

Title: Do You See the Pattern?

Brief Overview:

In this unit, students will move through a sequence of activities that help the student develop needed pattern solving skills. They will be able to develop and reinforce strategies to find the pattern in a sequence. They will be able to copy, continue, describe, build, and create patterns.

NCTM 2000 Principles for School Mathematics:

Equity: *Excellence in mathematics education requires equity - high expectations and strong support for all students.*

Curriculum: *A curriculum is more than a collection of activities: it must be coherent, focused on important mathematics, and well articulated across the grades.*

Teaching: *Effective mathematics teaching requires understanding what students know and need to learn and then challenging and supporting them to learn it well.*

Learning: *Students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge.*

Assessment: *Assessment should support the learning of important mathematics and furnish useful information to both teachers and students.*

Technology: *Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning.*

Links to NCTM 2000 Standards:

Content Standards

Number and Operations

Understand numbers, ways of representing numbers, relationships among numbers, and number systems.

Understand meanings of operations and how they relate to one another.

Algebra

Understand patterns, relationships and functions.

Geometry

Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.

Specify locations and describe spatial relationships using coordinate geometry and other representational systems.

Data Analysis and Probability

Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.

Select and use appropriate statistical methods to analyze data.

Process Standards

Problem Solving

Build new mathematical knowledge through problem solving.

Solve problems that arise in other contexts.

Apply and adapt a variety of appropriate strategies to solve problems.

Monitor and reflect on the process of mathematical problem solving.

Reasoning and Proof

Recognize reasoning and proof as fundamental aspects of mathematics.

Communication

Organize and consolidate their mathematical thinking through communication.

Communicate their mathematical thinking coherently and clearly to peers, teachers and others.

Analyze and evaluate mathematical thinking and strategies of others.

Use the language of mathematics to express mathematical ideas precisely.

Connections

Recognize and use connections among mathematical ideas.

Understand how mathematical ideas interconnect and build on one another to produce a coherent whole.

Recognize and apply mathematics in contexts outside of mathematics.

Representation

Create and use representations to organize, record, and communicate mathematical ideas.

Select, apply, and translate among mathematical representations to solve problems.

Grade/Level:

Grades 3 to 5 with extension activities for integrating into other subjects and higher levels of thinking.

Duration/Length:

There are 7 lessons, approximately 10 minutes in length. They could be done in a block, daily as a warm-up, or used once a week.

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

Basic pattern recognition, e.g., ABAB

Basic shape recognition

Some mathematical language associated with patterns and functions

Student Outcomes:

Students will be able to:

identify patterns and pattern characteristics.

extend and continue patterns.

name pattern rules and relationships.

analyze a given pattern based on previous practice.

use correct terminology to describe patterns.

create and design a pattern.

complete a T-table, describe a function, predict an answer and write a rule.

Materials/Resources/Printed Materials:

Handouts provided

Candies that lend themselves to repetitive patterns (Skittles, M & M's, etc.)

Basket in center of table with markers, crayons, buttons, individual packs of candy, scissors, rulers

Clothes pins

Clothes line

Poster board- for charts

Copy masters

Transparencies made from copies

Journals

Clipboard

Development/Procedures:

Environment: The teacher needs to have students in groups of two or four. At each group place a basket of supplies. Students should be instructed to give only positive or constructive comments (No put-downs). Posters **A** and **B** (Teacher Resources #9 & #10) should be hung prior to class time. All **bold** words need to be written on the "Pattern Talk" poster.

Teacher directions

Q Suggested questions

Lesson 1: Tee Shirts- Do They Have a Pattern?

Objective: Recognize whether a pattern is an **AB** pattern or not a Pattern.
Copy a pattern.
Continue a pattern core two more times.

Hang tee shirt **A** on the clothesline.

Q- Tell me something about the tee shirt?
Is there a “**pattern**”? What is it?

Hang up tee shirt **B** on the clothesline.

Q- Tell me about this tee shirt?
Do all shirts have a pattern?

Hang up tee shirt **C**.

Q- What pattern do you see?

Hand out blank tee shirt worksheet **D**

Q- Copy the pattern on tee shirt **C** and continue this pattern to fill the shirt.

Wait time Students who finish quickly can do the Problem of the Day #1. (Teacher Resource #3)

Q- If we were to use letters to describe this pattern, what would it be?
Let's put that pattern- **ABAB...** on our poster.
Q- Why are the three (3) periods used?

Place overhead transparency **DD** on the overhead.

Q- As a class we will create an **AB** pattern tee shirt on the overhead.
Would _____ come to the board and draw the first “**Term**”?
Would _____ come and draw the second term?
Would _____ continue the pattern two more “**Cores**”?

Give each student one tee shirt **D** and ask them create their own **ABAB...** pattern. Walk around the room and using the Pattern Evaluation Rubric (Directions on Teacher Resource Sheet #7). Check off the student's progress on his/her card.

Homework assignment: Give students a blank tee shirt **D** and ask them to create a pattern that is **AAB...** Have students repeat the core three times, which leaves room for another student to complete the pattern the next day.

