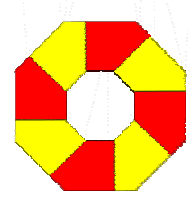


Connecting Octagon Star to Mathematics



Below are ideas to reinforce important mathematical concepts by folding paper.

Measurement

➤ **Angles** (upper elementary, middle school)

- How many obtuse angles can you find in the star? In the octagon? How many acute angles can you find in the star? In the octagon?
- Are there any right angles?

Note: Teachers, you may want to have them label the angles either by drawing a picture or on the octagon-star.

➤ **Perimeter**

- If the length of one of the outside octagonal edges is 2 inches, what is the perimeter of the outside edges of the octagon? What is the perimeter of the star? Which perimeter is longer? Support your answer and explain why this may be. (middle/high school)

➤ **Area**

- Look at the area of the star and the hexagon. Which figure do you think has the larger area? Support your reasoning. (upper elementary/middle/high school - - depending on your expectations)

Geometry

- What shapes can you find in the star? In the octagon? (elementary/middle)
- After you are given the length of one of the outside octagonal edges, without using a ruler, how long are all the edges in the star? This includes the all the lengths of the small hexagon inside the star. (middle/high school)

Number & Operations

➤ **Fractions**

- If you have students make the star with 3 of one color (blue), 4 of another color (yellow) and 1 of another color (red), the following questions could be asked (upper elementary/middle school):
 - What fraction of the star (or hexagon) is blue? Yellow? Red? How do you know? Support your answer.
 - What percentage of the star (or hexagon) is blue? Yellow? Red? How do you know? Support your answer.
 - How can you represent the blue part of the star (or hexagon) as a decimal? The yellow part? The red part? How do you know? Support your answer.
- In the octagon, do you have more yellow sections or red? How many more do you have? (lower elementary)

Algebra

- If there are eight sheets of paper to make one octagon-star, how many sheets of paper would it take to make 12 of them? Create a table, graph, and algebraic expression to support your answer.

Websites: Paper folding and Mathematics

<http://www.paperfolding.com/math/>

<http://mathworld.wolfram.com/Folding.html>

<http://erikdemaine.org/folding/>

<http://math.serenevy.net/?page=Origami-WhereMath&layout=framed>

If you have questions or comments about this session, contact Lori.Gibson@dickinsonstate.edu or (701) 250-1318.

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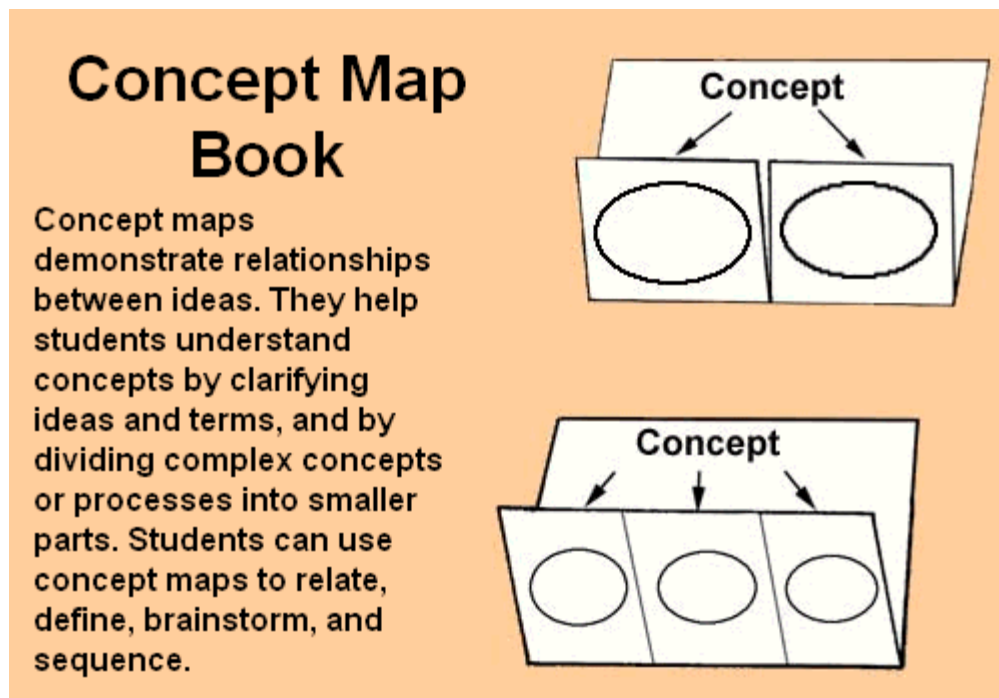
Foldables

Make and Take Session

For more information, go to <http://www.dinah.com/>

On this site, you will find colored elementary and secondary examples, free catalog, and more information on foldables. Below is just one example that can easily be made and used by your students.

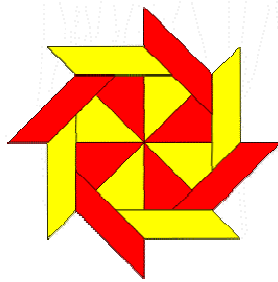
Concept Map Books



Instructions:

1. Fold a sheet of paper along the long or short axis, leaving a two-inch tab uncovered.
2. Fold in half or in thirds. (Additional tabs can be created by folding into more parts.)
3. Unfold and cut along the inside fold lines to create tabs.
4. Have students identify the concept by writing key words or using pictures on the two-inch tab. Draw arrows from the central idea to the tabs, where students record data underneath each tab.

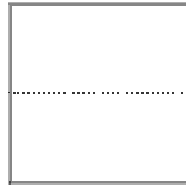
Octagon Star



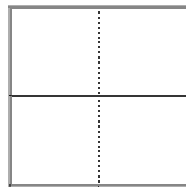
To build the octagon star you need eight pieces of origami paper. You may use either 4 pieces each of two colors or 2 pieces each of four colors. Each piece of origami paper will be folded in the same manner. You will then assemble the folded pieces together, according to the following instructions.

