

## **SEE Math Activities**

In the TechLinks for CTCs: Science, Math, Health & Literacy Activities for  
Community Technology Centers



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Other activities by Sue P. White from various sources.

### **Activities**

- I. Estimation Challenge
- II. What's Your Wingspan?
- III. Tangrams
- IV. Handshake Problem
- V. The Newspaper Fold
- VI. The Allowance Challenge
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# Estimation Challenge

THE BASICS	THE TOOLBOX	EDUCATION STANDARDS	Connections Math Standard:
 Grade Level: 2-12   Estimated Time: 25 min.	<ul style="list-style-type: none"> <li>• 1-2 large boxes of Cheerios</li> <li>• 32-oz. or 48-oz. clear container with lid (i.e. Rubbermaid)</li> <li>• 3-oz. or 7-oz. cups, 1 per student</li> <li>• Paper plates, 1 for every 2-4 students</li> <li>• Pencil and paper</li> </ul>	<b>SAFETY CONCERNS</b>	Learning to estimate by making connections among various concepts and learning how to apply mathematics in contexts outside of math.  Remind the students not to eat the Cheerios you use in this activity. You may want to provide a separate cup of Cheerios for eating.
		<b>FOR KIDS WITH DISABILITIES</b>	Visually-impaired students can do this activity by feeling the Cheerios container. Mobility-impaired students may use a larger container and larger objects.

## What To Do



### Educational Objective:

To learn how to use estimation to solve everyday problems.

### What to Do:

- Prepare the container with Cheerios by counting them out one at a time. Write the number on a small piece of paper and tape it to the **inside** of the lid. If you are using a 32-oz. container, you should use 3-oz. cups. 7- or 9-oz. cups work best with 48- or 64-oz. containers. Try to get cups whose capacity does not divide evenly into the capacity of the container.
- During the activity, give the students paper plates, a quantity of cereal more than the capacity of the cup, and paper and pencil.
- You may save the materials for future use.

### Questions to Ask Students As They Do This Activity:

- About how many Cheerios do you think the container holds?
- If you know the volume of the container and the volume of the cup, how can you figure out how many Cheerios are in the container?
- How many times will the volume of the cup fit into that of the container?

- About how many Cheerios do you think the cup will hold?

### Why It Happens:

In order to figure out how many Cheerios are in the container, you need to divide the volume of the container by the volume of the cup. Then, multiply the answer by the number of Cheerios that will fit in the cup. If the cup does not divide evenly into the container, you need to "round off" and take that into account when you come up with your final answer. Remember, this is estimating. Getting the "reasonable" answer is more important than getting the exact answer. Depending on the size of the container and the age of the students, reasonable answers will vary. There will be many reasonable answers, and therefore, "winners" of the prizes.

## WEB SITES

- **At Arm's Length**  
[http://www.pbs.org/wgbh/nova/teachers/activities/2313\\_threemon\\_02.html](http://www.pbs.org/wgbh/nova/teachers/activities/2313_threemon_02.html)  
 (Grades 6-12)
- **How Many Pearls?**  
<http://www.pbs.org/wgbh/nova/pearl/uncountable.html> (Grades 3-12)

## SOFTWARE

- **Carmen Sandiego Math Detective**  
 The Learning Company, 1998.  
 (Grades 3-9)
- **Math Blaster 6-9**  
 Knowledge Adventure, Inc., 1996  
 (Grades 1-4)

## READING ROOM

- Kenda, Margaret, and Phyllis Williams. **Math Wizardry for Kids.** Barron's, 1995. (Grades 3-8)
- Murphy, Stuart. **Betcha!** HarperTrophy, 1997. (Grades 1-4)
- Smoothey, Marion. **Estimating.** Marshall Cavendish, 1995. (Grades 3-8)

## Career Connections

It is important for people to know the value of their property so that they can get the right amount of insurance, or ask for the right amount of money if they want to sell it. An appraiser is a person who uses what they know to estimate the value of property.



# ESTIMATION CHALLENGE ACTIVITY SHEET

## You Will Need:

- A cup
  - Cheerios
  - Paper plates
  - Scrap paper and a pencil
1. Your teacher will show you a large container of Cheerios. Using the materials you are given, how can you estimate the number of Cheerios in the large container you were shown? Write down what you did.
  2. Discuss your answer with the other students in your group. Can you think of a way to make your estimate more accurate?
  3. We all make estimates every day. Each time you estimate you have to have some information as a reference before you can make a good estimate. What kind of information would you use in making the following estimates:
    - a. You're going through a buffet line at a birthday party. How do you decide how much of each food to put on your plate?
    - b. The bus will pick you up at 7:45 a.m. to take you to school. How do you decide what time to set your alarm so you can make it to school on time?
    - c. Your family of four is expecting three relatives to visit for a special dinner. How do you estimate how much food to buy for the special dinner? How would the ages of the children in your family and your visitors affect your estimates?
    - d. You're going on a field trip to a science museum in a nearby city. If you plan to take public transportation, buy your lunch, and buy a souvenir, how much money should you take with you? What if you are taking a car pool? Can you determine the distance and the car's approximate gas mileage to figure out how much money each person in the car should contribute for gas?



# What's Your Wingspan?

<p><b>THE BASICS</b></p>  <p>Grade Level: 1-12</p>  <p>Estimated Time: 45 min.</p>	<p><b>THE TOOLBOX</b></p> <ul style="list-style-type: none"> <li>• Tape measure</li> <li>• Paper &amp; pencil</li> <li>• Large chalkboard or dry-erase board and chalk or markers</li> </ul>	<p><b>EDUCATION STANDARDS</b></p>	<p><b>Data Analysis and Probability Math Standard:</b></p> <p>Learning to formulate questions that can be answered by collecting, organizing, and displaying data in graphs and charts.</p>
		<p><b>SAFETY CONCERNS</b></p>	<p>Students should not loop the tape measure around their necks. If students remove their shoes, be sure they don't step on sharp objects or slip on a wet floor.</p>
		<p><b>FOR KIDS WITH DISABILITIES</b></p>	<p>Visually-impaired students may need a Braille measuring tape. Mobility-impaired students may need to measure shorter portions of their body and add them together.</p>



**Educational Objective:**

To learn measuring skills and problem-solving. To learn how to gather and analyze data.

**What to Do:**

- Gather the materials.
- Duplicate the activity sheet.

**Questions to Ask Students As They Do This Activity:**

- How can you solve the problem of measuring someone who is taller or wider than the tape?
- After the students have finished measuring each other, have them share their results while one of the students records the data on the chalkboard or other large surface. Ask them if they see any patterns in the information they have gathered.
- What conclusions, if any, can be drawn from the data collected?
- Can you make generalizations based on a small amount of data?

