^3 + 2x^6) \div 4x^3$

$(8k^5 - 3k^3 + 8k^2) \div 8k^2$

Unit 7 - Day 4 - Factor by GCF

Simplify: $5x(2x^2 - 3x + 4)$

Could you go backwards? If I gave the solution, could you find the original problem?

$12x^4 + 8x^3 + 6x^2$

This is called factoring. Today, we will factor out a GCF. Find the Greatest Common Factor and factor it out: $10x^5y^2 - 30x^3y^2 + 20x^3y$

$40+64x$

$-10+20n^2$

$20v^8+90v^3+40v^6$

$-56n^8+80n-56$

$-45x^2y^3+5xy^2$

$7x^2y-21xy$

$-63+14x^3y^2$

$30uv^3-48u^8v+48uv$

$6x^5y^3+14x^3y^8-16x^3y$

$9ab+9a^3b+9b^5$

$6xy^4+9xy^5+27x^9y^4+18x^2y$

Unit 7 - Day 5 - Factor by Grouping

Are these two expressions equivalent? Prove it!
$x(x + 1) + 3(x + 1) = (x + 1)(x + 3)$

Write the following as two binomial factors.

$4(x+2)+x(x+2) =$
$x(x+2)+3(x+2) =$
$x(x+2)-(x+2) =$
$x(x+2)-x-2 =$
$x^2+2x-x-2 =$
$x^3+4x^2+2x+8 =$
$t^3-3t^2+5t-15 =$
$t^3-5t^2-3t+15 =$
$4x^3+2x^2+6x+3 =$
$6x^3-9x^2-4x+6 =$
$6x^3y-9x^2y-4x+6 =$
$x^3-2-3x^3y+6y =$

*Show the box method either as a hint to groups or during consolidation.

Unit 7 - Day 6 - Factor Trinomials When a is 1

Multiply the first binomials. Can you go backwards to find the original problem?

x^2+5x+6	$(x+2)(x+3)$	$x^2-2x-24$	$(x-6)(x+4)$
x^2+7x+6	$(x+6)(x+1)$	$x^2-6x-16$	$(x-8)(x+2)$
$x^2+7x+12$	$(x+4)(x+3)$	$x^2-0x-16$	$(x-4)(x+4)$
$x^2+14x+24$	$(x+2)(x+12)$	x^2-25	$(x-5)(x+5)$
$x^2+10x-24$	$(x-2)(x+12)$	x^2-49	$(x-7)(x+7)$
$x^2+4x-12$	$(x-2)(x+6)$	$x^2-10x+24$	$(x-6)(x-4)$
x^2-x-12	$(x-4)(x+3)$	$x^2-13x+12$	$(x-1)(x-12)$

$4x^2+36x+72$	$4(x+3)(x+6)$
$6x^2-114x+540$	$6(x-9)(x-10)$
$2n^2+4n-48$	$2(n-4)(n+6)$
$5k^2+15k-20$	$5(k-1)(k+4)$
$3a^2+30ab+63b^2$	$3(a+7b)(a+3b)$
$4x^2-36$	$4(x+3)(x-3)$
$3x^2-12$	$3(x+2)(x-2)$

**For the top problems. Ask students to multiply the first binomials using double distribution and the box method. Then ask students to find the missing info for numbers 2 and 3.

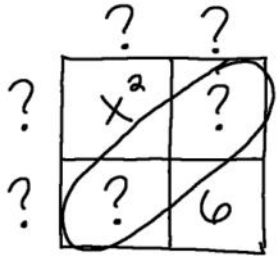
Fill in the missing info.

$(?+?)(?+?)$

$x^2+?+?+6$

x^2+7x+6

$(?+?)(?+?)$



x^2+7x+6

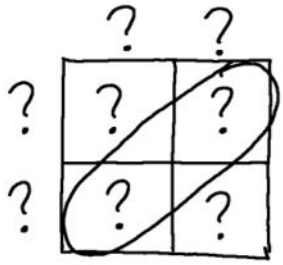
Fill in the missing info.

$(?+?)(?+?)$

$?+?+?+?$

$x^2+7x+12$

$(?+?)(?+?)$



$x^2+7x+12$

Unit 7 - Day 7 - Factor Trinomials When a is Not 1

Prove that these are equivalent.