Lesson 2 Post Problem of the Day #2 (Teacher Resource Sheet #4)

Ask the students to take out their homework. Use the **“Send a Problem”** strategy of passing their paper to another student who will complete one more core. Do this at least one more time. Pass papers back to their owner. Have them turn over their papers and write about the activity using words from the **Pattern Talk** poster (Poster B).

Pass out the Activity **“Be a Smarty!”** Worksheet E. Give each student a small packet of Smarties, or other multi-colored candy. Ask them to place them on their sheet in a core pattern. Complete the shirt by filling in all the spots. If completed correctly, they can munch the candy in their patterns!

Distribute the **“Patterns Work Mat”** (Worksheet F) and ask the student to use the manipulatives on the table to continue the patterns two more cores. The student can use colored pencils to write the pattern and colored counters, pattern blocks, Smarties candy or Fruit Loops cereal to complete the pattern on the Patterns Work Mat.

Is there a way to represent the pattern using numbers? Using a transparency of the Patterns Work Mat **FF** write on the transparency the pattern in numbers.

Place **“Let’s Go On!”** (transparency **GG**) on the overhead. Call on individual students to come up to the overhead and write the next numbers in the pattern.

Q- What number comes next in number 1? 2? 3? And so on. Fill in the Answers on the overhead for 1-3. Pass out paper copies of Worksheet G.

Q- Ask the students to complete Worksheet G.

Cruise the room with the clipboard evaluation rubric, evaluating student progress (Teacher Resource #7).

Lesson 3: What’s “Next”? Post Problem of the Day #3 (Teacher Resource #5)

Give each student a copy of the **“Next”** (Worksheet H) activity and the **“Design the Tee Shirt”** (Worksheet I) activity.

Q- Using what we have learned so far, continue each of these number patterns and then color in the “next” number on the tee shirt. Cut out, collect, and hang the completed shirts on the clothesline (available at the dollar store).

There are other ways to display our data. Today, we are looking at the **T- Table**. Place the transparency JJ, **“Power of the “T” Table”** on the overhead projector.

- Q- Ask students to help you fill in the table.
What is the **relationship** between column **A** and column **B** for #1?
What would be a rule for the relationship?
Write the **rule** on the overhead.

Lesson 4 What's My Rule? Post Problem of the Day #4 (Teacher Resource #6)

Do the whole group activity “**What's My Rule ?**” (Worksheet K). Play musical chairs. With the Transparency **KK** on the overhead, ask the students to fill in the number of chairs and number of students there were when we began the game. Then move step by step through each round and fill in the chart.

- Q- If we were to start with 40 students, how many chairs would be needed?
Turn in their journal, and write about the relationship and rule using a t-table, a picture, and a written description of the rule. Walk around the room with the clipboard for a quick evaluation of the journal writing. Help students to integrate all the words and skill learned so far in their writing.

Extension: Create a **T-table** with students and chair legs.

Lesson 5 Scoot On By!

Following up on the previous lesson's activity, place the “**Scoot On By!**” transparency **LL** on the overhead. Using “**Scoot On By!**” worksheet, discuss with the students the relationship between children and wheels. Describe the rule you would use to get the next answer. Check the rule and then using the rule, predict how you would solve the problem if there were 298 wheels. Turn in your journal and write how you would describe the relationship between children and wheels. Using the clipboard with the evaluation rubric cards, circle the room and evaluate the students writing.

Lesson 6 Away We Go!

Hand out “**Away We Go!**” worksheet **M**. Place the Transparency **MM** on the overhead and discuss with the students the relationship between cars and wheels. Fill in the t-table.

Lesson 7 The Elves and the Shoemaker

Go to the Media Center; find and check out the story of the Elves and the Shoemaker. Read the story to your students. Ask questions about the story. Pass out “**Boots**” t-table Worksheet **P**. As you re-read the story fill in the t-table.

- Q- At this rate how many boots will there be on the 10th day? With your partner write the rule for this relationship. Check your rule with the data from Day 1,2 and 3. Write and demonstrate in your journals how the problem was solved. Collect journals and write a sentence or two of feedback in each journal.

Final Activity:

Give each student handout **P**.

- Q- Applying everything you have learned:
1. The student will write a short story about the silver vest.
 2. The student will create a **t-table** with the beginning data filled in for the first three rows.
 3. The student will write a rule.
 4. The student will check the rule by using the data to fill in the rule and predict the correct outcome.
 5. The student will then write a paragraph explaining how the or she would answer the question.

These “**Vests**” will be the “**Problem of the Day.**”

Performance Assessment:

A rubric with the outcomes/objectives listed on the top and the points on the side is included in Teacher Resource Sheet #7. Each and every activity has a suggestion of how to evaluate the day’s activity. You can use the journals to have a concrete progression of the learning the skills set forth in this unit. Each student will be giving feedback at appropriate times.

In this lesson, a certificate (Teacher Resource Sheet #8) is included to distribute to the students after they have completed the initial study of patterns.

Extension/Follow Up:

A grid (Teacher Resource Sheet #11) may be used to adapt this activity to graphing linear equations.

Students could move from manipulatives to musical instruments.