**Why It Happens:**

No matter what their age, most people have a wingspan that is the same length or almost the same length (within 2 inches) as their height. There are, however, some people whose wingspans are 3 – 5 inches (or even more) longer than their height.

There are many different ways of looking at the data, and each will give you slightly different information about it. If you have a large enough group—roughly 10 or more—to analyze, you will usually find that the greatest number of participants have wingspans equal to their heights. The category into which most people fall is called the **mode**. Measurements that differ by one or two inches are also very common. In fact, if you count together in one category all the people whose wingspans differ from their height by zero, one, and two inches, you will probably account to most of the people in your sample.

Another way to look at the results is to make a line with "0" as the midpoint and hash marks for +1, 2, 3...8 to the right and -1, 2, 3...8 to the left and make a mark for each person at the appropriate difference: wingspan-height. You would probably find that about half of the people in the sample would be to the left of "0" and half would be to the right. (See Activity Sheet, Part C.) This is called finding the **median**. Depending on your particular sample, the median may well be some number other than "0" such as +1 or -2.

If you added all the plus and minus entries together (adding algebraically so the pluses and minuses cancel out) and divided them by the total entries, you would get the **mean**. The mean is usually what we think of as the **average**.

**Calculating:** In finding the mean in Part C, students will be calculating with negative and positive numbers. They may need to be reminded that they should think of numbers on a continuous line with 0 in the middle:

-5    -4    -3    -2    -1    0    +1    +2    +3    +4    +5

When adding a positive and negative number, the answer will be between the value of the two numbers they are adding on the number line. For example:

$$\begin{array}{r} +4 \\ + -3 \\ \hline +1 \end{array}$$

When two positive numbers are added together they make a greater positive number, and when two negative numbers are added together they make a greater negative number. For example:

$$\begin{array}{r} +3 \\ + +5 \\ \hline +8 \end{array} \qquad \begin{array}{r} -3 \\ + -5 \\ \hline -8 \end{array}$$

One way to add a long list of positive and negative numbers is to first add all the positive numbers together, and all the negative numbers together, then add the positive and negative totals together.

When dividing a positive number, such as the number of people in the data sample, into a negative number such as might result by adding up the data, the answer (quotient) will always be negative. Of course if the total for the data is positive, the division answer will be positive.

## WEB SITES

- **Cool to Rule**  
<http://ericir.syr.edu/Virtual/Lessons/Mathematics/Measurement/MEA0015.html>  
(Grades 5-6)
- **The Tides of Change**  
[http://score.kings.k12.ca.us/lessons/Tides\\_of\\_Change\\_Lessons.html](http://score.kings.k12.ca.us/lessons/Tides_of_Change_Lessons.html) (Grades 7-12)

## SOFTWARE

- **Math Alive**  
BonusPoint, Inc., 1998  
(Grades 6-12)
- **Leapfrog Math: Intermediate 1-4**  
Meridian Creative Group  
(Grades 3-6)

## READING ROOM

- D'Amico, Joan and Karen E. Drummond. **The Math Chef: Over 60 Math Activities and Recipes for Kids.** Wiley, 1997. (Grades 3-8)
- Friedhoffer, Bob. **Magic Science: Math, Measurement, the Mind.** Educational Design, 1996. (Gr. 3-6)
- Pluckrose, Henry. **Size.** Children's Press, 1995. (Grades K-2)

## Career Connections

A person who analyzes data or numerical facts is called a statistician.

# WHAT'S YOUR WINGSPAN ACTIVITY SHEET

## PART A

Work with a partner. Take turns measuring your wingspans and heights.

1. Have your partner spread his/her arms out straight from the shoulders on each side of the body.
2. Using a tape measure, measure the distance in inches or centimeters (decide which you will use with your group) from the tip of the longest finger on one of your partner's hands to the tip of the longest finger on the other hand. This is your wingspan.
3. Write down your names and wingspans in the boxes below. Round your answers to the nearest inch (or centimeter).

Name	Wingspan	Height

4. Measure your partner's height from the bottom of their heel to the top of their head. Don't measure their shoes. Your partner may want to remove their shoes before you measure their height. Write their height down in the correct box above. Round to the nearest inch (or centimeter).
5. Now, let your partner measure you.
6. Share the information, or **data**, that you collected with the others in your group.
7. Have someone record all the data on a big chart or a chalkboard for all to see.
8. How many people have the same wingspan and height measurement?
9. How many people have a wingspan measurement that is one inch different from their height measurement? Two inches?