Folding each piece of origami paper:

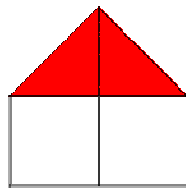
Fold the paper in half and then unfold it. Fold it so that the colored sides remain on the outside.



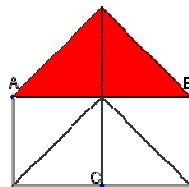
Rotate the paper 90 degrees, fold in half and then unfold. Again, fold so that the color remains on the outside.



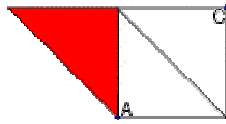
Fold the top two corners down to the center.



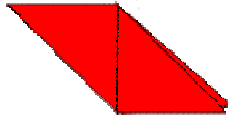
Fold point A down to point C to make the crease in the middle of the left square. Do not crease past the center of the piece of origami paper. Unfold and then do the same on the other square by folding point B down to point C. Unfold this fold. Your origami paper should then look like the following picture.



Rotate the paper 90 degrees and fold it in half.

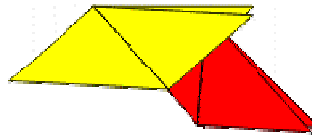


Push the fold inside by pushing point C to point A. This will require reversing the fold that goes down the center of the white rectangle in the previous picture. You will then have a parallelogram. One end of the parallelogram will be made up of two flaps forming a valley.

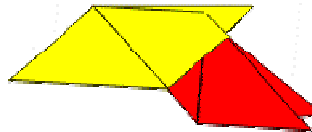


Assembling the pieces.

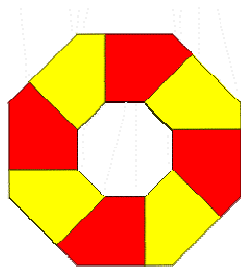
Place one parallelogram inside another of a different color as the following picture indicates. The short side of the second parallelogram should go inside the valley of the first parallelogram.



Fold the tails of the first parallelogram over the second to lock them together. The following picture indicates one of the tails folded into the valley of the second parallelogram.



Repeat this procedure until you have locked all 8 parallelograms to form the resulting octagonal ring. When you hook the 8th with the first, make sure that you fold the tails over only the first parallelogram and not the first and second (you'll have to look carefully at the resulting shape to follow this instruction). The resulting figure should slide together fairly easily to form the star at the top of the assignment.



Question: Determine, as a fraction of the length of the side of the origami paper, the lengths of the sides of the resulting parallelogram along with the length of its diagonal. What is the area of the parallelogram, as a fraction of the area of the origami paper?

Note: These directions were taken from <http://sierra.nmsu.edu/morandi/CourseMaterials/OctagonStar.html> with permission.

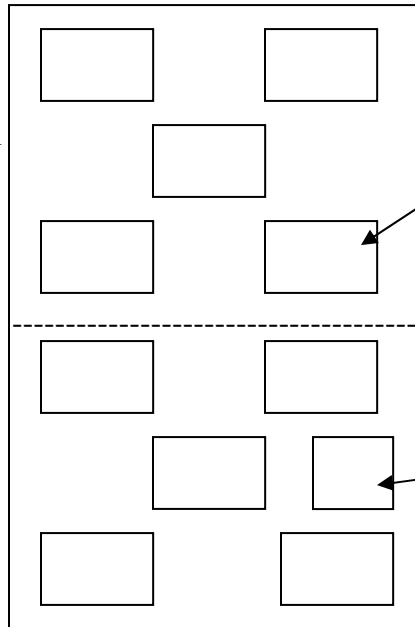
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Vocabulary and Math Activity Folders

The following are a few examples of how the folders can be used.

Reinforcement of Vocabulary Words

The definitions are typed or written on shipping labels and the words are typed on clear address labels or written on small Post-It notes. Students take the pile of Post-It notes and begin matching them with the definitions.

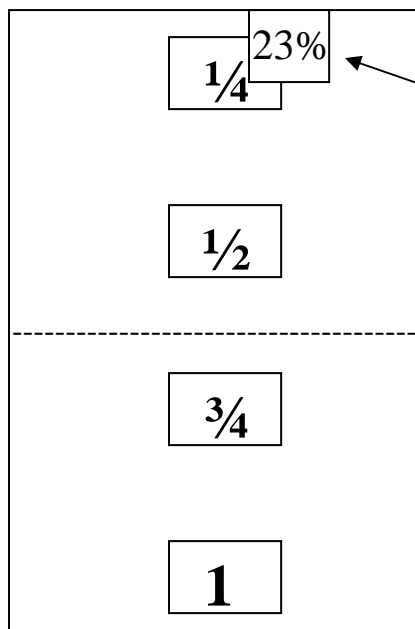


Shipping labels with definitions

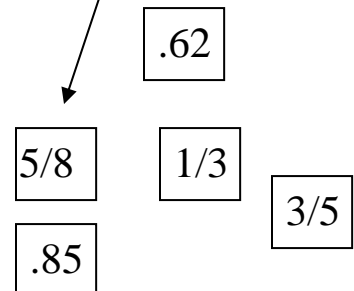
Pile of Post-It notes with words on them.

Reinforcement of Math Concepts

Students will place the Post-It notes in order with fractions, decimals, or percents written on them.



Six to eight Post-It notes are made with decimals, percents, or fractions written on them. A few examples are provided for you.



Recipe Master Game Directions

Fractions are an important part of mathematic skills; however, many students have a problem learning fractions and realizing how they might apply to real life. This game will allow students to work with whole numbers and fractions using cooking recipes. Students will take a recipe and make it larger or smaller within this game.

