

*hands-on*  
**mathematics**  
**Grade 1**

*Senior Author*

Jennifer Lawson

*Senior Consultants*

Meagan Mutchmor

Dianne Soltess

*Authors*

Joni Bowman

Cathy Haggart

Betty Johns

Kara Kolson



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**Note:** This edition of Hands On Mathematics Grade 1 has been revised to correspond to the amended Ontario Curriculum for Mathematics (2005). Although there are similarities to the first edition (2004) of the book, many changes have been made to ensure that the lessons and activities that follow meet all current curricular expectations.

## Program Implementation

### Program Resources

**Hands-On Mathematics** is arranged in a format that makes it easy for teachers to plan and implement.

Units comprise the selected topics of study for the grade level, organized into lessons. The units relate directly to the learning expectations identified on pages 6 through 11, which complement those established in the *Ontario Curriculum for Mathematics (2005)*.

The introduction to each unit summarizes the general goals for the unit and provides background information for teachers. Each unit begins with a list of books for students that relate to the unit; a list of related websites (for all units combined) can also be found on pages 53-54.

Units are organized into lessons, based on the expectations.

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**Note:** This does not imply that a lesson can be covered in only one lesson period; many will carry over several lesson periods.

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The lessons are arranged in the following format:

#### **Background Information for Teachers:**

Some lessons provide teachers with the basic mathematical knowledge they will need to present the activities. This information is offered in a clear, concise format, and focuses specifically on the topic of study.

**Materials:** A complete list of materials required to conduct the main activity is provided. It includes classroom materials, equipment, and visuals. The quantity of materials required will depend on how you conduct activities and whether students are working individually or in groups.

**Activity:** This section details a step-by-step procedure, including higher-level questioning techniques and suggestions for encouraging active inquiry and discussion.

**Activity Sheet:** Reproducible activity sheets have been designed to correlate with the specific expectations of the activity. Many of these are used during the activity to record results of investigations. Others are used as follow-up to the in-class activities. Students may work independently on these sheets, in small groups, or you may choose to read through them together and complete them in a large group setting. Activity sheets can also be made into overheads or large experience charts. Since it is also important for students to learn to construct their own charts and recording formats, these activity sheets can be used by the teacher as examples of ways to record and communicate ideas about an activity. Students can then create their own sheets rather than use the ones provided.

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**Note:** Activity sheets are meant to be used only in conjunction with, or as a follow-up to, the hands-on activities. The activity sheets are not intended to be the mathematics lesson in itself or the sole assessment for the lesson.

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**Problem Solving:** Many lessons include suggestions for problem-solving activities that are directly related to the lesson's expectations. These problems may be presented orally, acted out with concrete objects, presented pictorially, or written out on chart paper. At the end of each unit, many of these problems are presented again on black line masters. Teachers can copy these sheets onto overhead transparencies to present to students as daily problem solving activities. Or, the masters can be copied for students and cut apart, problem by problem. Students can then paste the problems into their math journals or agendas for completion independently.



**Extension:** Many lessons include optional activities to extend, enrich, and reinforce the expectations.

**Activity Centre:** Some lessons include independent student activities that focus on the expectations.

**Assessment Suggestions:** Throughout each unit, several suggestions are made for assessing student learning. Again, these assessment strategies focus specifically on the expectations of a particular activity topic. In the next section of the *Hands-On Mathematics* program, assessment is dealt with in detail. Keep in mind that the suggestions made within activities are merely ideas to consider; you may use your own assessment techniques or refer to the other assessment strategies on pages 17 and 18.

### **Classroom Environment**

The classroom setting is an important component of the learning process. An active environment – one that gently hums with the purposeful conversations and activities of students – indicates that meaningful learning is taking place. While studying a specific topic, the room should display related objects and materials, student work, pictures and posters, maps, graphs, and charts made during activities, and summary charts of important concepts taught and learned. These reinforce concepts and skills that have been stressed during mathematics activities.

### **Timelines**

No two groups of students will cover topics and material at the same rate. Planning the duration of units is the responsibility of the teacher. In some cases, the activities described will not be completed during one block of time and will have to be carried over. (Division of units into “lessons” does not imply that they can be covered in only one lesson period. Many lessons will, in fact, carry over several lesson periods.) In other cases, you may observe that the students are especially interested in one topic, and you may choose to expand upon it. The individual needs of your students should be considered as there are no strict timelines involved in the *Hands-On Mathematics* program. It is important, however, to spend time on every unit in the program so that students focus on all of the expectations established for their grade level.

