Important Concepts . . .

Preview Review

Mathematics Grade 4 *TEACHER KEY*

W1 - Lesson 3: Patterns

V5-07

Important Concepts of Grade 4 Mathematics

W1 - Lesson 1 ..... Number Concepts
W1 - Lesson 2 ..... Addition and Subtraction
W1 - Lesson 3 ..... Patterns
W1 - Lesson 4 ..... Fractions and Decimals
W1 - Lesson 5 ..... Data Management
W1 - Quiz
W2 - Lesson 1 ..... Multiplication 1
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W2 - Lesson 3 ..... Division 1
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W2 - Lesson 5 ..... Exploring Outcomes
W2 - Quiz
W3 - Lesson 1 ..... Measurement 1
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W3 - Lesson 3 ..... Geometry 1
W3 - Lesson 4 ..... Geometry 2
W3 - Lesson 5 ..... Problem Solving
W3 - Quiz

Materials Required

Mathematics Grade 4
Version 5
Preview/Review W1 - Lesson 3 TEACHER KEY

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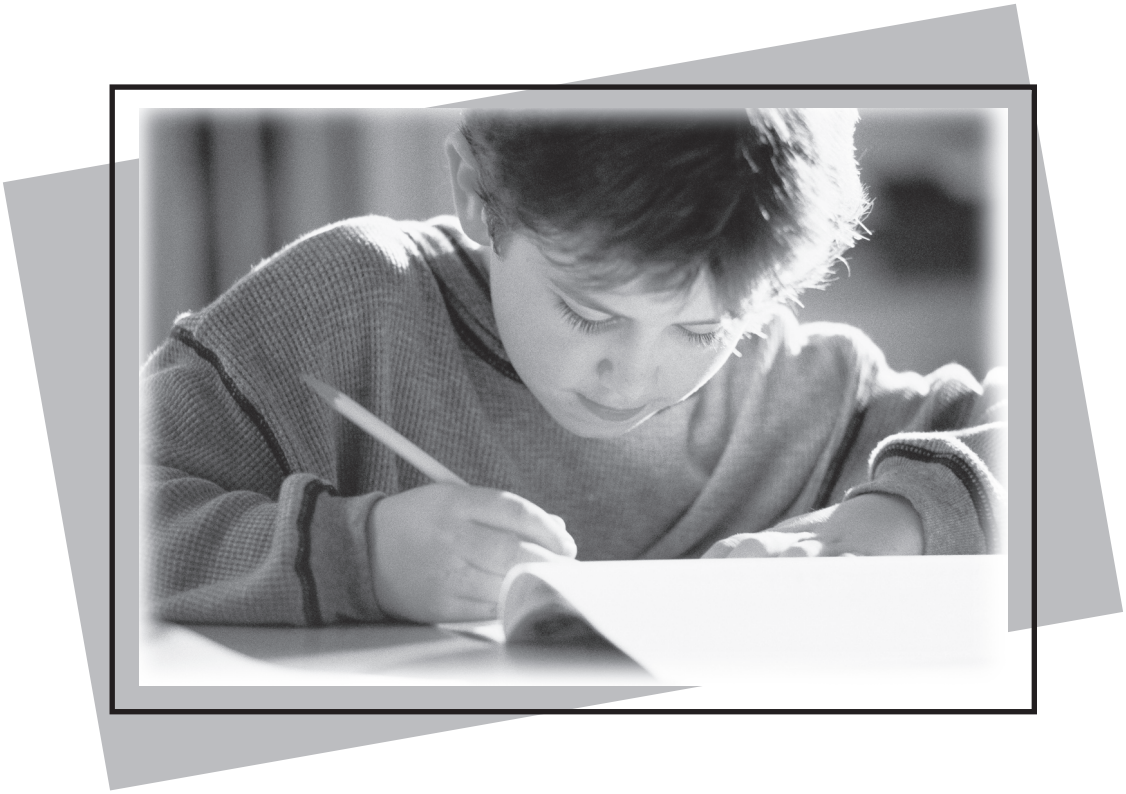
Preview/Review Concepts for Grade Four Mathematics

TEACHER KEY



W1 - Lesson 3: Patterns

OBJECTIVES

By the end of the lesson, you should

- identify and describe shape patterns in your surroundings
- identify mathematical relationships and patterns using T-tables
- make predictions based on addition, subtraction, or multiplication patterns
- use skip counting (forward and backward) to support an understanding of patterns in multiplication and division
- make, describe, and/or extend geometric patterns
- use the *Guess-and-Check* problem solving strategy

GLOSSARY

pattern - a repeating design of colours, shapes, lines, figures, sounds, words, letters, or numbers

skip counting - counting in a pattern by omitting numbers (e.g., 3, 6, 9, 12, ...)