Steps to assemble your own Recipe Master Game:

1. Gather the three items needed to assemble the Recipe Master Game including the game board, one package of pawns containing one dice, blank game cards, and recipe package.
2. The game board comes pre-designed on card stock paper. The pawns and dice are used in the game to advance around the game board to determine a winner.
3. Next, take one card with the Recipe Master Card lines pre-drawn on them.
4. Cut all the Recipe Master Cards apart by cutting on each line; each sheet will make 12 cards.
5. On a single game card, take a black marker and write down the options the students will have once they have taken a recipe card from the stack. They will have to double the recipe, triple the recipe, quadruple to recipe, half the recipe, or quarter the recipe; please make choices based on the student's ability to achieve a correct solution to the recipes.
6. Take the recipe package, which includes recipes printed on card stock and cut each one into a separate card; these cards can be used for the game or feel free to use your own recipes.
7. Once your set is complete, get a large storage bag to put your game board, game cards, pawns, and recipes for storage in so they are ready to use with students.

What you will need to play the game:

- A flat surface
- Storage bag with game supplies (game board, game cards, pawns and single dice, and recipe cards)
- Scratch paper, pencils, and erasers

Game directions:

1. Take the game supplies out of the storage bag.
2. Place the game board down on a flat surface.
3. Allow students to select a pawn or distribute the pawns to the students.
4. Put all recipe cards in one pile and all game cards in a second pile.
5. Give each student a piece of scratch paper and pencil in case they need to calculate the answer to the problem.
6. Determine which student will go first; they will select a recipe card from one stack and a game card from the other stack. Have them read the recipe and the ingredient list out loud. Then, place the card flat on the table and have all students in the group solve the recipe challenge doing what ever the game board piece indicates they should do to the recipe (i.e., double, triple, quadruple...each ingredient). If the recipe challenge is correctly solved by the student that drew the card, then that student will be able to shake the dice and advance around the game board. The other student(s) that also performed the recipe calculation will serve as the judge(s) to determine if the student drawing the card correctly solved the recipe calculation challenge.
7. Optional Change: If it is too difficult for the student to perform all calculations using the entire recipe, you may choose to select just one ingredient for them to perform the calculation.
8. Once the first student has completed their turn, the next student receives a turn.
9. Only correct answers may earn the student a roll of the dice and advance around the game board.
10. Once a student has reached the end of the game and landed on the Recipe Master game space, the game is over. (Special Note: You do not have to roll an exact number in order to land on the space.) Have some fun practicing becoming a Recipe Master!

Pumpkin Muffins

Ingredients

- 1 yellow cake mix
- 1 16 oz. pumpkin
- 3 eggs
- 1/2 c. vegetable oil
- 1 tsp. baking soda
- 2 tsp. cinnamon

Chocolate Peanut Butter Yummies

Ingredients

- 2 c. crunchy peanut butter
- 2 eggs
- 1 1/2 c. sugar
- 1 c. chocolate syrup
- 1 1/2 c. flour
- 8-10 oz. package of M & M's

Hot Spiced Apple Cider

Ingredients

- 1 gallon apple cider
- 4 whole cinnamon sticks
- 3 tsp. brown sugar
- 2 whole cloves

Apple Pie Smoothie

Ingredients

- 2 red apples, cored and peeled
- 1 1/2 c. apple juice or cider
- 1 tsp. cinnamon
- 2 c. vanilla yogurt
- 2 c. ice

Optional toppings:

- 2 tbsp. chopped almonds
- Whipped cream

Tropical Salsa

Ingredients

Peel and dice the following ingredients:

- 4 oranges
- 2 pink grapefruit
- 2 mangos
- 1 medium red onion
- Add--
- 1/2 c. lime juice
- 2 tsp. fine sugar
- 1/2 tsp. dried mint

Snickerdoodle Spread

Ingredients

- 3 tbsp. of natural peanut butter
- 1 1/2 tbsp. of Philadelphia cream cheese
- 1 1/2 tbsp. of Light'n'Fit Dannon Vanilla Yogurt
- 1 packet of Splenda (sugar substitute)
- Sprinkle of cinnamon

Start



You spilled the ingredients, go back one space!



You win a spot on a TV cooking show, move ahead three spaces!



You are the Recipe Master!



You win a cooking contest, move ahead four spaces!



Recipe Master



You lost your recipe, move back one space!



You ran out of ingredients, go back two spaces!

You discovered a new magic ingredient, move ahead four spaces!



Place Value Game Directions

One of the most challenging pieces of math for a student to learn is place values. Many students need lots and lots of worksheet/problem practice in order to achieve an understanding of this skill. This game will allow students to achieve some problem practice in a way other than using a traditional worksheet.

Steps to assemble your own Place Value Game:

1. Gather the three items needed to assemble the Place Value Game including the spinner board, one black spinner and bottom piece, blank game cards, help chart, and progress chart.
2. The spinner board comes pre-designed on card stock paper and all you need to do is add the spinner. First, you will need to use a paper-punch to make a hole in the middle of the spinner board. The black spinner piece then slides through the hole and the bottom piece then simply snaps in place.
3. Next, take one card with the Place Value card lines pre-drawn on them.
4. Cut all the Place Value cards apart on each line; each sheet will make 24 cards. To make additional cards, use the included Place Value Game Card – Template.
5. Take a black marker write down various four-digit numbers representing thousands, hundredths, tens, and ones place (i.e., 1,234). Make only one four-digit number per card.
6. Your Place Value Help Sheet will serve as a standing chart to help students associate which spot represents each value of the number. It can be assembled by simply folding along the dotted line to create a standing chart.
7. Since students will need lots of practice working with place values in order to achieve an understanding, a progress chart is included to allow the students to keep track by writing down their name, the date, and tallying a mark for each correct answer.
8. Once completed with your set, get a quart size storage bag to put your spinner board, game cards, help chart, and progress charts in for storage in so they are ready to use with students.