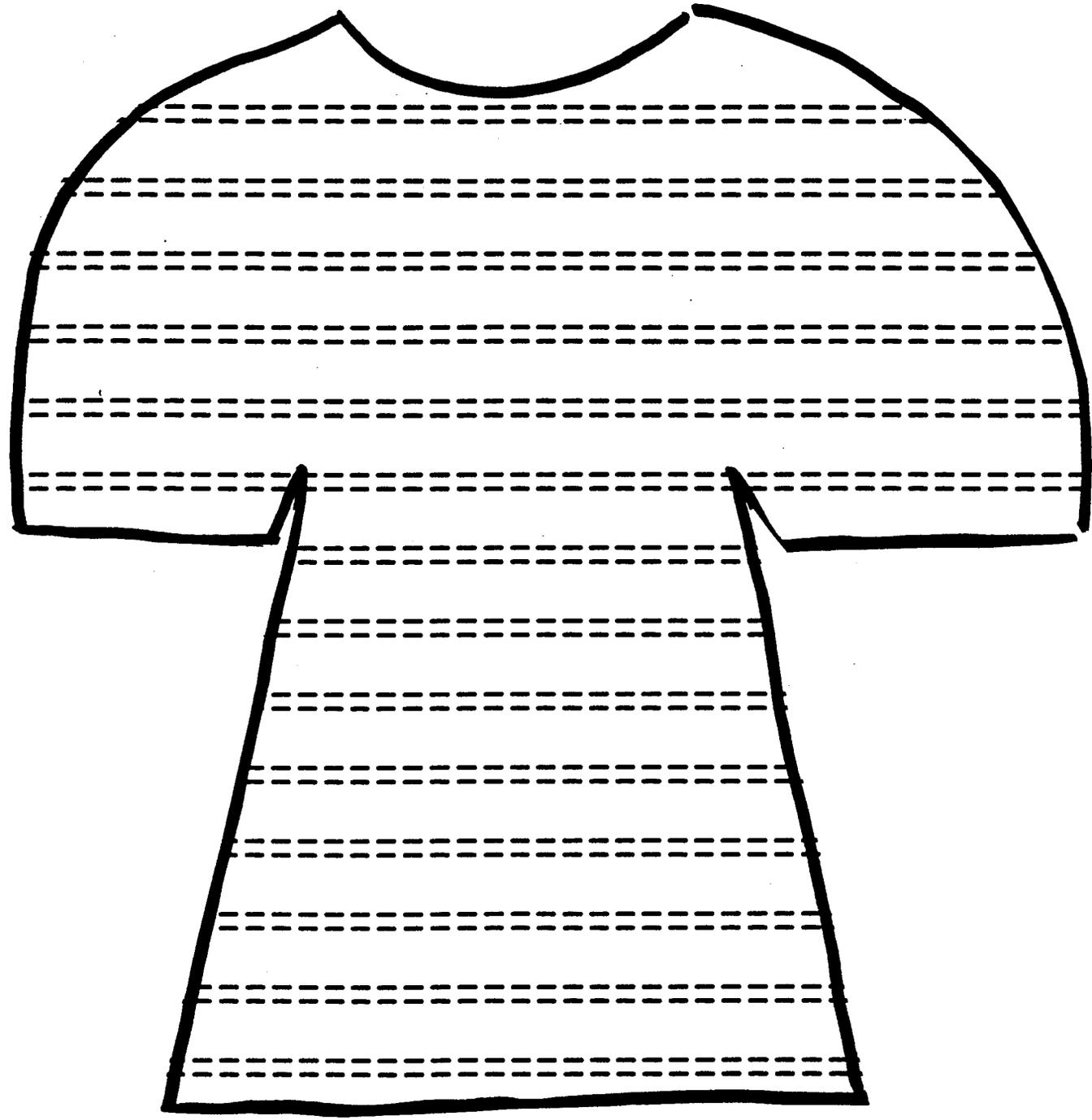
For the student who loves sports, they could come up with patterns using the incremental skill associated with that sport.

Authors:

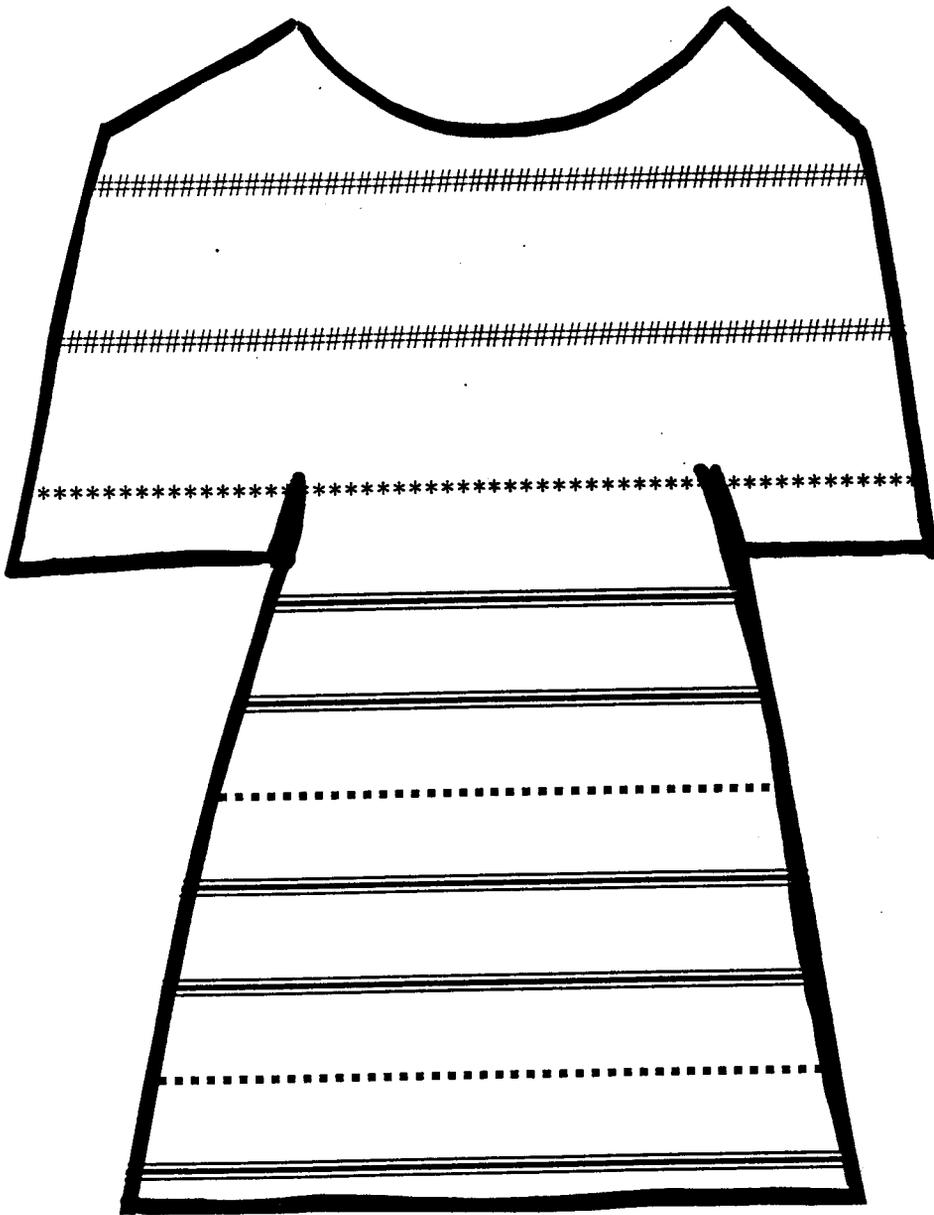
Nancy A. D. Jones
Whitcomb Model Elementary School
Richmond, Virginia