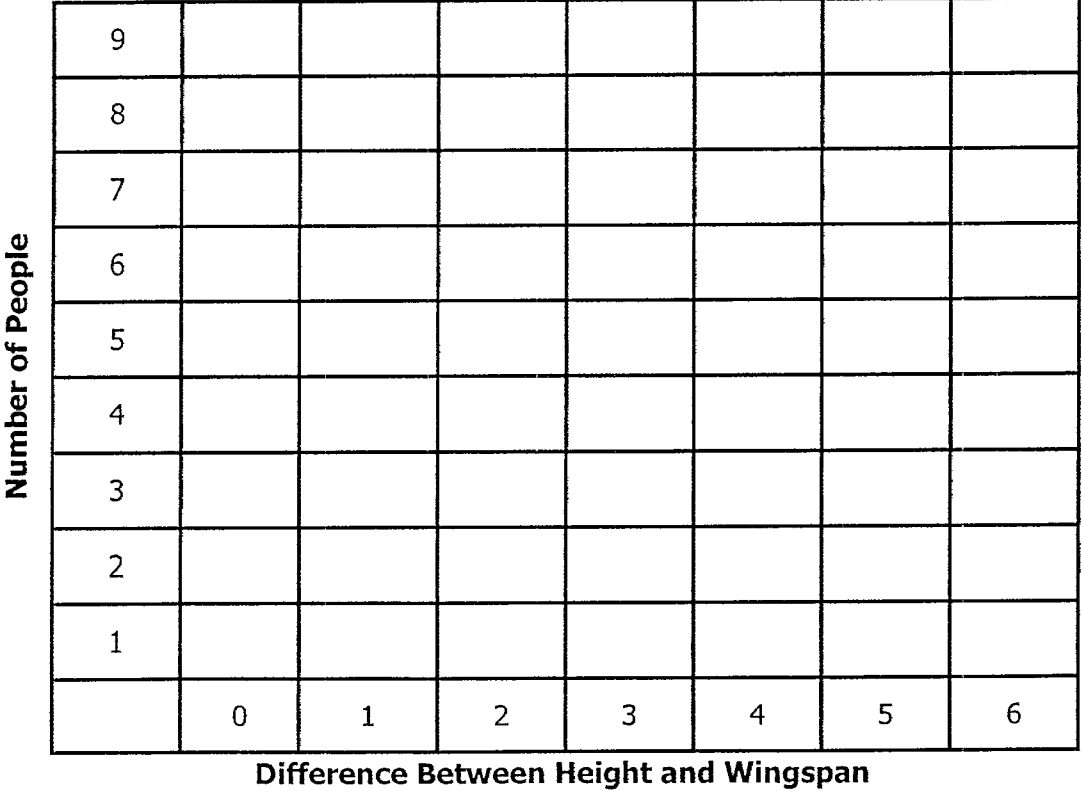
# WHAT'S YOUR WINGSPAN ACTIVITY SHEET

## PART B (For Grades 3-6)

11. Follow steps 1-10 from Part A. Record your data from steps 1 to 5 on the following chart:

Name	Wingspan	Height	Difference

12. Share the group data you have developed with others by making a group graph that is large enough for everyone to see. Make the graph like the one below. Have each person add their own data by making an X in the column describing the difference in his or her wingspan and height.



- 13. What conclusions can you draw about your group's data?
- 14. Which column has the most X's? This is called the **mode**. How many modes does your group's chart have?

# WHAT'S YOUR WINGSPAN ACTIVITY SHEET

## PART C (For Grades 6-12)

15. Follow steps 1-10 in Part A. Record your data from steps 1 to 5 on the following chart. If your wingspan is less than your height, record the difference in column A next to the minus sign. If your wingspan is more than your height, record the difference in column C next to the plus sign. If there is no difference, record a zero in column B. There will be only one entry to the right of the double line for each person.

Name	Wingspan	Height	A Wingspan Less Than Height	B Wingspan Same As Height	C Wingspan More Than Height
			-		+
			-		+

16. Share the data you have developed with your group.

17. Make a Group Analysis chart like the sample below that is big enough for everyone to see.

Sample Group Analysis													
Number of People	6												
	5												
	4												
	3						X						
	2						X	X					
	1					X	X	X				X	
	0	-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
Difference in Wingspan and Height (inches or cm)													



18. Each person in the group records their minus, plus, or zero data on the Group Analysis chart by putting an X in the empty box closest to the bottom row above the appropriate number. The chart above shows you how your chart **might** look after a few entries.

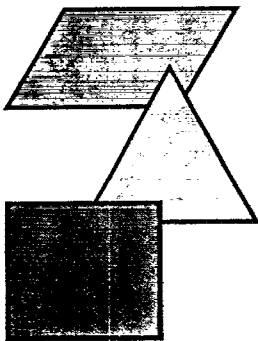
19. Look at the graph of your group's data. What kinds of conclusions can you draw?
20. Which of your columns has the most entries? This is called the **mode**.
21. Draw a line connecting the top X in each column. What is the shape of the line? Your line **may** look something like a bell, high in the middle, and low at the ends. If it does, your data have formed what scientists and mathematicians call a **bell curve**. It is a very common shape for data such as these to make.
22. Half of the entries fall above, and half below, the point known as the **median**. Try to determine the median difference for your group's data.
23. The **mean** is found by adding up all the entries and dividing by the number of entries. Determine the mean. Don't forget that you will be calculating with negative numbers.

Group Analysis Chart													
Number of People	6												
	5												
	4												
	3												
	2												
	1												
	0	-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
Difference in Wingspan and Height (inches or cm)													



# Tangrams

THE BASICS	THE TOOLBOX	EDUCATION STANDARDS	Geometry Content Math Standard:
 <p>Grade Level: K-8</p>  <p>Estimated Time: 30 min.</p>	<ul style="list-style-type: none"> <li>• 1 set of 7 tangram pieces (2 sets for younger students)</li> <li>• Cardboard</li> <li>• Scissors</li> <li>• Tangram cut-out sheet</li> </ul>	<b>SAFETY CONCERNS</b>	Using visualization and spatial reasoning to analyze characteristics of two-dimensional geometric shapes in order to understand geometric relationships.  Make sure the younger students do not put small tangram pieces in their mouths.
		<b>FOR KIDS WITH DISABILITIES</b>	Visually-impaired students may need time to become familiar with the tangram pieces. Mobility-impaired students may need proportionately larger pieces.



## Educational Objective:

To develop an understanding of spatial relationships by making various shapes using triangles, squares, and parallelograms.

## What to Do:

- Copy the activity sheets.
- Cut out the tangrams using heavy colored cardboard, using several different colors. (Or use purchased plastic tangrams.)
- Older children can cut out their own tangrams.
- Be sure to keep individual tangram sets together.
- Distribute tangram sets to groups of students, alternating colors for each group.

## Questions to Ask Students As They Do This Activity:

- What did you discover about triangles?
- What process did you use to figure out the shapes?
- How is a parallelogram different from a trapezoid? (Refer to the Tangram Exploration Chart.)

### **Why It Happens:**

By using the tangram shapes, children learn, for instance, that two identical right isosceles triangles fit together to form a square. Additionally, children learn that three basic shapes—triangles, squares, and parallelograms—can fit together to form many other shapes and figures. Experiences in exploring and understanding relationships of shapes to each other is an important prerequisite for advanced mathematics. The opportunity to explore shapes introduce vocabulary and geometric concepts that are part of mathematics and everyday problem-solving, such as storing articles in a tight space or building a model car.

## **WEB SITES**

- **Tangram Puzzle**  
<http://enchantedmind.com/tangram/tangram.htm> (Grades K-8)
- **Tangrams**  
<http://explorer.scrtec.org/explorer/explorer-db/html/783750363-447DED81.html>  
(Grades 4-12)

## **SOFTWARE**

- **Thinkin' Things: All Around Fripple Town**  
Edmark Corporation, 1999  
(Grades K-3)
- **Geometry World: Middle Grades Interactive Explorer**  
Cognitive Technologies Corp., 1999  
(Grades 3-8)

## **READING ROOM**


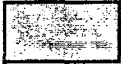



- D'Amico, Joan and Karen E. Drummond. **The Math Chef: Over 60 Math Activities and Recipes for Kids.** Wiley, 1997. (Grades 3-8)
- Hewitt, Sally. **Puzzles.** Raintree Steck-Vaughn, 1996. (Grades K-4)
- Hewitt, Sally. **Shapes.** Raintree Steck-Vaughn, 1996. (Grades K-4)