What you will need to play the game:

- A flat surface
- Storage bag with game supplies (spinner board, game cards, progress charts, and help chart)
- Pencils

Game directions:

1. Take the game supplies out of a storage bag.
2. Place the spinner board down on the flat surface.
3. Put all game cards in one pile.
4. Give each student a progress report sheet and pencil and ask them to write their name and date on the card. If you have previously played this game, their progress report on this game can be filed in their student files and can be easily removed to see progress over time.
5. Determine which student will go first; then allow them to draw a game card and spin the dial on the spinner board.
6. Whichever place value the spinner lands on is the number the student must identify from their drawn card. For example, if the student draws a game card with the number 4,793 and the spinner lands on the thousands place, the student must identify the correct number of 4 as the number representing the place value of thousands.
7. For each correct answer, the student is able to put down a tally mark in the correct answers column of their progress sheet.
8. Play the game as long as time allows. To determine a winner, the student with the most tallies in their correct answers column is declared the winner. Have some fun practicing place values with this easy game!

Place Value Help Chart

1 , 2 3 4

Thousands

Hundreds

Tens

Ones

Ones

Tens

Ones

Tens

Thousands

Hundreds

Thousands

Hundreds

Ones

Tens

Ones

Tens

Thousands

Hundreds

Thousands

Hundreds

Ones

Tens

Ones

Tens

Thousands

Hundreds

Thousands

Hundreds

Memory Math Game Directions

All of us have played the memory game, whether it is with a deck of cards or the game pieces matching animals, numbers, symbols, or other items. Have you ever thought about using this same idea with math? While it makes the game a little more challenging, students must be able to use their calculation skills to find the answers to math problems and their analytical skills to remember where the cards are located before picking up matching pieces; it is a fun way to work on simple problems rather than completing worksheets.

Steps to assemble your own Memory Math Game:

1. Decide if you want your students to work on addition, subtraction, multiplication, division, or algebra problems or a combination of these areas.
2. Once you have decided your focus, retrieve a copy of the Free Math Worksheets to use if assembling your cards. Free Math Worksheets are available at www.math-drills.com for multiple math areas.
3. Next, gather two cards with the Memory Math card lines pre-drawn on them.
4. Cut all the Memory Math cards apart on each line; each sheet will make 12 cards.
5. Take a black marker and write out the game cards by splitting each selected math problem in two, writing the equation on one card and the answer on the other card. You may also wish to consider if you plan to write your cards with two problems that have the same possible answer or if you wish to make all of your cards with different answers.
6. Once your set is completed, get a small storage bag to put your cards in so they are ready to use with students. To make additional sets of cards, use the Memory Game card – template and run off copies on card stock paper.

What you will need to play the game:

- A flat surface
- Storage bag with pre-made game cards
- Scratch paper, pencils, and erasers
- Calculator (optional)

Game directions:

1. Take your Memory Math Game out of the storage bag.
2. Indicate the directions to the students by explaining the game of memory and showing them that all cards have a split math problem, an equation on one side and an answer on the other side. Remind them that they can only make a pair of cards using one equation card and one answer card.
3. Give each student a piece of scratch paper and pencil in case they need to calculate the answer to the problem. Remind students that both you and your opponent will need to watch the cards closely as you both may be choosing from the same set of cards.
4. Next, spread all cards face down on a flat surface and determine which student will select first.
5. The first student will turn over two cards and determine if they have a match. Remember, matches can only be achieved if one card contains the equation and the other card the answer. If the student has a matching set, they get to keep this set of cards and choose again; if not, the next player gets a turn.
6. Turns continue back and forth until all of the cards have been cleared. As the teacher, be prepared to offer teachable moments during the game and to also have fun!

Optional change:

For a twist to this game, let the students use a calculator to solve the problems. It will make the game go faster and let the students have fun learning something new!

Two-Digit Plus One-Digit Addition (A)

$$\begin{array}{r} 62 \\ + 8 \\ \hline \end{array}$$
$$\begin{array}{r} 38 \\ + 7 \\ \hline \end{array}$$
$$\begin{array}{r} 57 \\ + 5 \\ \hline \end{array}$$
$$\begin{array}{r} 35 \\ + 2 \\ \hline \end{array}$$
$$\begin{array}{r} 53 \\ + 2 \\ \hline \end{array}$$
$$\begin{array}{r} 96 \\ + 8 \\ \hline \end{array}$$
$$\begin{array}{r} 40 \\ + 9 \\ \hline \end{array}$$
$$\begin{array}{r} 17 \\ + 6 \\ \hline \end{array}$$

$$\begin{array}{r} 80 \\ + 6 \\ \hline \end{array}$$
$$\begin{array}{r} 96 \\ + 2 \\ \hline \end{array}$$
$$\begin{array}{r} 82 \\ + 6 \\ \hline \end{array}$$
$$\begin{array}{r} 85 \\ + 3 \\ \hline \end{array}$$
$$\begin{array}{r} 52 \\ + 2 \\ \hline \end{array}$$
$$\begin{array}{r} 72 \\ + 5 \\ \hline \end{array}$$
$$\begin{array}{r} 26 \\ + 8 \\ \hline \end{array}$$
$$\begin{array}{r} 25 \\ + 3 \\ \hline \end{array}$$

$$\begin{array}{r} 11 \\ + 8 \\ \hline \end{array}$$
$$\begin{array}{r} 84 \\ + 7 \\ \hline \end{array}$$
$$\begin{array}{r} 96 \\ + 5 \\ \hline \end{array}$$
$$\begin{array}{r} 71 \\ + 4 \\ \hline \end{array}$$
$$\begin{array}{r} 37 \\ + 8 \\ \hline \end{array}$$
$$\begin{array}{r} 25 \\ + 1 \\ \hline \end{array}$$
$$\begin{array}{r} 43 \\ + 5 \\ \hline \end{array}$$
$$\begin{array}{r} 91 \\ + 2 \\ \hline \end{array}$$