### **Classroom Management**

Although active learning is emphasized throughout this program, the manner in which these experiences are handled is up to you. In some cases, you may have all students working with materials and resources individually; in others, you may choose to use small group settings. The latter encourages the development of social skills and enables all students to be active in the learning process; it also means less cost in terms of materials and equipment. Again, classroom management is left up to you, since it is the teacher who ultimately determines how the students in his/her care function best in the learning environment.



## Planning Guidelines

Mathematics is a skills-based subject. In order to acquire these skills, students need to visit and revisit them over the course of the school year.

***Hands-On Mathematics*** is organized into strand- or topic-focused units. This organization allows teachers to follow the development of concepts from introduction to mastery within a given grade level. To ensure that students have opportunities to develop their mathematical skills in all topics throughout the year, it is recommended that teachers address concepts from each of these units in every reporting period or school term. For example, teachers may choose to begin the year with the unit on Patterning and Algebra (unit 1) but should continue to develop students' skills in this area throughout the entire school year through review, continued practice, and new mathematical challenges. In the same way, although the unit on Number Sense and Numeration (unit 5) is presented last in the ***Hands-On Mathematics*** program, students should be provided with opportunities to review, practice, and investigate number concepts throughout the school year. Planning in this way gives students the time needed to solidify their understanding and, at the same time, helps to keep the concepts and vocabulary in the forefront throughout the year.

**Note:** Developing a year plan will ensure that topics are dealt with throughout the school year. Teachers can design the plan to meet their students' specific needs and fit into their school calendars. On the following two pages, a sample year plan template is provided. Teachers can use the template to record the skills from each unit that they will teach during each month. There is also additional space for briefly noting other curriculum connections and themes that may relate to the overall math plan. Teachers can divide the bottom row of the chart according to the duration of the curriculum connection and related theme, which may be less than or greater than one month.

# 6 Necklace Patterns

## Background Information for Teachers

These activities have students making a variety of necklace patterns using the attribute of size, and then colour. Students then create and describe the patterns in other ways.

## Materials

- *A String of Beads*, a book by Margarett S. Reid
- straws cut into two lengths: long and short
- large sheets of graph paper
- coloured construction paper
- scissors
- glue
- one size of pasta in a variety of colours: plain (uncoloured), red, blue, green, purple, and orange. (To colour pasta, place it in a Ziploc bag together with one part food colouring and four parts rubbing alcohol. Shake the pasta and dye until all the pasta is coloured, then pour it out onto absorbent paper and allow it to dry.)

**Safety Note:** Be sure to do this in a well-ventilated area and not in the school. Students must be told that this pasta is not safe to eat.

- construction paper squares that match the colours of the dyed pasta
- Froot Loops cereal
- string cut into necklace-sized lengths (Tie a large knot at one end; wrap the other end with tape to make it easier for students to string.)
- chart paper
- markers
- crayons
- paper bags

## Activity: Part One

**Note:** For this activity you will need one colour of straws cut into two lengths (long and short).

Read the book *A String of Beads*. Ask:

- How did the girl make necklaces?
- Can you describe how the beads were different from each other? (colour, size, shape)
- How did she make patterns with the beads? (different colours, sizes, shapes)

Explain to students that they will now have an opportunity to make necklaces. Show students the two lengths of straws. Ask:

- How are the straws different from each other?
- How can you make a pattern using the straws? (long and short)
- Can you make an *AB* pattern using the straws?
- Can you name this pattern using words? Using numbers? Actions?
- Can you make another pattern, other than an *AB* pattern, using the straws?

Provide students with string and straw pieces. Have them create necklace patterns, then use Activity Sheet A (1.6.1) to record their patterns.

## Activity Sheet A

### Directions to students:

Draw a picture of your necklace pattern. Name your pattern using letters. Tell how many long straws and how many short straws you used. Tell whether you used less long straws or short straws (1.6.1).

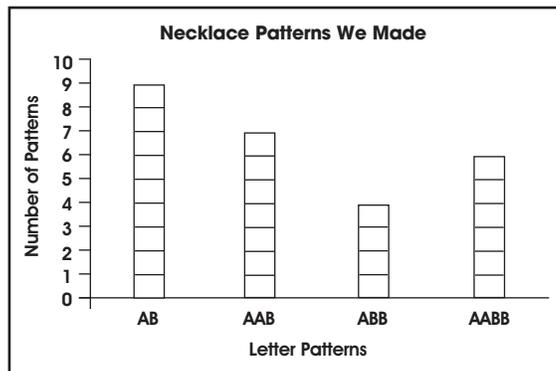
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**Activity: Part Two**

**Note:** Before beginning this activity, prepare a graph on chart paper to record the patterns students made in Activity: Part One. Cut out squares of one colour of construction paper to fit the graph. Have the students' activity sheets available for reference.