T-table - a table of data that has two columns

W1 - Lesson 3: Patterns

A. Introduction

A pattern occurs whenever something repeats. Patterns can be made of repeating lines, dots, or designs. A pattern can also be a series of colours, letters, and even sounds. Patterns are used in mathematics whenever numbers repeat themselves in a certain way.

Patterns can be found everywhere. The bricks or wood used to build houses are in patterns. Patterns can be seen in many floor coverings and in wallpapers. Most clothing designs use patterns. Bees use patterns to build their honeycombs. Even building a fence requires using some sort of pattern. All the steps in every house have a pattern in them. Computers create patterns when they store data.

Recognizing and using patterns can help you solve problems. They can help you predict the number, shape, or colour that will occur next. In this lesson you will learn how to recognize and use patterns to help you make predictions.

1. Look around the classroom. What sort of patterns can you see? What is repeating itself? (Hint: Look at the floor, at the ceiling, at the walls, and at the clothing of the other students.) List as many patterns as you can find.

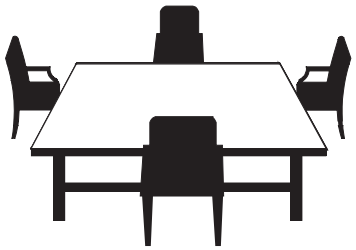
Answers will vary. Students may note patterns in the arrangement of floor tiles or floor coverings, light fixtures, windows, clothing of other students, wall displays, etc.

B. T-tables

T-tables are an easy way to record information using a table with two columns. They are a useful way to discover and predict patterns.

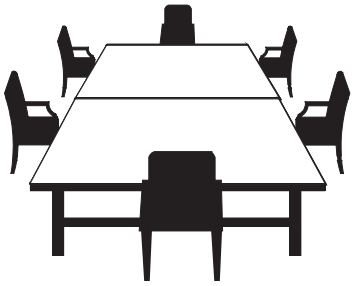
You can use a T-table whenever you want to keep track of how numbers change. By keeping track of the changes, you can discover if a pattern is forming.

Suppose 4 people can be seated at a square table.

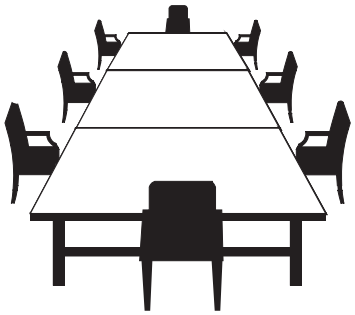


4 people

What happens if you add one more table and the tables are pushed together? How many people can sit at the larger table now?



____ people



What happens if you add a third table? How many people can sit at the table now?

____ people

If you keep adding more square tables, the table will get bigger. A T-table will help you keep track of how many people can sit at the table.

Number of Square Tables	Number of People
1	4
2	6
3	8
4	***10***
5	***12***
6	***14***
7	***16***

1. Complete the T-table at the right by filling in the last four blank squares. Draw each table if it helps you see how many people each table will sit.

2. a. How many people can be seated at 4 tables? ***10*** people

   b. How many people can be seated at 7 tables? ***16*** people

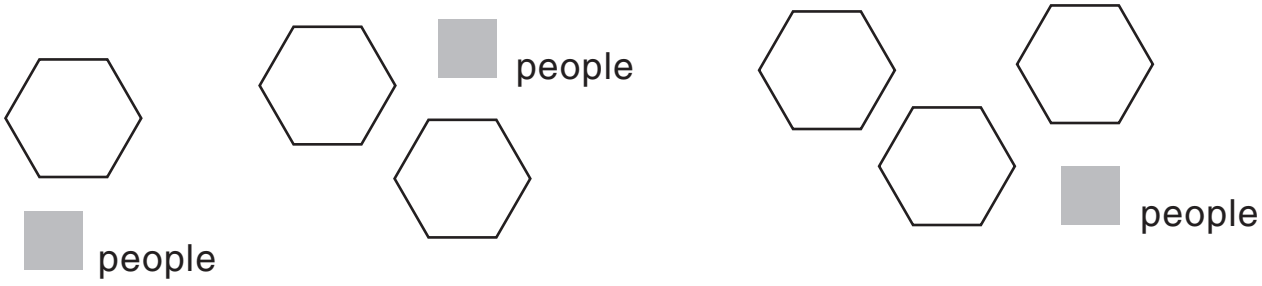
   c. Predict how many people can be seated at 10 tables. ***22*** people

   d. Predict how many people can be seated at 12 tables. ***26*** people

   e. Describe the pattern that you can find in this t-table.