$$\begin{array}{r} 23 \\ + 5 \\ \hline \end{array}$$
$$\begin{array}{r} 10 \\ + 2 \\ \hline \end{array}$$
$$\begin{array}{r} 77 \\ + 2 \\ \hline \end{array}$$
$$\begin{array}{r} 49 \\ + 7 \\ \hline \end{array}$$
$$\begin{array}{r} 48 \\ + 6 \\ \hline \end{array}$$
$$\begin{array}{r} 33 \\ + 8 \\ \hline \end{array}$$
$$\begin{array}{r} 87 \\ + 7 \\ \hline \end{array}$$
$$\begin{array}{r} 90 \\ + 4 \\ \hline \end{array}$$

$$\begin{array}{r} 71 \\ + 1 \\ \hline \end{array}$$
$$\begin{array}{r} 64 \\ + 8 \\ \hline \end{array}$$
$$\begin{array}{r} 87 \\ + 7 \\ \hline \end{array}$$
$$\begin{array}{r} 96 \\ + 8 \\ \hline \end{array}$$
$$\begin{array}{r} 61 \\ + 4 \\ \hline \end{array}$$
$$\begin{array}{r} 89 \\ + 7 \\ \hline \end{array}$$
$$\begin{array}{r} 45 \\ + 5 \\ \hline \end{array}$$
$$\begin{array}{r} 31 \\ + 5 \\ \hline \end{array}$$

$$\begin{array}{r} 47 \\ + 9 \\ \hline \end{array}$$
$$\begin{array}{r} 89 \\ + 5 \\ \hline \end{array}$$
$$\begin{array}{r} 58 \\ + 2 \\ \hline \end{array}$$
$$\begin{array}{r} 48 \\ + 6 \\ \hline \end{array}$$
$$\begin{array}{r} 48 \\ + 6 \\ \hline \end{array}$$
$$\begin{array}{r} 23 \\ + 3 \\ \hline \end{array}$$
$$\begin{array}{r} 28 \\ + 5 \\ \hline \end{array}$$
$$\begin{array}{r} 71 \\ + 9 \\ \hline \end{array}$$

$$\begin{array}{r} 15 \\ + 6 \\ \hline \end{array}$$
$$\begin{array}{r} 45 \\ + 3 \\ \hline \end{array}$$
$$\begin{array}{r} 27 \\ + 1 \\ \hline \end{array}$$
$$\begin{array}{r} 57 \\ + 5 \\ \hline \end{array}$$
$$\begin{array}{r} 32 \\ + 3 \\ \hline \end{array}$$
$$\begin{array}{r} 51 \\ + 9 \\ \hline \end{array}$$
$$\begin{array}{r} 63 \\ + 7 \\ \hline \end{array}$$
$$\begin{array}{r} 75 \\ + 9 \\ \hline \end{array}$$

$$\begin{array}{r} 86 \\ + 5 \\ \hline \end{array}$$
$$\begin{array}{r} 15 \\ + 8 \\ \hline \end{array}$$
$$\begin{array}{r} 12 \\ + 8 \\ \hline \end{array}$$
$$\begin{array}{r} 59 \\ + 6 \\ \hline \end{array}$$
$$\begin{array}{r} 51 \\ + 2 \\ \hline \end{array}$$
$$\begin{array}{r} 69 \\ + 2 \\ \hline \end{array}$$
$$\begin{array}{r} 61 \\ + 4 \\ \hline \end{array}$$
$$\begin{array}{r} 79 \\ + 5 \\ \hline \end{array}$$

Two-Digit Plus One-Digit Addition (A) Answers

$$\begin{array}{r} 62 \\ + 8 \\ \hline 70 \end{array}$$
$$\begin{array}{r} 38 \\ + 7 \\ \hline 45 \end{array}$$
$$\begin{array}{r} 57 \\ + 5 \\ \hline 62 \end{array}$$
$$\begin{array}{r} 35 \\ + 2 \\ \hline 37 \end{array}$$
$$\begin{array}{r} 53 \\ + 2 \\ \hline 55 \end{array}$$
$$\begin{array}{r} 96 \\ + 8 \\ \hline 104 \end{array}$$
$$\begin{array}{r} 40 \\ + 9 \\ \hline 49 \end{array}$$
$$\begin{array}{r} 17 \\ + 6 \\ \hline 23 \end{array}$$

$$\begin{array}{r} 80 \\ + 6 \\ \hline 86 \end{array}$$
$$\begin{array}{r} 96 \\ + 2 \\ \hline 98 \end{array}$$
$$\begin{array}{r} 82 \\ + 6 \\ \hline 88 \end{array}$$
$$\begin{array}{r} 85 \\ + 3 \\ \hline 88 \end{array}$$
$$\begin{array}{r} 52 \\ + 2 \\ \hline 54 \end{array}$$
$$\begin{array}{r} 72 \\ + 5 \\ \hline 77 \end{array}$$
$$\begin{array}{r} 26 \\ + 8 \\ \hline 34 \end{array}$$
$$\begin{array}{r} 25 \\ + 3 \\ \hline 28 \end{array}$$

$$\begin{array}{r} 11 \\ + 8 \\ \hline 19 \end{array}$$
$$\begin{array}{r} 84 \\ + 7 \\ \hline 91 \end{array}$$
$$\begin{array}{r} 96 \\ + 5 \\ \hline 101 \end{array}$$
$$\begin{array}{r} 71 \\ + 4 \\ \hline 75 \end{array}$$
$$\begin{array}{r} 37 \\ + 8 \\ \hline 45 \end{array}$$
$$\begin{array}{r} 25 \\ + 1 \\ \hline 26 \end{array}$$
$$\begin{array}{r} 43 \\ + 5 \\ \hline 48 \end{array}$$
$$\begin{array}{r} 91 \\ + 2 \\ \hline 93 \end{array}$$