### **Career Connections**

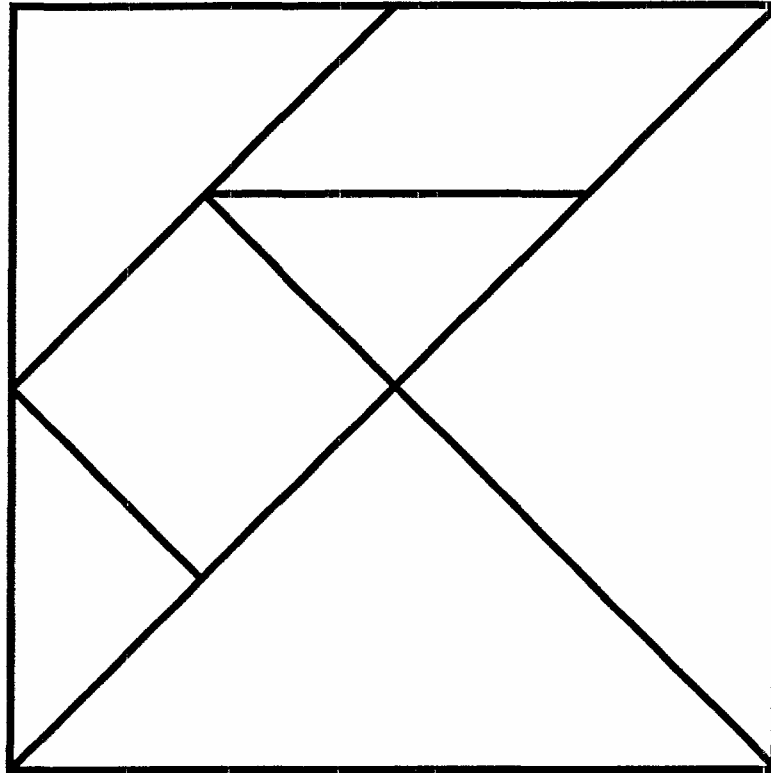
Architects and architectural engineers use their knowledge of how shapes work together to design all kinds of buildings.

# TANGRAMS ACTIVITY SHEET

1. Work with a partner to complete the Tangram Exploration Chart. Are you able to make all the shapes? What is the largest number of tangram pieces you can use in creating each shape?

Tangram Exploration Chart					
Shapes to Make					
Number of Tangram Pieces	Triangle 	Rectangle 	Square 	Parallelogram 	Trapezoid 
1					
2					
3					
4					
5					
6					
7					