Distribute the students' activity sheets from Activity: Part One. As a class, discuss the kinds of necklace patterns that students created.

Display your graph, and explain that students are now going to complete the graph to show the kinds of necklace patterns they made. Provide each student with a construction paper square. Have each student come up, one at a time, and point to the pattern he/she made, on the graph. Then, have him/her glue his/her square onto the appropriate location of the graph. For example:



When all students have placed their squares on the graph, ask:

- What pattern did most students make with the long and short straws?
- What pattern did the least students make?
- How many more students made *AB* patterns than *AAB* patterns?

**Activity: Part Three**

Explain to students that they are going to make Froot Loops necklace patterns using three different colours. Display a small pile of Froot Loops, and have students choose three colours for the demonstration. Write the colours on chart paper (e.g., pink, green, yellow). Ask:

- How many colours of Froot Loops are there in this pile? (six)
- How many colours do we need to make our Froot Loops necklaces? (three)

What can we do with the Froot Loops to make it easier to create a pattern with only three colours? (Sort them, and take away the colours not needed.)

Have students sort the Froot Loops and remove the colours not chosen. Show students how to create a Froot Loops pattern necklace. Ask:

- How can we make a pattern using the three colours?

Using students' suggestions, create the necklace. Ask:

- How can we name this pattern using letters?

Record the letter name for this pattern on chart paper.

Provide each student with a handful or two of Froot Loops, string, Activity Sheet B (1.6.2), and one of the letter pattern cards from the previous lesson (Set B, 1.5.3). Have them sort the Froot Loops according to colour, and choose three colours for their necklace. Once they have created their Froot Loops necklace pattern, have students draw and colour their pattern on their activity sheet. Below their picture, have them identify the number of each colour of Froot Loops they used.

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**Note:** Store these necklaces in a safe place as you will use them again in the following activity.

### Activity Sheet B

#### Directions to students:

Record the letter pattern you made using Froot Loops. Draw and colour a picture of your necklace pattern. Below your picture, write down the number of each colour of Froot Loops you used (1.6.2)

### Activity: Part Four

**Note:** For this activity, you will need to prepare a graph, similar to the one found on Activity Sheet C (1.6.3), on chart paper.

Using the model Froot Loops necklace you created in Activity: Part Three, colour the Fruit Loops at the bottom of the graph the same colours you used to make the necklace. Then, demonstrate to students how to graph the number of each colour of Froot Loops you used. Ask:

- How many pink Froot Loops did I use?

Colour that number of rectangles on the graph. Do the same for the other two colours of Froot Loops.

Have students describe the graph. Ask:

- What colour of Froot Loops did I use the most? What colour did I use the least?
- Did I use an equal number of any two colours of Froot Loops? Any three colours of Froot Loops?
- How many more pink Froot Loops than green Froot Loops did I use?

Record the students' answers on chart paper.

Provide students with their Froot Loops necklaces from Activity: Part Three and a copy of Activity Sheet C (1.6.3). Have them construct a graph to record the colours they used for their necklace pattern.

### Activity Sheet C

#### Directions to students:

Colour the three Froot Loops, found at the bottom of your graph, the same as the colours you used to make your necklace. Record the number of each colour of Froot Loops you used in your necklace pattern. Then, tell two things about your graph, on the back of your activity sheet (e.g., What colour you used the most. What colour you used the least. How many of each colour you used.) (1.6.3).

### Activity: Part Five

This activity has students making growing necklace patterns using colour. The students will use two colours of pasta in a specific growing pattern.

**Note:** For this activity, you will need pasta dyed blue, red, green, orange, and purple, as well as strings cut into necklace-sized lengths and knotted at one end. You will also need to prepare a graph on chart paper, and have construction paper shapes (to fit the graph) in the same colours as the pasta.

Review with students the different necklace patterns they have made in previous activities. Display two jars of uncooked pasta: one plain (uncoloured) and one dyed blue. Ask:

- What colours of pasta do I have?

Explain to students that you are going to make a necklace using a different pattern than the ones you have already made. Say:

- First, I am going to put one piece of yellow pasta onto the string.
- Then, I will add one piece of blue pasta.