$$\begin{array}{r} 23 \\ + 5 \\ \hline 28 \end{array}$$
$$\begin{array}{r} 10 \\ + 2 \\ \hline 12 \end{array}$$
$$\begin{array}{r} 77 \\ + 2 \\ \hline 79 \end{array}$$
$$\begin{array}{r} 49 \\ + 7 \\ \hline 56 \end{array}$$
$$\begin{array}{r} 48 \\ + 6 \\ \hline 54 \end{array}$$
$$\begin{array}{r} 33 \\ + 8 \\ \hline 41 \end{array}$$
$$\begin{array}{r} 87 \\ + 7 \\ \hline 94 \end{array}$$
$$\begin{array}{r} 90 \\ + 4 \\ \hline 94 \end{array}$$

$$\begin{array}{r} 71 \\ + 1 \\ \hline 72 \end{array}$$
$$\begin{array}{r} 64 \\ + 8 \\ \hline 72 \end{array}$$
$$\begin{array}{r} 87 \\ + 7 \\ \hline 94 \end{array}$$
$$\begin{array}{r} 96 \\ + 8 \\ \hline 104 \end{array}$$
$$\begin{array}{r} 61 \\ + 4 \\ \hline 65 \end{array}$$
$$\begin{array}{r} 89 \\ + 7 \\ \hline 96 \end{array}$$
$$\begin{array}{r} 45 \\ + 5 \\ \hline 50 \end{array}$$
$$\begin{array}{r} 31 \\ + 5 \\ \hline 36 \end{array}$$

$$\begin{array}{r} 47 \\ + 9 \\ \hline 56 \end{array}$$
$$\begin{array}{r} 89 \\ + 5 \\ \hline 94 \end{array}$$
$$\begin{array}{r} 58 \\ + 2 \\ \hline 60 \end{array}$$
$$\begin{array}{r} 48 \\ + 6 \\ \hline 54 \end{array}$$
$$\begin{array}{r} 48 \\ + 6 \\ \hline 54 \end{array}$$
$$\begin{array}{r} 23 \\ + 3 \\ \hline 26 \end{array}$$
$$\begin{array}{r} 28 \\ + 5 \\ \hline 33 \end{array}$$
$$\begin{array}{r} 71 \\ + 9 \\ \hline 80 \end{array}$$

$$\begin{array}{r} 15 \\ + 6 \\ \hline 21 \end{array}$$
$$\begin{array}{r} 45 \\ + 3 \\ \hline 48 \end{array}$$
$$\begin{array}{r} 27 \\ + 1 \\ \hline 28 \end{array}$$
$$\begin{array}{r} 57 \\ + 5 \\ \hline 62 \end{array}$$
$$\begin{array}{r} 32 \\ + 3 \\ \hline 35 \end{array}$$
$$\begin{array}{r} 51 \\ + 9 \\ \hline 60 \end{array}$$
$$\begin{array}{r} 63 \\ + 7 \\ \hline 70 \end{array}$$
$$\begin{array}{r} 75 \\ + 9 \\ \hline 84 \end{array}$$

$$\begin{array}{r} 86 \\ + 5 \\ \hline 91 \end{array}$$
$$\begin{array}{r} 15 \\ + 8 \\ \hline 23 \end{array}$$
$$\begin{array}{r} 12 \\ + 8 \\ \hline 20 \end{array}$$
$$\begin{array}{r} 59 \\ + 6 \\ \hline 65 \end{array}$$
$$\begin{array}{r} 51 \\ + 2 \\ \hline 53 \end{array}$$
$$\begin{array}{r} 69 \\ + 2 \\ \hline 71 \end{array}$$
$$\begin{array}{r} 61 \\ + 4 \\ \hline 65 \end{array}$$
$$\begin{array}{r} 79 \\ + 5 \\ \hline 84 \end{array}$$

Two-Digit Subtraction; No Regrouping (A)

$\begin{array}{r} 63 \\ - 12 \\ \hline \end{array}$	$\begin{array}{r} 58 \\ - 48 \\ \hline \end{array}$	$\begin{array}{r} 89 \\ - 70 \\ \hline \end{array}$	$\begin{array}{r} 78 \\ - 14 \\ \hline \end{array}$	$\begin{array}{r} 79 \\ - 10 \\ \hline \end{array}$	$\begin{array}{r} 56 \\ - 31 \\ \hline \end{array}$	$\begin{array}{r} 49 \\ - 32 \\ \hline \end{array}$
---	---	---	---	---	---	---

$\begin{array}{r} 57 \\ - 22 \\ \hline \end{array}$	$\begin{array}{r} 56 \\ - 36 \\ \hline \end{array}$	$\begin{array}{r} 88 \\ - 41 \\ \hline \end{array}$	$\begin{array}{r} 49 \\ - 10 \\ \hline \end{array}$	$\begin{array}{r} 65 \\ - 22 \\ \hline \end{array}$	$\begin{array}{r} 87 \\ - 14 \\ \hline \end{array}$	$\begin{array}{r} 87 \\ - 22 \\ \hline \end{array}$
---	---	---	---	---	---	---

$\begin{array}{r} 65 \\ - 41 \\ \hline \end{array}$	$\begin{array}{r} 69 \\ - 30 \\ \hline \end{array}$	$\begin{array}{r} 77 \\ - 43 \\ \hline \end{array}$	$\begin{array}{r} 87 \\ - 23 \\ \hline \end{array}$	$\begin{array}{r} 87 \\ - 64 \\ \hline \end{array}$	$\begin{array}{r} 71 \\ - 10 \\ \hline \end{array}$	$\begin{array}{r} 65 \\ - 25 \\ \hline \end{array}$
---	---	---	---	---	---	---

$\begin{array}{r} 34 \\ - 20 \\ \hline \end{array}$	$\begin{array}{r} 93 \\ - 11 \\ \hline \end{array}$	$\begin{array}{r} 99 \\ - 15 \\ \hline \end{array}$	$\begin{array}{r} 89 \\ - 10 \\ \hline \end{array}$	$\begin{array}{r} 77 \\ - 30 \\ \hline \end{array}$	$\begin{array}{r} 85 \\ - 11 \\ \hline \end{array}$	$\begin{array}{r} 39 \\ - 10 \\ \hline \end{array}$
---	---	---	---	---	---	---