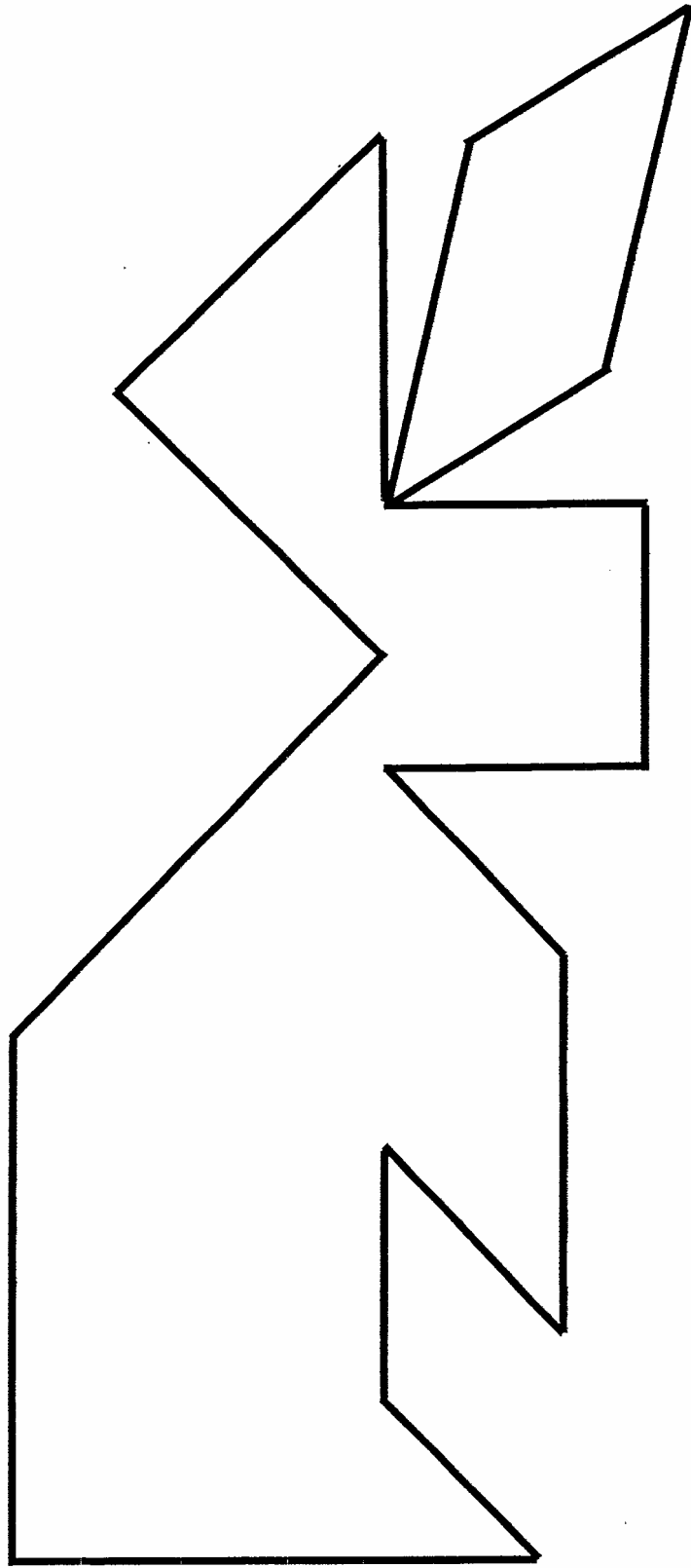
# Tangram Cut-Out

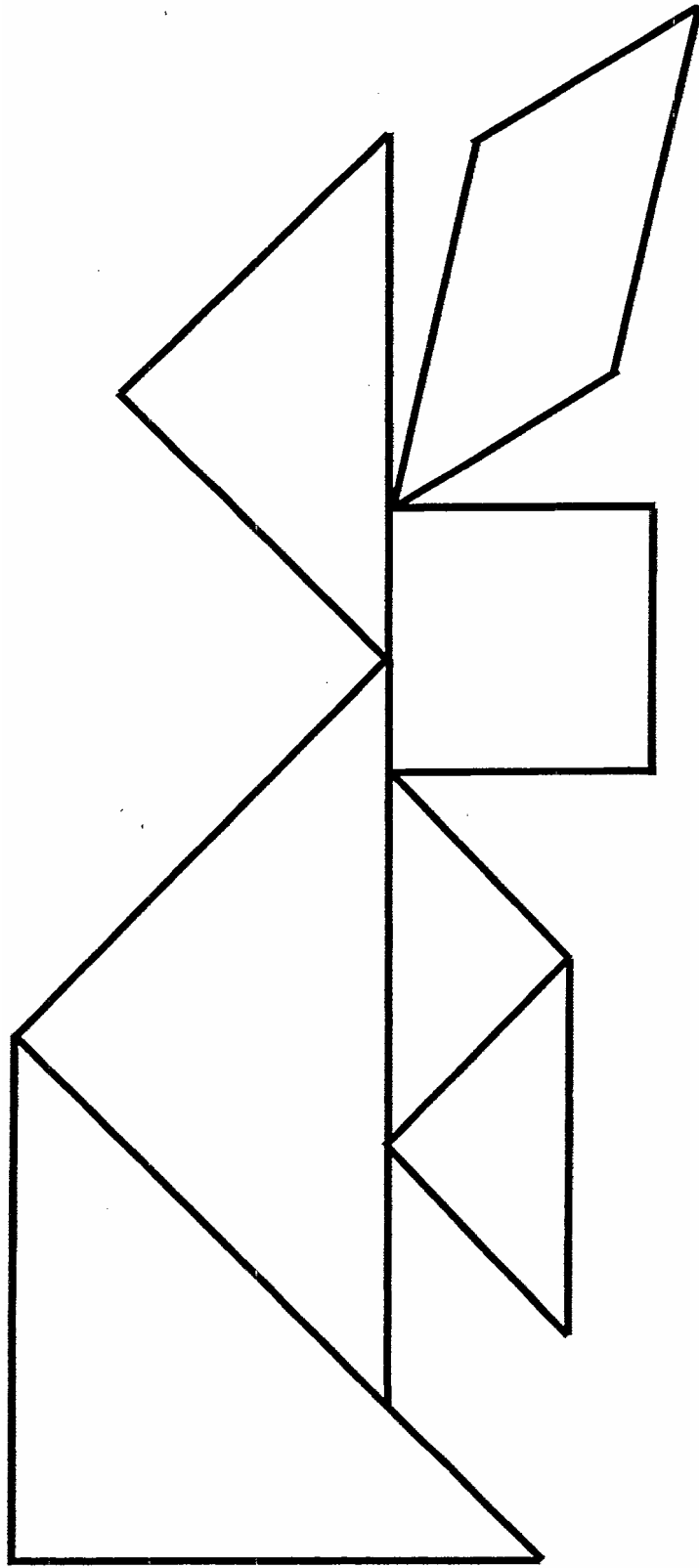


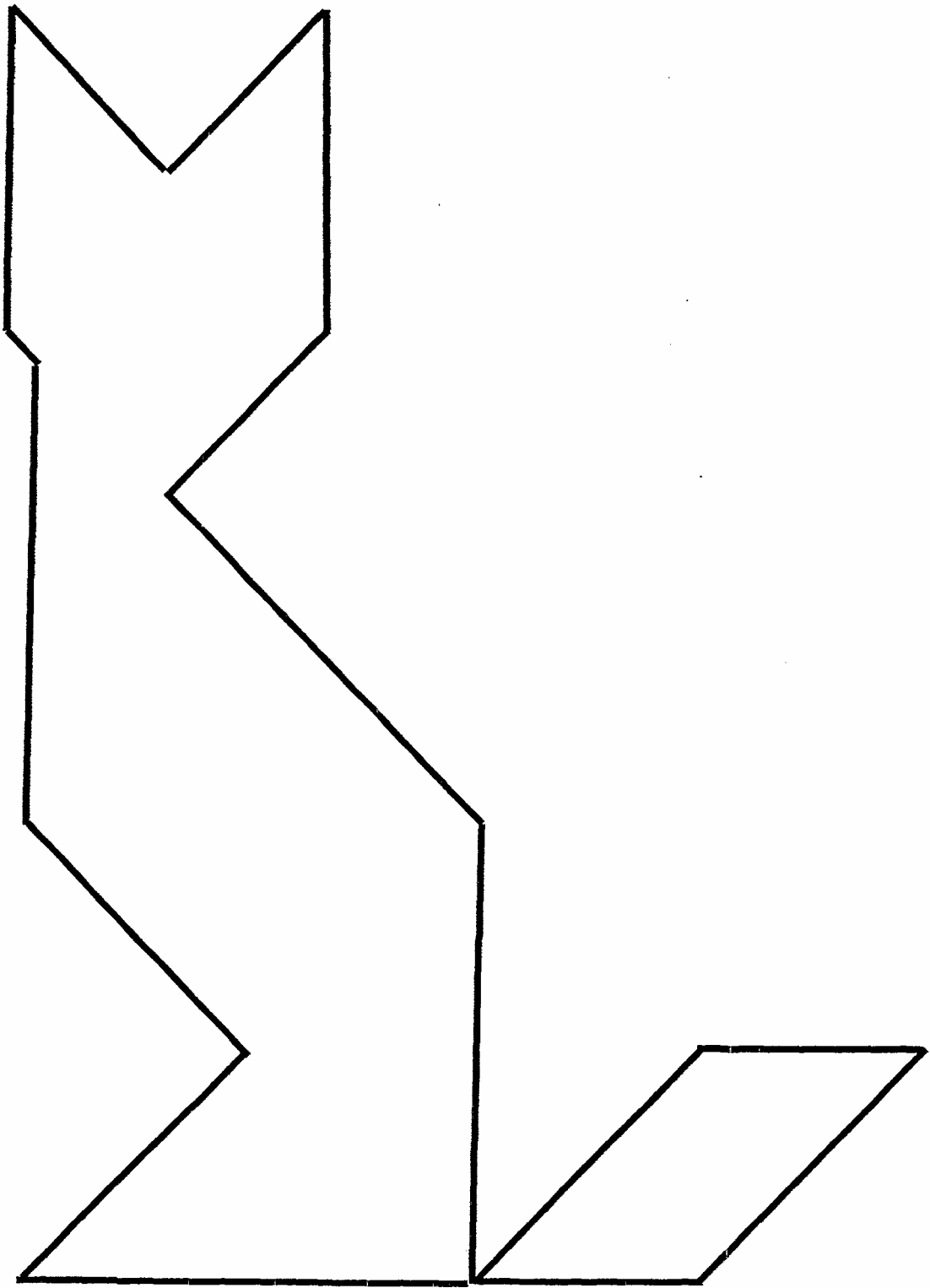
Use this master to create your own tangram sets! Carefully cut out the tangrams using heavy cardboard or card stock. You can use several different colors to create different sets of tangrams. Be sure to keep individual tangram sets together. Then, using your new tangram pieces, fit all 7 shapes together within the lines of each of the figures on the following pages.