Multiply:

① $(x+3)(x+4)$

$x^2+7x+12$

Multiply:

② $(2x+3)(x+4)$

$2x^2+11x+12$

Factor:

① $x^2+7x+12$

$x^2+?+?+12$

$(?+?)(?+?)$

Factor:

② $2x^2+11x+12$

$2x^2+?+?+12$

$(?+?)(?+?)$

Discuss

$3x^2 + 7x + 4$ $(3x + 4)(x + 1)$
$2x^2 + 9x + 9$ $(2x + 3)(x + 3)$

$5x^2+16x+12$ $(5x+6)(x+2)$
$3n^2+40n+100$ $(3n+10)(n+10)$
$2x^2-17x-30$ $(2x+3)(x-10)$
$2b^2+7b-15$ $(2b-3)(b+5)$
$10b^2-3b-4$ $(5b-4)(2b+1)$
$6x^2-5x-56$ $(3x+8)(2x-7)$
$14b^2-40b-6$ $2(7b+1)(b-3)$
$15x^2-100x+60$ $5(3x-2)(x-6)$

Unit 7 - Day 8 - Factor a Difference of Squares

If the sides of a rectangle are (x + 6) and (x - 8), what is the area?

If the area is $x^2 + 3x - 10$, what are the sides?

What if the area is $x^2 - 25$? What are the sides?

Factor

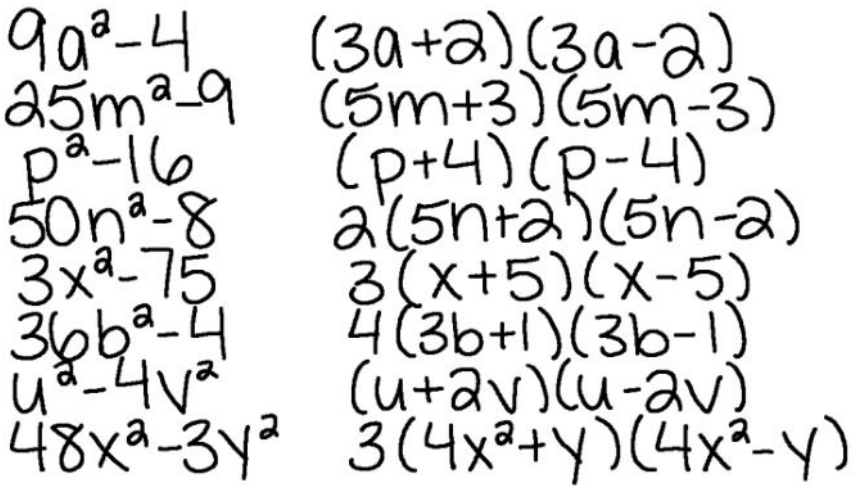
$x^2 + 0x - 16$

$x^2 - 81$

$49 - x^2$

$3x^2 - 12$

$5x^2 - 45$



Unit 7 - Day 9 - Divide Polynomials

Find the area of a rectangle if the length is $2x - 4$ and the width is $x + 1$.

If the area of a rectangle is $x^2 + 2x - 8$, what are the sides?

If the area is $x^2 + 8x + 15$ and the width is $x + 3$, what is the length?

Discuss.

Simplify:

$$\frac{x^2 - 2x - 24}{x + 4}$$

$$\frac{2x^2-13x+20}{x-4} = 2x-5$$

$$\frac{3x^2+12x-63}{x+7} = 3x-9$$

$$\frac{4x^2-36}{x+3} = 4(x-3)$$

$$\frac{2x^2+7x+5}{x^2-5x-6} = \frac{2x+5}{x-6}$$

$$\frac{2x+20}{2x^2-200} = \frac{1}{x-10}$$

Unit 7 - Day 10 - Review

Polynomial Operations Review Activity:
https://docs.google.com/presentation/d/1uhjO8ypbvXdC5nCVRg1D1J5koOiSE93drXqZldtDD_U/edit?usp=sharing

Unit 8 - Day 1 - Graphing Quadratics

Show students model rocket launch. https://www.youtube.com/watch?v=wfUrUc6JtHw
Ask them to make a graph that represents height (y) and time (x).
Ask students to label the domain, range, intercepts, vertex (max or min), zero(s).