$\begin{array}{r} 98 \\ - 14 \\ \hline \end{array}$	$\begin{array}{r} 70 \\ - 20 \\ \hline \end{array}$	$\begin{array}{r} 59 \\ - 23 \\ \hline \end{array}$	$\begin{array}{r} 56 \\ - 35 \\ \hline \end{array}$	$\begin{array}{r} 45 \\ - 12 \\ \hline \end{array}$	$\begin{array}{r} 58 \\ - 20 \\ \hline \end{array}$	$\begin{array}{r} 88 \\ - 12 \\ \hline \end{array}$
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$\begin{array}{r} 89 \\ - 12 \\ \hline \end{array}$	$\begin{array}{r} 69 \\ - 40 \\ \hline \end{array}$	$\begin{array}{r} 78 \\ - 31 \\ \hline \end{array}$	$\begin{array}{r} 97 \\ - 12 \\ \hline \end{array}$	$\begin{array}{r} 82 \\ - 41 \\ \hline \end{array}$	$\begin{array}{r} 69 \\ - 18 \\ \hline \end{array}$	$\begin{array}{r} 65 \\ - 11 \\ \hline \end{array}$
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$\begin{array}{r} 88 \\ - 26 \\ \hline \end{array}$	$\begin{array}{r} 76 \\ - 15 \\ \hline \end{array}$	$\begin{array}{r} 89 \\ - 32 \\ \hline \end{array}$	$\begin{array}{r} 99 \\ - 10 \\ \hline \end{array}$	$\begin{array}{r} 45 \\ - 20 \\ \hline \end{array}$	$\begin{array}{r} 67 \\ - 40 \\ \hline \end{array}$	$\begin{array}{r} 69 \\ - 21 \\ \hline \end{array}$
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Two-Digit Subtraction; No Regrouping (A) Answers

$\begin{array}{r} 63 \\ - 12 \\ \hline 51 \end{array}$	$\begin{array}{r} 58 \\ - 48 \\ \hline 10 \end{array}$	$\begin{array}{r} 89 \\ - 70 \\ \hline 19 \end{array}$	$\begin{array}{r} 78 \\ - 14 \\ \hline 64 \end{array}$	$\begin{array}{r} 79 \\ - 10 \\ \hline 69 \end{array}$	$\begin{array}{r} 56 \\ - 31 \\ \hline 25 \end{array}$	$\begin{array}{r} 49 \\ - 32 \\ \hline 17 \end{array}$
--	--	--	--	--	--	--

$\begin{array}{r} 57 \\ - 22 \\ \hline 35 \end{array}$	$\begin{array}{r} 56 \\ - 36 \\ \hline 20 \end{array}$	$\begin{array}{r} 88 \\ - 41 \\ \hline 47 \end{array}$	$\begin{array}{r} 49 \\ - 10 \\ \hline 39 \end{array}$	$\begin{array}{r} 65 \\ - 22 \\ \hline 43 \end{array}$	$\begin{array}{r} 87 \\ - 14 \\ \hline 73 \end{array}$	$\begin{array}{r} 87 \\ - 22 \\ \hline 65 \end{array}$
--	--	--	--	--	--	--

$\begin{array}{r} 65 \\ - 41 \\ \hline 24 \end{array}$	$\begin{array}{r} 69 \\ - 30 \\ \hline 39 \end{array}$	$\begin{array}{r} 77 \\ - 43 \\ \hline 34 \end{array}$	$\begin{array}{r} 87 \\ - 23 \\ \hline 64 \end{array}$	$\begin{array}{r} 87 \\ - 64 \\ \hline 23 \end{array}$	$\begin{array}{r} 71 \\ - 10 \\ \hline 61 \end{array}$	$\begin{array}{r} 65 \\ - 25 \\ \hline 40 \end{array}$
--	--	--	--	--	--	--

$\begin{array}{r} 34 \\ - 20 \\ \hline 14 \end{array}$	$\begin{array}{r} 93 \\ - 11 \\ \hline 82 \end{array}$	$\begin{array}{r} 99 \\ - 15 \\ \hline 84 \end{array}$	$\begin{array}{r} 89 \\ - 10 \\ \hline 79 \end{array}$	$\begin{array}{r} 77 \\ - 30 \\ \hline 47 \end{array}$	$\begin{array}{r} 85 \\ - 11 \\ \hline 74 \end{array}$	$\begin{array}{r} 39 \\ - 10 \\ \hline 29 \end{array}$
--	--	--	--	--	--	--

$\begin{array}{r} 98 \\ - 14 \\ \hline 84 \end{array}$	$\begin{array}{r} 70 \\ - 20 \\ \hline 50 \end{array}$	$\begin{array}{r} 59 \\ - 23 \\ \hline 36 \end{array}$	$\begin{array}{r} 56 \\ - 35 \\ \hline 21 \end{array}$	$\begin{array}{r} 45 \\ - 12 \\ \hline 33 \end{array}$	$\begin{array}{r} 58 \\ - 20 \\ \hline 38 \end{array}$	$\begin{array}{r} 88 \\ - 12 \\ \hline 76 \end{array}$
--	--	--	--	--	--	--

$\begin{array}{r} 89 \\ - 12 \\ \hline 77 \end{array}$	$\begin{array}{r} 69 \\ - 40 \\ \hline 29 \end{array}$	$\begin{array}{r} 78 \\ - 31 \\ \hline 47 \end{array}$	$\begin{array}{r} 97 \\ - 12 \\ \hline 85 \end{array}$	$\begin{array}{r} 82 \\ - 41 \\ \hline 41 \end{array}$	$\begin{array}{r} 69 \\ - 18 \\ \hline 51 \end{array}$	$\begin{array}{r} 65 \\ - 11 \\ \hline 54 \end{array}$
--	--	--	--	--	--	--