Donna D. Anderson
Salisbury Christian School
Salisbury, Maryland

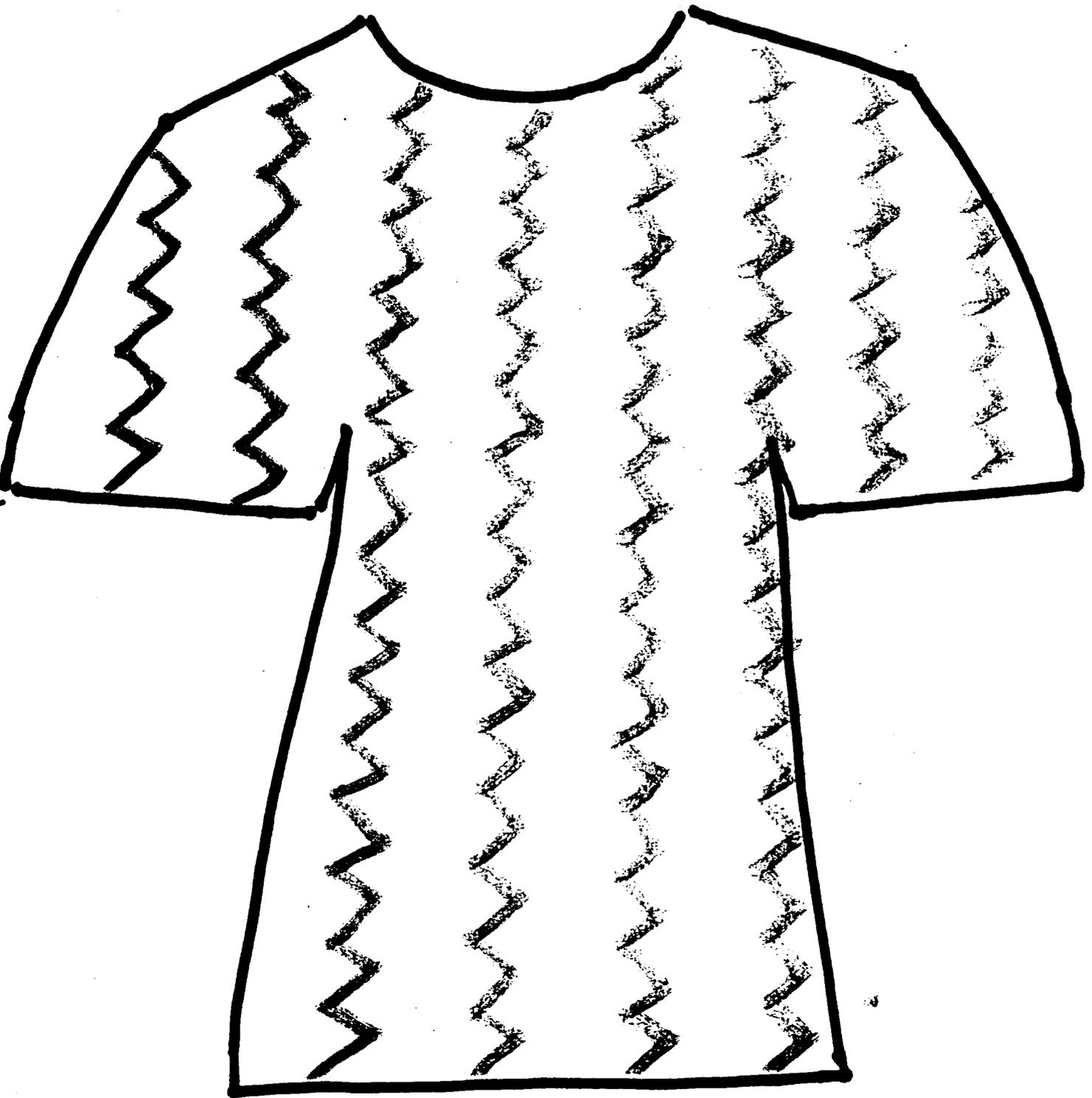
Tee Shirt A



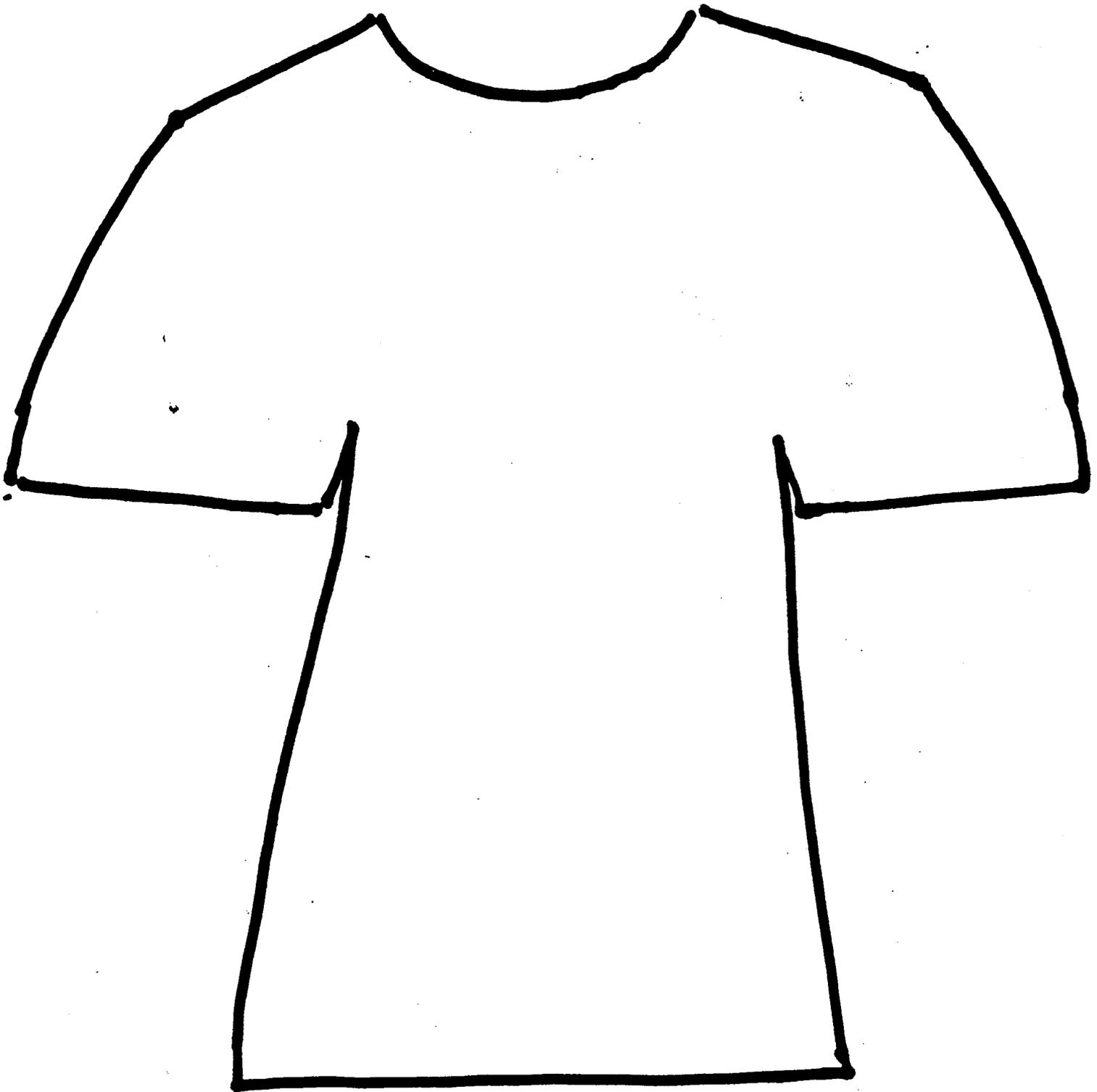
Tee Shirt B



Tee Shirt C



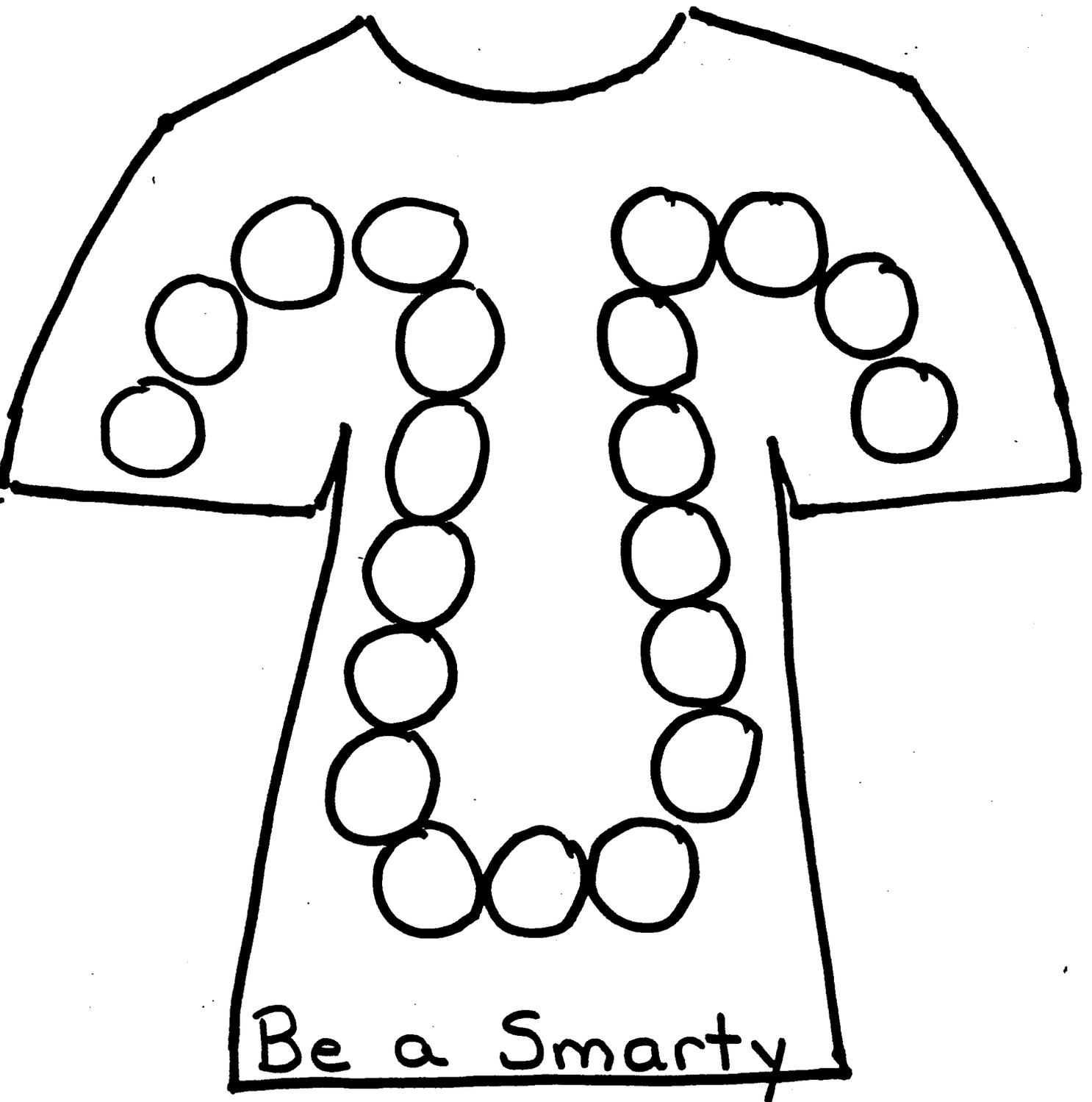
Tee Shirt D



Transparency DD

Be A Smarty!

Open your packet of Smarties. Construct a pattern using the candy pieces. Let your teacher look at your pattern. Now, color in two more cores using the crayons on your desk. You may eat your candy after you have checked your answers with a classmate and your teacher and they agree the pattern was constructed correctly.



Patterns Work Mat

AABB

AACAAB

ABAABBAAA

ABACADAE

Let's Go On!

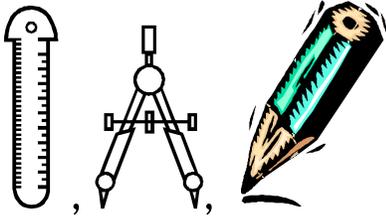
Complete the patterns.