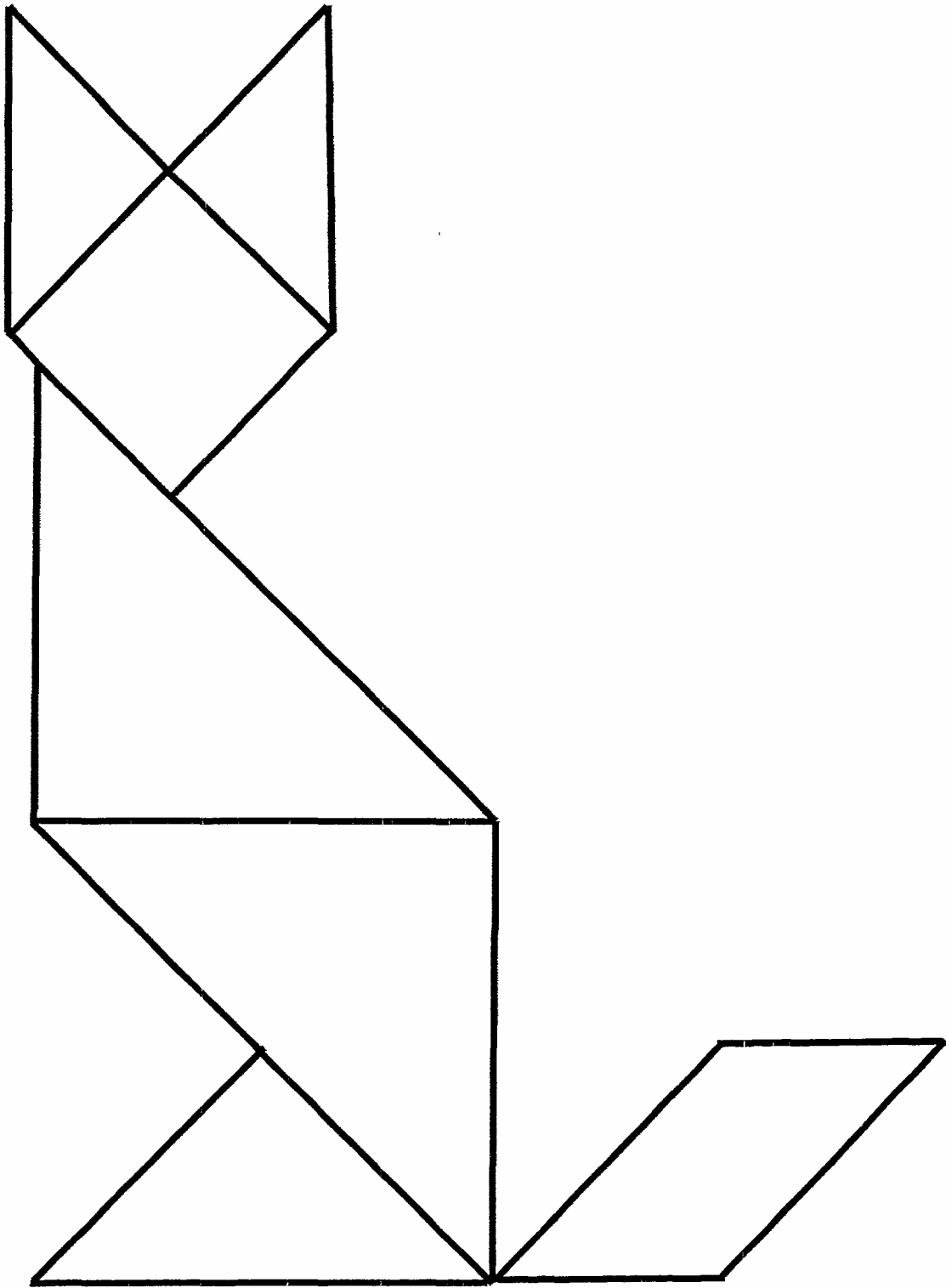
Can you think of any other shapes to make with your tangrams?

Can you create new puzzles for your friends?









## THE HANDSHAKE PROBLEM (Number Theory)

*Mathematics Standard — Number and Operations*

**Audience:** Grades 4— Adult

**Materials:** None — strictly “Minds-On”

**Directions:** **Purpose the Question:**

**If 6 people are in attendance at a meeting, and each person shakes hands with every other person only one time, what is the total number of handshakes will occur?**

.....**Allow time for exploration**.....

(Encourage participants to solve the problem using any method or strategy they feel comfortable with)

Possibilities: Demonstration, drawings, narrative, discussion

**Ask each group to be prepared to share their respective solutions in writing. This helps students to realize the importance of writing in mathematics as well as recording data in an organized manner.**

*Move around the room to listen to the group discussions. You may need to guide and probe but do not give answers. If any group has difficulty getting started, ask a question or two to point them in a solid direction but no answers please!*

**Demonstrating solutions:**

One suggestion is to issue a large poster sheet (from a flip chart) to each group for recording their result. The richness of this activity lies in the fact that in most cases, each group has a different approach to the problem. Students then begin to realize that there is more than one way to solve a problem and that ‘informal’ methods are as acceptable as formal methods. At the least, they begin to see the background and ‘why’ things work versus the isolated rote memorization of a formula.

**Extensions:**

Change the number of people at the meeting to 8, then 10, then 20, etc., to see if students begin to see a pattern. Students should eventually be able to make a conjecture. I have had students as early as 4 (with some guidance) learn to form a general rule.

## THE HANDSHAKE PROBLEM (A Solution)

**Our Problem calls for a tally of 6 people at a meeting.**

Person A shakes 6 hands.

Person B shakes 5 hands since this person has already shaken hands with Person A.

Person C shakes 4 hands and son on

Do you see the pattern? Did you get 15?

- 1) Actually, most students will arrive at the fact that you will ultimately add (in this case):

$$5 + 4 + 3 + 2 + 1 = 15$$

For 8 people at the meeting, your will add:

$$7 + 6 + 5 + 4 + 3 + 2 + 1 = 28$$

What you really want students to begin to see is how they can predict the solution for any number of people attending the meeting without adding all the numbers each time. This would be quite tedious for larger numbers say 20, or 50 or even 100, even with the use of a calculator!

### How it works:

The final conjecture for 10 persons at the meeting is: The number of people, say 10, times the number below it, 9, = 90, divided by 2 = 45.

$$\text{So it looks like } (10 \times 9) / 2 = 45$$

Now try it with a new number to check your understanding. Students may want to get into a discussion of why this works. **Please note there are a variety of ways to approach this problem and this is one strategy.**

## THE NEWSPAPER FOLD (A MILLION DOLLAR BET)

**Audience:** Grades 4 through adult

**Materials:** A stack of newspapers. Each participant will need the double page from any newspaper.

Areas of Mathematics Developed: Number Sense, specifically mathematical progression or exponential growth.