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- Now, I will add one piece of yellow pasta, and then two pieces of blue pasta.
- Now, I will add one piece of yellow pasta and then three pieces of blue pasta.
- Now, I will add one piece of yellow pasta and then four pieces of blue pasta.
- Now, I will add one piece of yellow pasta and then five pieces of blue pasta.

Stop here and have students predict what will come next in the pattern. Then, say:

- Finally, I will add one piece of yellow pasta and then six pieces of blue pasta.

Ask students:

- Did I make a pattern?

Some students may say “yes,” and some may say “no.” Explain that this is a pattern, but it is different from the ones they have made before. As a class, record the pasta pattern on chart paper. Ask:

- What colour of pasta did I put on first? (yellow)
- How many pieces of yellow pasta did I put on? (1)
- What colour did I put on next? How many? (1 blue)
- What colour did I put on next? How many? (1 yellow)
- What colour did I put on next? How many? (2 blue)

Continue with this questioning, and record the pattern on chart paper, as in the following example:

```

1 Y
1 B
1 Y
2 B B
1 Y
3 B B B
1 Y
4 B B B B
1 Y
5 B B B B B
1 Y
6 B B B B B B

```

Have students examine this information carefully. Ask:

- Can you see a pattern?
- Is there a pattern with the yellow pasta?

Circle the numbers representing yellow pasta on the chart paper with a yellow marker. Explain that each time, the pattern repeats with one piece of yellow pasta. Now, ask:

- Is there a pattern with the blue pasta?

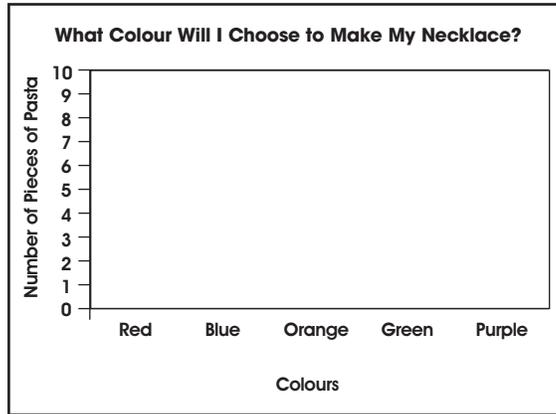
Circle the numbers representing blue pasta on the chart paper with a blue marker. Explain that each time, the pattern repeats with one more piece of blue pasta (1, 2, 3, 4, 5, 6). Ask:

- If I was going to make my pattern longer, how many pieces of yellow pasta would I need next? How many pieces of blue?

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**Activity: Part Six**

**Note:** Prior to this activity, construct a graph, like the one below, on chart paper:



Explain to students that they are now going to make their own necklaces using the plain, uncoloured pasta and one other colour. Display your graph, and show them the coloured construction paper squares (red, blue, green, orange, and purple). Call up each student individually. Have him/her select a colour to use for his/her necklace and then glue a square onto the graph in the appropriate location.

When the graph is complete, discuss the results. Ask:

- Which colour was chosen the least? Which colour was chosen the most?
- Were any colours chosen by an equal number of students?

Now, focus on the construction of the pasta necklaces. Ask:

- We know what colours you are going to use to make your necklace, but how many pieces of pasta of each colour will you need?

Refer to the recorded pattern you made on chart paper, earlier. Have students count the number of pieces of yellow pasta (six) and the number of pieces of blue pasta (twenty-one). Explain that the students will use the same number of pieces of pasta to create their own necklaces.

Have students make their necklace patterns by using one of the following methods:

- Have each student count out the number of each colour of pasta he/she needs, put the pieces in a bag, and take them back to his/her seat to make a necklace.
- Place a different colour of pasta, along with the plain, uncoloured pasta, at each of five tables and have students go to the table with the colour of pasta they chose.

Have students record their necklace patterns on Activity Sheet D (1.6.4).

**Activity Sheet D****Directions to students:**

Draw your necklace pattern on the sheet. Tell how many of each colour of pasta you used. Describe how you made your necklace pattern (1.6.4).

**Problem Solving**

Devon made a necklace in an *AAB* pattern with red and blue beads. If the first bead she used was blue, what colour was the tenth bead? The fifteenth bead? The twentieth bead?

**Note:** A reproducible master for this problem can be found on page 165.

# 6

## Extensions

- Have students create necklace patterns using more than one attribute. Use coloured straws cut into two lengths. Students can create patterns. For example:

*Long red, long blue, short blue, long red, long blue, short blue, and so on*

- Have students make beads as described in the book *A String of Beads* by Margarett S. Reid. Use the beads to make friendship bracelets in patterns.