1. 2, 4, 6, 8, __, __, __

2. 3, 6, 9, 12, __, __, __

3. 5, 10, 15, 20, __, __, __

4. 1, 3, 5, 7, __, __, __

5.  , _____, _____, _____

6.  , _____, _____, _____

_____ , _____ , _____



Complete each sequence.

Then place an X on that number on the tee shirt.

22, 33, 44, ___

6, 8, 10, ___

11, 13, 15, ___

35, 45, 55, ___

7, ___, 21, 28

9, ___, 29, 39

0, 25, 50, ___

17, 19, 21, ___

22, 24, 26, ___

79, 81, 83, ___

8, 16, 24, ___

25, 29, 33, ___

68, 74, 80, ___

4, 14, 24, ___

36, ___, 42, 45

78, 81, 84, ___

Design the Tee Shirt

Power of the "T" Table

Write in sentence/equation form the relationship between columns a and b.

1.

A	B
1	4
2	5
3	—
4	—
5	—

2.

A	B
6	5
5	4
4	—
3	—
2	—

3.

A	B
20	10
18	9
16	—
12	—
10	—

What's My Rule?

- Materials:** Students, music from a CD, record, or cassette tape
- Organization:** Whole group activity
- Procedure:** Students will play the game of "Musical Chairs". The teacher will discuss with the students the pattern and function (relationship) between the number of chairs to the number of students.
- Remember:** There is always one more student than chairs.

Now, put Transparency KK on the overhead projector. Demonstrate the relationship of chairs to students by filling in the T-Table.

What's My Rule?

Complete the "T" chart

<u>Chairs</u>	<u>Students</u>

Scoot On By!

Scooter Function Table

Discuss with the students the relationship between children and wheels.

- Ask the students how they would solve the problem if there were 298 wheels.
- Write and demonstrate in journals how the problem was solved.

Away We Go!

Car Wheels Function Table

Discuss with the students the relationship between cars and wheels.

Ask students how they would solve the problem if there were 73 cars.

Write and demonstrate in journals how the problem was solved.

Away We Go!

Car Wheels Function Table

<u>Number of cars</u>	<u>Number of Wheels</u>
8	32
12	48
25	
47	
60	
73	

Ideas of questions that stimulate thinking:

- Tell me three things you notice about the pattern
- Are there activities that we have done before that might help with this activity?
- Could you explain how you came about solving the pattern?
- Is there more than one way to find the answer?
- What method for understanding the pattern best helps you: using a chart, drawing a picture, using the manipulatives, or something else? What makes that method better for you?
- Tell me why you think your answer is right?
- Using your answer for how they are related, check to see if it works with the other numbers in the pattern. Does it work?
- If you could apply what you know to a real life situation, what would that situation be?

Definitions of vocabulary for this unit:

Core - The core is a repeating pattern that is the shortest string of elements that repeats.

Function - When you have a set of ordered pairs, for every first number (input) there is only one second number (output).

Pattern - A pattern is a sequence of numbers, colors, objects, etc. that repeat. The core of the pattern needs to repeat three times for a student to demonstrate understanding of the pattern.

Relationship - It is the description of how two sets of numbers relate. It can be written in words, numbers or with an algebraic expression.

Rule - A rule is the description of the pattern.

Sequence - A set of numbers, colors, objects that are arranged in a specific order.

Term - A term is one number, color, or object in a sequence.

Teacher Resource Sheet #2

Developmental steps to solving patterns

Copy

Continue

Describe

Build when given a description

Create

See patterns and make predictions

Organize information and find regularity in the data

Basic Pattern Sequences

ABABAB...

ABCABCABC...

AABAABAAB...

ABACABACABAC...

AABBAABBAABB...

Growing patterns:

ABACADAEAF...

ABAABAAABAAAAB...

ABBCCDDDEEEEEE...



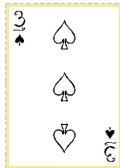
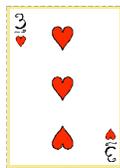
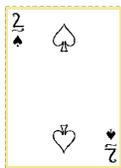
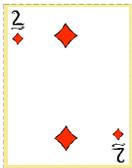
Suit Yourself!

Materials:

One deck of cards

Using the deck of cards, create a pattern using the Colors AND Numbers.

Ex.



Using the deck of cards, create a pattern using Colors, Numbers, Suits, Odds, or Evens. Ask another student to copy the core three more times.

Roller Coaster Ride

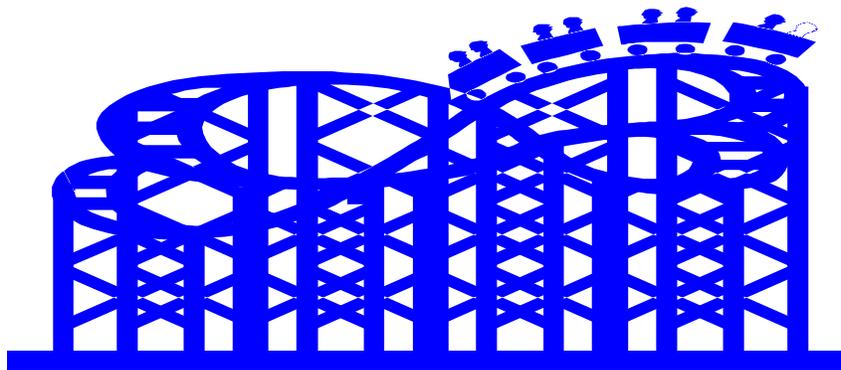
At the Six Patterns Amusement Park, you are boarding the first ride on the roller coaster. There are 6 people in the cars. On the second trip, there are 12 people in the cars. The third trip carries 18 people. If this continues in the same pattern, how many people will be on the 8th ride?