   Each time you add a table, the number of people increases by 2. Some students may note that the number of people seated is found by multiplying the number of tables by 2, then adding 2.

3. Suppose you set up a restaurant using large hexagonal (6-sided) tables. These tables all stand alone. They are not put side by side.



   a. How many people can sit at one table? ***6***

   b. How many people can sit at two tables? ***12*** at three tables? ***18***

c. Complete the following T-table.

Number of Tables	Number of People
1	6
2	12
3	***18***
4	***24***
5	***30***
6	***36***
10	***60***
12	***72***

d. How many people can be seated at 4 tables? ***24*** people

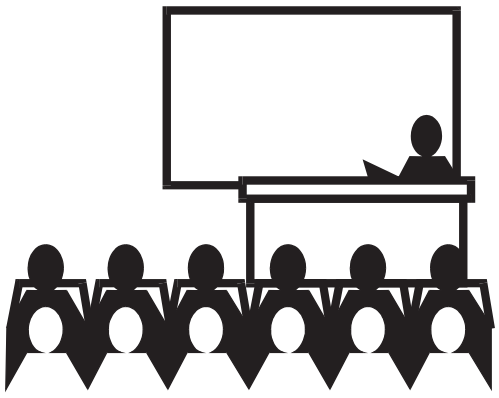
e. How many people can be seated at 6 tables? ***36*** people

f. Predict how many people can be seated at 10 tables. ***60*** people

g. Predict how many people can be seated at 12 tables. ***72*** people

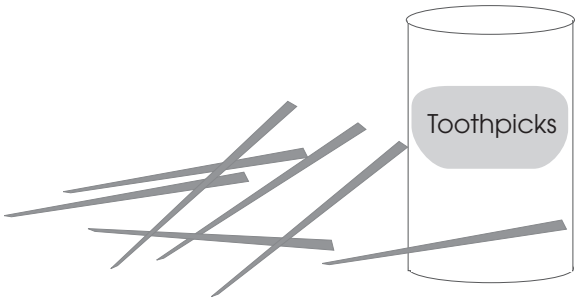
h. Describe the pattern you see in this T-table.

To find the number of people who can be seated, multiply the first number by 6. Or, each time you add a table, the number of people increases by 6.

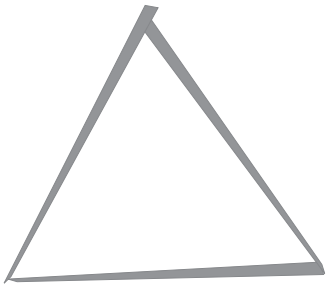


Toothpick Triangles

Ask your teacher for a set of toothpicks. Use the toothpicks to make the models in the following activity. If toothpicks are not available, you can draw the diagrams.

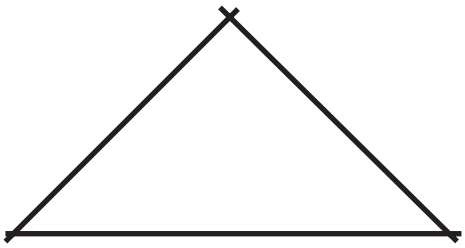


Make a triangle like this:

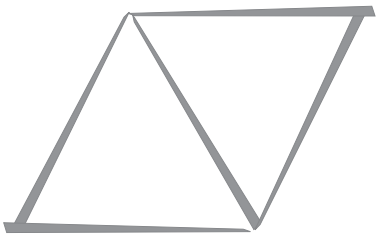


OR

Draw a toothpick triangle like this using 3 lines:



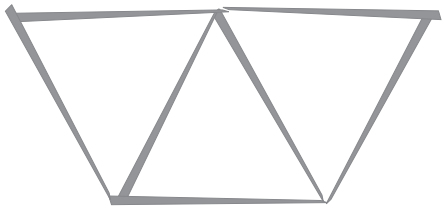
Then make 2 triangles by adding 2 more toothpicks (or lines) to the first triangle like this:



4. a. How many toothpicks did you use in all to make 2 triangles?

   5 toothpicks

Now make 3 side-by-side triangles by adding another 2 toothpicks.



b. How many toothpicks did you use in all to make 3 triangles?