Show students bungee jumping video. https://www.youtube.com/watch?v=l9m4cW2yxy0
Ask them to make a graph that represents height (y) and time (x).
Ask students to label the domain, range, intercepts, vertex (max or min), zero(s).

Unit 8 - Day 2 - Transformations

Recall: What do the following things do to the linear parent function y = x?

y = 2x
y = 1/2x
y = -x
y = x + 3
y = x -3

Your goal: Figure out how to make the following transformations occur to the quadratic parent function $y = x^2$.

Shift up
Shift down
Shift left
Shift right
Flip (Reflection)
Vertical stretch (more narrow)
Vertical shrink/compression (more wide)

**Notes for the future: Include a Desmos activity where students use sliders to investigate the transformations.

Unit 8 - Day 3 - Linear vs Quadratic Graphs

Looking over some investment options, I came across a mutual fund with the stock prices at the beginning of each of the months below starting in the year 2022.

When I turn 40 in January 2028, how much will each stock be worth?

If I invested $10,000 in November 2023, how much will I have based on the stock price when I turn 40?

Date	Stock Price
Jan 2022	431.77
Mar 2022	400.49
May 2022	380.99
Jul 2022	353.06
Sep 2022	363.24
Nov 2022	348.34
Jan 2023	359.33
Mar 2023	374.24
May 2023	375.02
Jul 2023	407.08
Sep 2023	416.02
Nov 2023	398.73

Unit 8 - Day 4 - Linear & Quadratic Regression

Dessert Shop Product Comparison:
https://docs.google.com/document/d/1WxSKwqPqVA88ovRVDeNXuB7yADpMlDE76fYvz3zNpr4/edit?usp=sharing

Another version of a student template:
https://docs.google.com/presentation/d/1X_saDa7g4fZlYSnxYzq6zEs__gFxVrU-JTqgJOPpGc4/edit?usp=sharing

Unit 8 - Day 5 - Solve Quadratics by Factoring & Graphing

$3x=0$

$(2)(x)=0$

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

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

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

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

$(x+3)(x+1)=0$

$x^2+4x+3=0$

$x^2-5x-36=0$

$x^2-5x=36$

$x^2-16=0$

$x^2-81=0$

$x^2-12x+36=0$

$x^2+10x=-25$

$4x^2-1=-3x$

$9x^2-3x+8=70x$

Unit 8 - Day 6 - Solve Using the Quadratic Formula

Evaluate both. Simplify as much as possible.

$$\frac{-b+\sqrt{b^2-4ac}}{2a} \qquad \frac{-b-\sqrt{b^2-4ac}}{2a}$$

① $a=2$ $b=12$ $c=-5$

② $a=1$ $b=4$ $c=-12$

Solve: $x^2-5x-14=0$ $x=-2,7$

$x^2+6x+3=0$ $x=-1\pm\sqrt{6}$

↑ Discuss. Students will get a decimal. Why is that not always good enough?

$ax^2+bx+c=0$

$a=1$
$b=6$
$c=3$

evaluate: (simplify as much as possible!)

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$$

Solve:

$9n^2-6n-9=0$ $\quad \frac{1\pm\sqrt{10}}{3}$

$p^2+12p-64=0$ $\quad 4$ & -16

$x^2-3x-20=-11$ $\quad \frac{3\pm3\sqrt{5}}{2}$

$3x^2+x-5=11$ $\quad \frac{-1\pm\sqrt{193}}{6}$

$10n^2+7n+8=0$ $\quad$ No real solution

$4k^2=6k+88$ $\quad \frac{11}{2}$ & -4

Unit 8 - Day 7 - Review

① Draw the graph of a quadratic function that has a range of $y \geq -6$ and factors $(x-1)(x+5)$.

② What is the maximum height and after how many seconds to hit the ground?
$h(t) = -16t^2 + 48t$

③ Is $x=6$ a solution to the equation $2x^2 - 5x - 30 = -12x$?

④ Which of the following have exactly two real roots?

a) $f(x) = (x-1)(x+3)$
b) $g(x) = 4x+7$
c) $h(x) = x^2 - 36$
d) $j(x) = x^2 + 5x - 6$
e) $k(x) = x^2 + 4x + 4$
f) $m(x) = x^2 + 3x + 8$

⑤ Create a quadratic equation that can only be solved using the quadratic formula and solve it.

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⑤ Create a quadratic equation that can only be solved using the quadratic formula and solve it.