Can you find a rule that would help you find out the number of people on the 35th ride?

What is the rule?

How many people would that be?

Check your rule with the numbers given on ride one, two and three.



Roller Coaster Ride

On the second day of your trip, they are asking people if they were afraid on the ride.

On trip one, 20 people rode and 10 were afraid.

On trip two, 30 people rode and 15 were afraid.

On trip three, 40 people rode and 20 were afraid.

How many people were on the 12th ride?

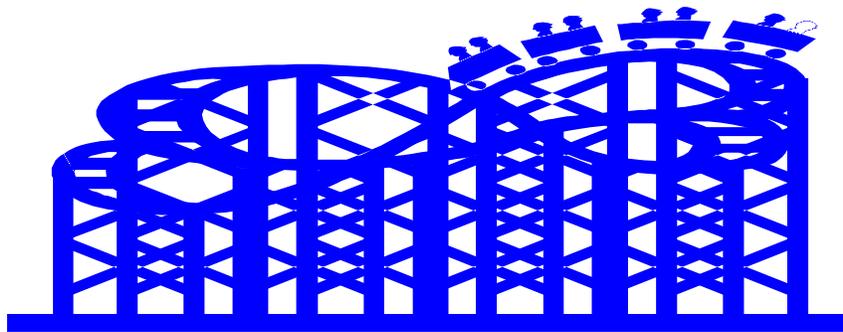
How many people were afraid?

Predict how many people were afraid on the 60th trip.

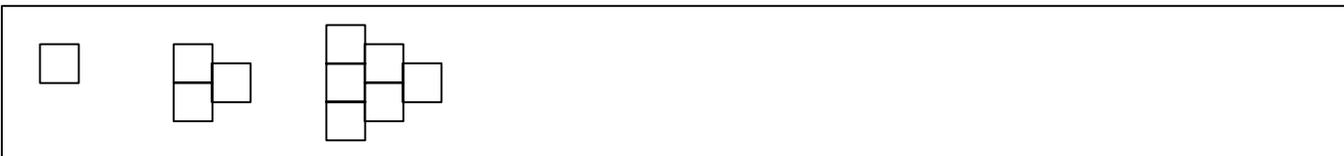
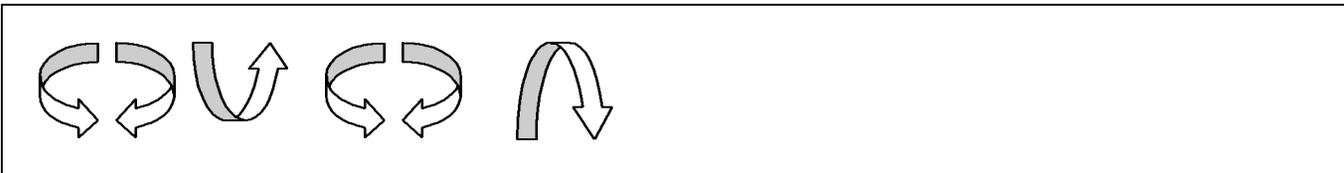
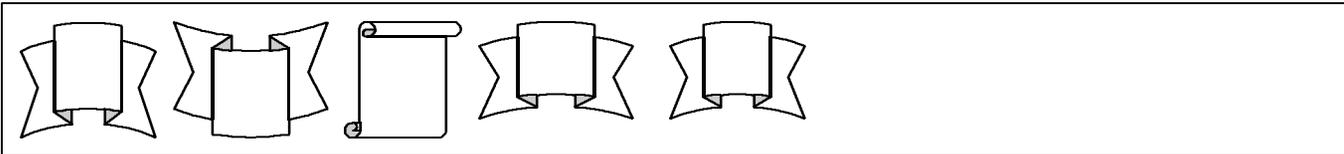
What is the rule?

How many people would that be?

Check your rule with the numbers given on ride one, two and three.



0 1 2 3 4 5 6 7 8 9 A B C D E F G H I J K L M N O P Q R S T U V W X Y Z



Pattern Evaluation Rubric

Days

	1 Copy	2 Continue	3 Describe	4 Build	5 Create	6 Make Predictions
1						
2						
3						

Name _____

Run off this 4 x 5 rubric. Tape it on a clipboard.

Have one card for each student.

Use as a way to quickly move around the room to evaluate a student's progress.

Example:

Mary	Nancy	Jennifer	Pat
Joe	Peter	Lois	Julie
Phil	Jason	Kevin	Mike

Do You See the Pattern?

is awarded to:

Recipient

For participating in and fulfilling the requirements of recognizing a pattern, copying a pattern, continuing a pattern, describing a pattern, building, and creating a pattern.

Date

Signature