___*7*___ toothpicks

c. The above information can be shown using a T-table. Use the information from your models to start the following T-table. Then build models with 4, 5, 6, 7, and 8 triangles. Use them to complete your T-table.

Number of Triangles	Number of Toothpicks
1	3
2	5
3	7
4	*9*
5	*11*
6	*13*
7	*15*
8	*17*

d. How many toothpicks did you use to make 8 triangles? ___*17*___

e. How many toothpicks would you use to make 10 triangles? ___*21*___

f. Describe the pattern that is used in the above T-table.

To find the number of toothpicks (lines) used each time, multiply the first number by 2, then add 1. Or, each time you add a triangle, the number of toothpicks used increases by 2.

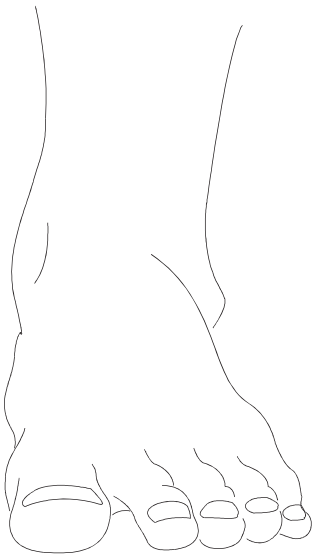
Other Kinds of T-Tables:

5. To complete each of the following T-tables, ask yourself: What was done to the number on the left to change it to the number on the right? Next, write the missing numbers in each T-table. Then, write the pattern rule on the line. An example has been completed for you.

Example:

Number of Feet	Number of Toes
1	5
2	10
3	15
4	20
5	25
6	30
9	45
11	55

Pattern Rule: Multiply the number of feet by 5.



a.

Number of Cars	Number of Wheels
1	4
2	8
3	***12***
4	***16***
10	***40***
15	***60***

Pattern Rule: ***Multiply the number of cars by 4.***

b.

First Number	Second Number
2	4
3	9
4	16
5	***25***
6	***36***
7	***49***
8	***64***

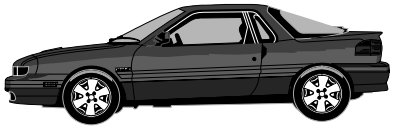
Pattern Rule: ***Multiply the first number by itself.***

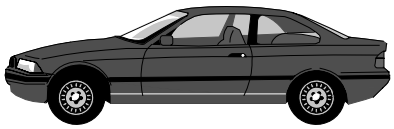
c.

First Number	Second Number
9	4
10	5
11	***6***
12	***7***
15	***10***
19	***14***

Pattern Rule: ***Subtract 5 from the first number.***

6. When building cars, 5 tires are used with each car. There are 4 tires on the wheels and 1 spare tire in the trunk.





a. On the T-table below, write the information for 1 to 10 cars and the number of tires that are needed. Write two titles at the top.

Number of Cars	*Number of Tires*
1	***5***
2	***10***
3	***15***
4	***20***
5	***25***
6	***30***
7	***35***
8	***40***
9	***45***
10	***50***

b. How many tires will be needed for making 50 cars? ***250*** tires

c. Describe the pattern rule you see in this T-table.

To find the number of tires, multiply the number of cars by 5.

C. Skip Counting

Skip counting is a pattern that is created by omitting certain numbers. The following team cheer uses skip counting:

Two, four, six, eight.
Who do we appreciate?

The following skipping song also uses skip counting:

Three, six, nine.
Travel down the line.

Counting by 2s is a very common form of skip counting. You count only every second number.

When you count by 2s, the starting number determines whether the set of numbers will be even or odd. If you start with an even number, the entire set will be even.

If you start with an odd number, the entire set will be odd.

When you skip count by 3s, you count one number and then skip the next two. Skip counting by 3s starting at 12 can be shown this way:

1. For each of the following sets tell what skip-counting pattern is being used. Then, fill in the empty blanks with the missing numbers.

   a. Skip counting by ***3***

   3, 6, 9, ***12*** ,15, ***18*** , ***21*** , ***24*** , 27, ***30*** ,
   33 , ***36*** , 39

   b. Skip counting by ***5***

   15, 20, 25, ***30*** , ***35*** , ***40*** , ***45*** , 50 , ***55*** ,
   60 , ***65*** , 70

   c. Skip counting by ***10***

   185, 175, 165, ***155*** , ***145*** , ***135*** , ***125*** , ***115*** ,
   105 , ***95*** , 85

   d. Skip counting by ***4***

   832, 836, 840, 844, ***848*** , ***852*** , ***856*** , ***860*** , ***864*** ,
   868 , ***872***