Division of fractions, particularly that dividing by  $\frac{1}{2}$  is the same as doubling the number.

**What to Do:**

Give each participant or group a large sheet of newspaper, a double page.

- 1) Then ask everyone to fold it in half. Which way to fold it does not matter. Each individual can decide this. (1st fold)
- 2) Now ask each person to fold it in half again. (2nd fold)
- 3) Challenge the group to try to fold it 8 more times and offer a significant reward if anyone is successful.

I usually start the session with saying “I’ll give \$10.00 to the first person. who can fold this newspaper in half 10 times.”

Move around to make certain that each new fold is one-half of the previous fold. Have enough newspaper handy so that more than one attempt can be made if requested. Participants may try as many times as they wish until time is called.

**Discussion:**

Number of folds	Thickness (Layers)
0	1
1	2
2	4
3	8
4	16
5	32
6	64
7	128

By now you will find you are having real trouble folding the paper again. It has been getting much smaller and more importantly, much **thicker** and harder to fold. And, you have only folded it 7 times! If you can fold it again, you’ll have 256 layers of paper. You might not be able to fold it anymore, but if you can, you will have 512 layers. It is not likely you can do it the tenth time as the paper would now be 1024 layers thick!

Notes: I've had students to try this over and over with different sizes of paper and even with the paper wet. Encourage your audiences to explore and let me know if anyone folds it successfully 10 times.

Extension: See attached "25 Folds"  
Answer: 33,554,432

Adapted from "Math-a-Magic" by Lawrence B. White (c. 1990) Edited and revised by Sue P. White,  
6/02

**If we could fold a  
sheet of paper 25  
times, how thick  
would it become?**

## THE ALLOWANCE CHALLENGE (Number Sense)

**Audience:** Grades 4 — adult

**Materials needed:** Calculators if preferred but not totally necessary. Paper and pencil calculations are fun.

**Group Arrangement:** Pairs, groups of 3 each, or groups of 4 each, if the audience is large. Assign each group member some calculations to perform and then have them to cross-check each other.

This problem is an immediate attention-getter and one that eludes the participant every time! It really is designed to assess number sense and intuition for large numbers. What students will also learn in this activity is exponential growth...

Problem: WHICH WOULD YOU CHOOSE?

Choice A-----\$10,000

OR

Choice B-----A penny today, double it on Day 2, double this on Day 3, and continue in this manner throughout the month of June for 30 days.

Pause and allow the group to conjecture how much Choice B would be at the end of 30 days. Record on the board (if available), on a flip chart, or on an overhead.

Solicit at least 5 guesses.

- |          |          |
|----------|----------|
| 1. _____ | 4. _____ |
| 2. _____ | 5. _____ |
| 3. _____ |          |

Now, let's work the problem:

- Day 1 .....1 cent or \$.01
- Day 2 .....2 cents or \$.02 (2 X .01)
- Day 3 .....4 cents or \$.04 (2 X .02)
- Day 4 .....8 cents or \$.08 (2 X .04)
- Day 5 .....16 cents or \$.16 (2 X .08)
- Day 6 .....32 cents or \$.32 (2 X .16)
- Day 7 .....64 cents or \$.64 (2 X .32)
- Day 8 .....1.28(2 X .64)
- Day 9 .....\$2.56 (2 X 1.28), ETC.

Record your final answer here \_\_\_\_\_

**Question:** On which day do you know you've made the right or wrong decision?

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Extensions: 1) Change the dollar amount depending on the grade level. (I've used this activity successfully with students from grades 4 through middle school and in many adult workshops as well).  
2) Following the closure, ask students to think of other instances or examples where this kind of number progression will occur.

**HAVE FUN!!!!!!**

**THE ALLOWANCE CHALLENGE**

**Choice A:**  
**\$1000**

**Choice B:**  
**A penny on Day 1, double that amount on Day 2, double that amount on Day 3, continuing through the month (30 days)**

**Which would you  
Choose?**

# LESS IS BETTER

## Mathematics Standard — Number and Operations

### Other Ideas for Extensions

#### Grades Used With:

Though recommended by the original author for grade levels 5-9, with some guidance, I have used this activity successfully with younger audiences (Grades 3 and 4), and I have used it with adult audiences. In cases where children have not yet begun to study fractions, it becomes enriching and empowering for them to use their own instincts to compare the size of the fractions. They are very good at this, and you will be amazed at their wisdom!

#### Additional Options:

- 1) For variety, I have changed the name of the game to **MORE IS BETTER**. In this case, the obvious intent is that the person with the **highest** fraction wins. Or, worded differently, the participant is now looking for **the fraction that is closes to 1**.
- 2) My students came up with the idea of making improper fractions with the two cars to determine which is larger or smaller. This was a great idea because it stimulates even more mature audiences.
- 3) Players could also play the game without changing the fractions to equivalent decimals. Methods of comparing fractions then becomes a powerful way to check for conceptual understanding.

#### Editorial Comments.....

Understanding the conceptual notion of fractions still eludes even the most savvy mathematics student. This game, however, has been a fun way to get students to not only gain a deeper understanding of fractional concepts, but their relationship to decimals as well. The use of interchanging decimals and fractions in this context has more meaning and inadvertently becomes a subtle way to reinforce the isolated way it is often taught in the classrooms.

# LESS IS BETTER

## TIME

@ 40 MINUTES

## PURPOSE

To compare fractions and decimals to see which is greater than, less than or equivalent.  
Discussion of rational and irrational numbers, proper and improper fractions and patterns.

## MANAGEMENT

One-on one or in pairs. Overhead cards make demonstrating the game very easy. Students love the overhead cards and love to manipulate them on the overhead so getting volunteers to help demonstrate the game is a snap. I usually like to have an overhead of the scoring sheet because then the students can just duplicate it on the paper and I do not have to make copies.

## AUDIENCE

Grades 5-9

## MATERIALS

- Paper and pencil
- Playing cards that include Ace — 9 only, (Ace = 1)
- Score sheet (optional)
- Calculator (optional for decimal equivalents)

Reference: Kathryn Chval. All Learn Mathematics Project, University of Illinois at Chicago.  
Organized and revised by Joanne Baker. 1997.

## DIRECTIONS

1. Each player or team is dealt two cards.
2. The players make a proper fraction using the two cards. The player with the smallest fraction is the winner. (closest to 0)
3. Players record their fraction and equivalent decimal on the score sheet.
4. The player with the smallest fraction for the round gets one point.
5. Play continues for a specific period of time or rounds. The winner is the player with the most points. If there is a tie, players are dealt 2 more cards to see who gets the point.