$\begin{array}{r} 88 \\ - 26 \\ \hline 62 \end{array}$	$\begin{array}{r} 76 \\ - 15 \\ \hline 61 \end{array}$	$\begin{array}{r} 89 \\ - 32 \\ \hline 57 \end{array}$	$\begin{array}{r} 99 \\ - 10 \\ \hline 89 \end{array}$	$\begin{array}{r} 45 \\ - 20 \\ \hline 25 \end{array}$	$\begin{array}{r} 67 \\ - 40 \\ \hline 27 \end{array}$	$\begin{array}{r} 69 \\ - 21 \\ \hline 48 \end{array}$
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Long Division No Remainders (A)

$$9 \overline{) 279}$$

$$2 \overline{) 84}$$

$$3 \overline{) 195}$$

$$9 \overline{) 801}$$

$$8 \overline{) 376}$$

$$5 \overline{) 75}$$

$$5 \overline{) 75}$$

$$6 \overline{) 396}$$

$$7 \overline{) 126}$$

$$3 \overline{) 288}$$

$$8 \overline{) 144}$$

$$9 \overline{) 612}$$

Long Division No Remainders (A) Answers

$$\begin{array}{r} 31 \\ 9 \overline{) 279} \end{array}$$

$$\begin{array}{r} 42 \\ 2 \overline{) 84} \end{array}$$

$$\begin{array}{r} 65 \\ 3 \overline{) 195} \end{array}$$

$$\begin{array}{r} 89 \\ 9 \overline{) 801} \end{array}$$

$$\begin{array}{r} 47 \\ 8 \overline{) 376} \end{array}$$

$$\begin{array}{r} 15 \\ 5 \overline{) 75} \end{array}$$

$$\begin{array}{r} 15 \\ 5 \overline{) 75} \end{array}$$

$$\begin{array}{r} 66 \\ 6 \overline{) 396} \end{array}$$

$$\begin{array}{r} 18 \\ 7 \overline{) 126} \end{array}$$

$$\begin{array}{r} 96 \\ 3 \overline{) 288} \end{array}$$

$$\begin{array}{r} 18 \\ 8 \overline{) 144} \end{array}$$

$$\begin{array}{r} 68 \\ 9 \overline{) 612} \end{array}$$

Linear Equations $ax = c$ (A)

Instructions: Solve each equation for the variable given.

$7f = 98$

$5f = 5$

$7h = 63$

$7t = 28$

$6a = 6$

$3m = 6$

$5k = 85$

$4g = 12$

$5g = 15$

$6r = 12$

$6x = 18$

$2f = 10$

$10q = 80$

$7a = 133$

$5r = 45$

$2t = 22$

$2h = 16$

$2u = 34$

$9k = 18$

$9q = 63$

$7x = 56$

$2a = 8$

$8g = 104$

$7n = 112$

$6x = 42$

$3b = 36$

$9u = 63$

$5k = 30$

$10w = 160$

$2m = 28$

$10x = 170$

$6k = 18$

Linear Equations $ax = c$ (A) Answers

Instructions: Solve each equation for the variable given.

$$\begin{aligned} 7f &= 98 \\ f &= 14 \end{aligned}$$

$$\begin{aligned} 5f &= 5 \\ f &= 1 \end{aligned}$$

$$\begin{aligned} 7h &= 63 \\ h &= 9 \end{aligned}$$

$$\begin{aligned} 7t &= 28 \\ t &= 4 \end{aligned}$$

$$\begin{aligned} 6a &= 6 \\ a &= 1 \end{aligned}$$

$$\begin{aligned} 3m &= 6 \\ m &= 2 \end{aligned}$$

$$\begin{aligned} 5k &= 85 \\ k &= 17 \end{aligned}$$

$$\begin{aligned} 4g &= 12 \\ g &= 3 \end{aligned}$$

$$\begin{aligned} 5g &= 15 \\ g &= 3 \end{aligned}$$

$$\begin{aligned} 6r &= 12 \\ r &= 2 \end{aligned}$$

$$\begin{aligned} 6x &= 18 \\ x &= 3 \end{aligned}$$

$$\begin{aligned} 2f &= 10 \\ f &= 5 \end{aligned}$$

$$\begin{aligned} 10q &= 80 \\ q &= 8 \end{aligned}$$

$$\begin{aligned} 7a &= 133 \\ a &= 19 \end{aligned}$$

$$\begin{aligned} 5r &= 45 \\ r &= 9 \end{aligned}$$

$$\begin{aligned} 2t &= 22 \\ t &= 11 \end{aligned}$$

$$\begin{aligned} 2h &= 16 \\ h &= 8 \end{aligned}$$

$$\begin{aligned} 2u &= 34 \\ u &= 17 \end{aligned}$$

$$\begin{aligned} 9k &= 18 \\ k &= 2 \end{aligned}$$

$$\begin{aligned} 9q &= 63 \\ q &= 7 \end{aligned}$$

$$\begin{aligned} 7x &= 56 \\ x &= 8 \end{aligned}$$

$$\begin{aligned} 2a &= 8 \\ a &= 4 \end{aligned}$$

$$\begin{aligned} 8g &= 104 \\ g &= 13 \end{aligned}$$

$$\begin{aligned} 7n &= 112 \\ n &= 16 \end{aligned}$$

$$\begin{aligned} 6x &= 42 \\ x &= 7 \end{aligned}$$

$$\begin{aligned} 3b &= 36 \\ b &= 12 \end{aligned}$$

$$\begin{aligned} 9u &= 63 \\ u &= 7 \end{aligned}$$

$$\begin{aligned} 5k &= 30 \\ k &= 6 \end{aligned}$$

$$\begin{aligned} 10w &= 160 \\ w &= 16 \end{aligned}$$

$$\begin{aligned} 2m &= 28 \\ m &= 14 \end{aligned}$$

$$\begin{aligned} 10x &= 170 \\ x &= 17 \end{aligned}$$

$$\begin{aligned} 6k &= 18 \\ k &= 3 \end{aligned}$$