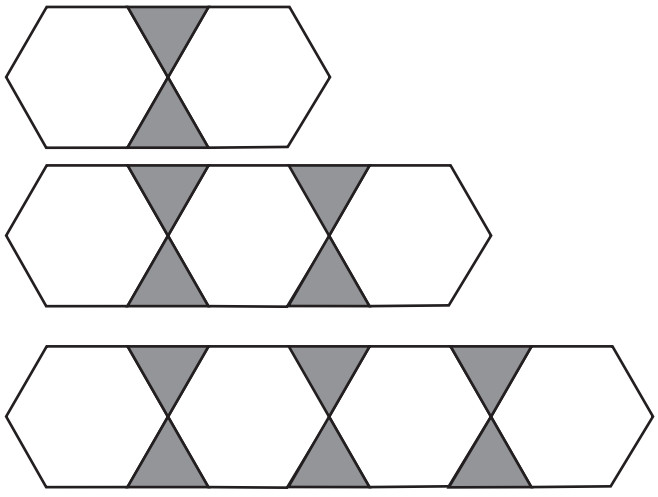
D. Geometric Patterns

Patterns using geometric figures are very common. One example is the honeycombs found in beehives. They are built by repeating the same shape over and over.

Diamonds, triangles, and circles are often found in geometric patterns. They are repeated over and over. You can find them in floor coverings, ceiling tiles, wallpaper patterns, and in many other places.

Your Turn!

1. Frank made a pattern using hexagons and triangles. It looked like this.



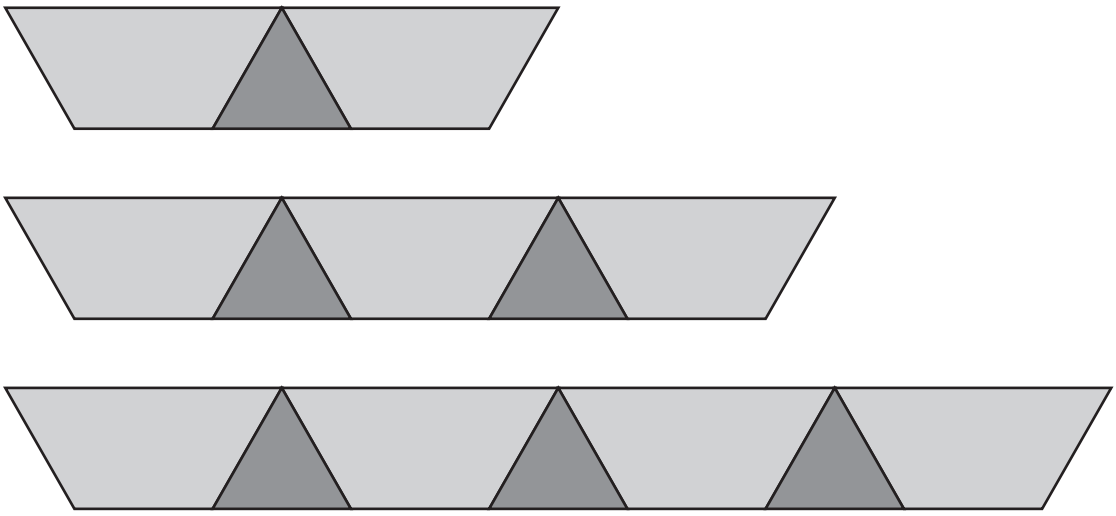
How many triangle blocks will he need if he uses 10 hexagon blocks? (Hint: Use a T-table to help you discover the pattern.)

Number of Hexagons	Number of Triangles
2	***2***
3	***4***
4	***6***
5	***8***
6	***10***
7	***12***
8	***14***
9	***16***
10	***18***

Most students will not likely be able to determine the relationship here. To find the number of triangles, multiply the number of hexagons by 2, then subtract 2. By completing the T-chart up to 10, they should be able to state that the number of triangles increases by 2 with each hexagon that is added.

Answer: _____

2. Polly made a chain pattern using triangle and trapezoid pattern blocks. Her design grew like this.



Polly kept building her design until she had used 25 triangle blocks.

a. How many trapezoids did she use? (Hint: Use a T-table to help you discover the pattern.)