## VARIATIONS and EXTENSIONS

- To add to the strategy of the game, three cards are dealt to each player. For each round, the player would use two of the cards to make a proper fraction and save the third card for the next round. Strategies for using the cards wisely can be discussed.
- Players could also play the game without changing the fraction to equivalent decimals. Methods of comparing fractions could be discussed only if you want to focus in on one thing at a time.
- After a complete game is played, the players can analyze the results.
  - Which fractions were greater than  $\frac{1}{2}$ ?
  - Which were closest to  $\frac{1}{2}$ ?
  - Which were closest to 1?
  - Which were closest to 0?
  - Which were equivalent?
  - What is the smallest possible fraction?
  - What are all of the possible fractions using the cards 1-9?
- Players can also analyze the decimals.
  - After finding the decimal equivalence of  $\frac{1}{9}$  and  $\frac{2}{9}$ , predict what the decimal for  $\frac{3}{9}$  and  $\frac{4}{9}$  will be. Check it out. Is there a pattern?
  - Investigate the other fractions and their decimal equivalence starting with  $\frac{1}{x}$ . Are there any of these fractions that follow a pattern?
- Non-repeating and repeating decimals can be compared.
  - What type of patterns did the students notice in the decimals?
  - Which decimals were rational and which were irrational numbers?
  - What kind of number is a fraction? (rational or irrational)  
What makes it that?

Name/s \_\_\_\_\_

### Less Is Better Scoresheet

ROUND	Player 1	Player 2	Player 3	Player 4	WINNER
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

# COUNTER GAME

## Mathematics Standard — Data Analysis and Probability

### Ideas for Extensions

**Audience:** Although the author recommended this game for grades 6 — 8, I have used it with grades 4 through 8. Students love this game and clearly understand the essence of the probabilities. Discussions that follow usually lead into the fairness of such games of chance. My students have often brought in their own games from home and have further explored probabilities of winning matched with maximizing strategies for winning.

### Other Variations:

- 1) When rolling the die, use the ‘difference’ between the cubes. If you choose to do this, be sure to add a column for zero to allow for rolling doubles. This is an interesting ‘twist’ as students will realize the limitations of this choice.
- 2) Use multiplication and record the ‘products’ of the two numbers rolled. Students will then have to list the possibilities in order to generate a new column format. What are the most frequently occurring products?
- 3) Use Fraction Dice and this gives the game a new flavor! Try all the operations. This is a great variation for reinforcing “Operations with Fractions”.

*Editorial Comments .....*

*The National Mathematics Standards published by the NCTM reflect that students don’t get nearly enough ‘hands-on’ experiences relative to learning probability. I feel that as trainers we could use games as a fun and interesting resource to support informal learning in this area.*

# COUNTER GAME

## TIME

@ 40 MINUTES

## PURPOSE

Think about strategies for winning and the probabilities associated with those strategies.

## MANAGEMENT

Two team game, can have one on one, or pairs on a team so the students have someone to discuss their strategies with.

## AUDIENCE

Grades 6-8

## MATERIALS

- Counter Game Board, (or a paper that has columns numbered 1 through 12)
- Pair of number cubes (numbered 1-6) or a pair of dot cubes 1-6 per team
- 12 markers per team so each team has different colors or sizes to distinguish the team markers like buttons, counters, cm cubes, pennies (heads, tails)

Reference: Adapted from Lappan, Fey, Fitzgerald, Friel, and Phillips. *Connected Mathematics. Data. How Likely Is It?* Dale Seymour Publications. Palo Alto, CA. 1996. Joanne Baker. 1997.

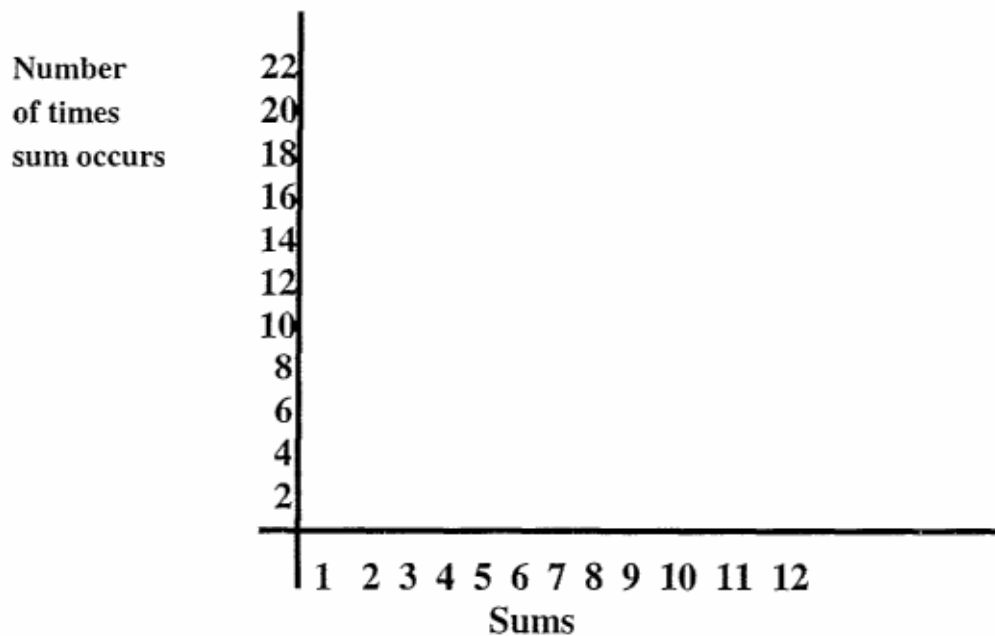
## DIRECTIONS

1. Each team places it 12 markers into the columns in any way they choose.
2. Each team rolls a number cube. The team with the highest roll goes first.
3. Teams take turns rolling the two numbers cubes and moving a marker from the column with the same number as the total shown on the cubes. (the sum) If the column is empty, the team does not get to remove a marker.
4. The first team to remove all the markers from its board wins.

## VARIATIONS and EXTENSIONS

Find a systematic way to list all the possible outcomes(number pairs) of rolling two number cubes and the sums of each of these outcomes. Analyze your list carefully.

If you are having trouble organizing your data set up a graph to assist you in answering the following questions.



## Questions to Ask

- **What sums are possible when you roll two cubes?**
- **Which sum or sums occur most often?**
- **How many ways can you get a sum of 6? 8?**
- **A sum of 2?**
- **Are all the sums equally likely? Explain.**
  
- **Play again using any new strategies for winning. Did it help?**