Number of Triangles	Number of Trapezoids
1	***2***
2	***3***
3	***4***
4	***5***
•	•
•	•
•	•
25	***26***

Note: For this question the student should not have to complete the entire T-table of 1 to 25 triangles. The pattern should be apparent after 4 or 5 triangles. The student should be able to state that the number of trapezoids is always one more than the number of triangles.

Answer: ***Polly used 26 trapezoids.***

b. How many blocks did she use in total?

25 + 26 = 51
Polly used 51 blocks in all.

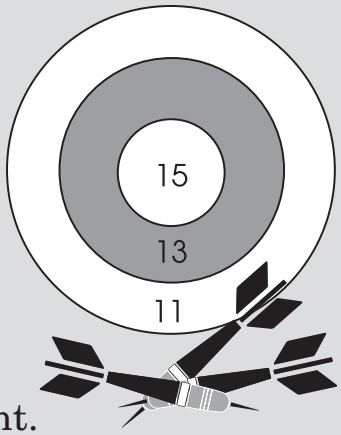
E. Problem Solving

Four-Step Process for Problem Solving
Step 1 Understand the problem
Step 2 Make a plan
Step 3 Try the plan
Step 4 Look back

The *Guess-and-Check* Strategy

Step 2 of the Problem-Solving Process tells you to make a plan or decide on a strategy to use in solving the problem. One strategy used to solve certain problems is to make a reasonable guess at the answer, and then to check to see if you are correct by looking back in the problem. The questions below are an example of the *Guess-and-Check* problem-solving strategy. First, make a reasonable guess. Then, check to see if your answers make sense based on the information in the problem.

Example: Tammy scored 71 points playing a dart game using this game board.



How many darts did she throw?
Tell one way the darts could have landed on the target.

The answers to these two questions are not easy to see. Make a guess at where you think the darts landed, and add the points to see if you are right. How many darts were thrown? Make a reasonable guess. To make a score of 71, would you need to throw 2 darts? 3 darts? 5 darts? 8 darts?

Guess 1

Let's start by guessing 3 darts with scores of 15, 15, and 17.

15 + 15 + 17 = ?
Answer: **47** [Too small]

This tells you that more than 3 darts were thrown.

Guess 2

Add on two more dart throws with scores of 15 and 13.

15 + 15 + 17 + **15** + **13** = ?
Answer: **75** [Too big]

75 is close to 71. The score of 75 is 4 points too high. How can we make the score smaller by 4 points?

Guess 3

Remove a 17 and replace it with a 13.

~~**17**~~ **13**
15 + 15 + 17 + 15 + 13 = **71**

Answer to the problem:

Tammy threw 5 darts. They landed on 13, 13, 15, 15, and 15.

This problem has more than one possible answer.

1. Try to think of another possible way to score 71 points using the game board shown in the example. How could you change the numbers and still have a score of 71? Remember, you can only use the numbers 13, 15, and 17.

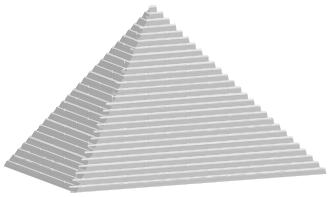
   There is one more combination of points that will equal 71. You can change two 15s to 13s, and change one 13 to a 17.

   13 13 17
   ~~15~~ + ~~15~~ + 13 + 15 + ~~13~~ = 71

   Answer: 13 + 13 + 13 + 15 + 17 = 71

In the next lesson, you will solve more problems using the *Guess-and-Check* strategy.

Homework



Just for Fun!

1. Build a pyramid of cubes. Note: If you don't have cubes, you can use pieces of paper that have cm grid lines on them. Instead of using cubes, you will cut squares of paper that get bigger with each layer.

   - Start with one cube for the top.
   - Place this cube on a layer that is 2 cubes by 2 cubes.
   - Place these 2 layers on top of a third layer that is 3 cubes by 3 cubes.
   - Continue adding more layers underneath, increasing the length of the sides each time.
   - Make your pyramid as big as you can.
   - Make a T-table. Record the number of cubes you used for each layer.
   - What pattern can you see? Describe it.
   - Bring your T-table to school tomorrow to share with others.

Layer Number	Number of Cubes
1	1
2	4
3	*9*
4	*16*
5	*25*
6	*36*
7	*49*
8	*64*
9	*81*

Students should note that the number of squares is the layer number multiplied by itself. For example, layer 4 used 4 x 4 = 16 cubes or squares. Some students may see a pattern in how the number of cubes increases as the layers increase. In other words, as the layers increase from 1 to 9, the number of cubes increases by 3, 5, 7, 9, 11, etc.