# Necklace Patterns Using Straws

Draw your necklace pattern.

Name your pattern with letters.

I used \_\_\_\_\_ long straws and \_\_\_\_\_ short straws.

I used less \_\_\_\_\_ straws than \_\_\_\_\_ straws.

# My Froot Loops Necklace

Name your pattern using letters.

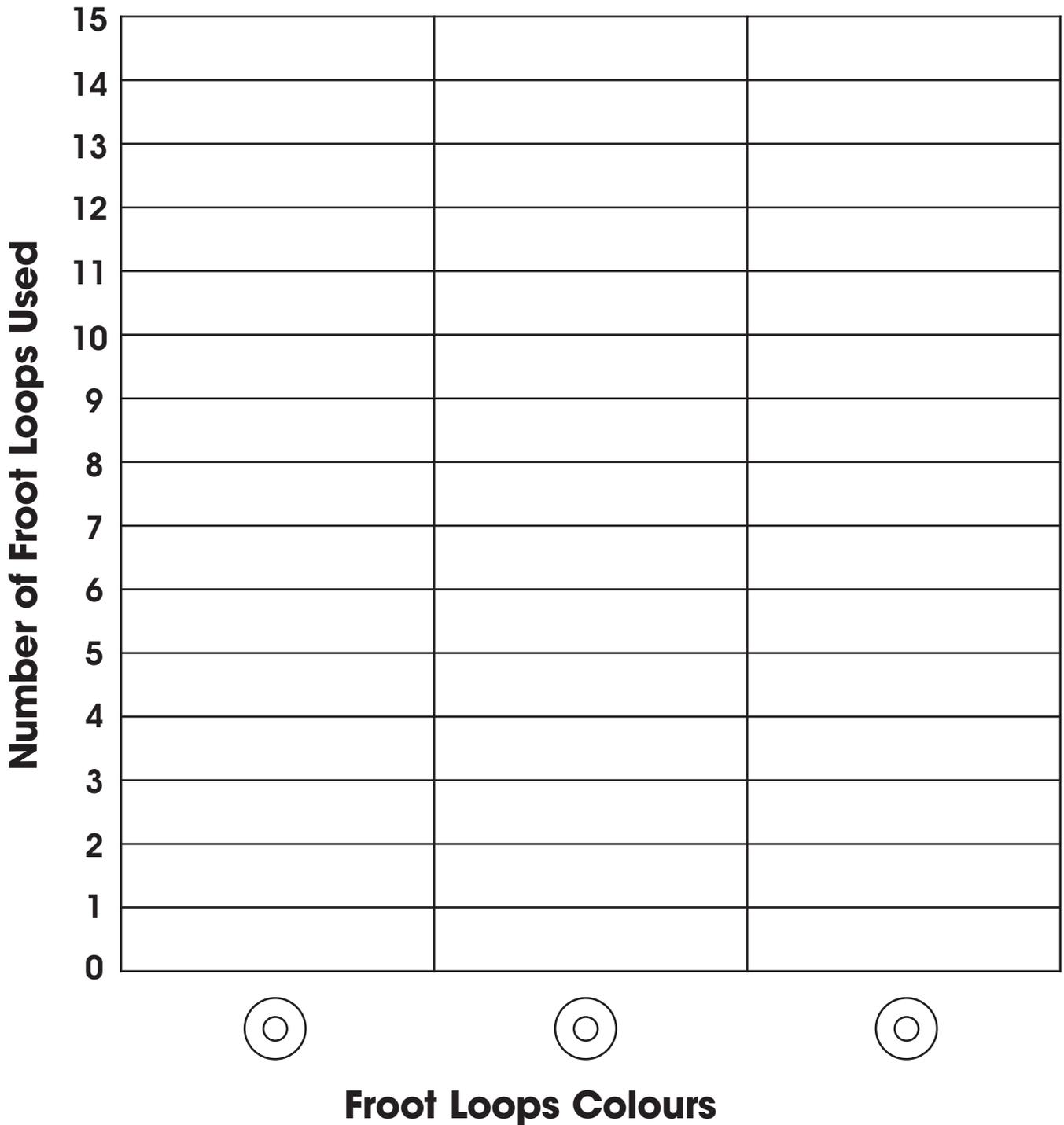
Draw your pattern here. Colour it.

I used \_\_\_\_\_ Froot Loops. 

I used \_\_\_\_\_ Froot Loops. 

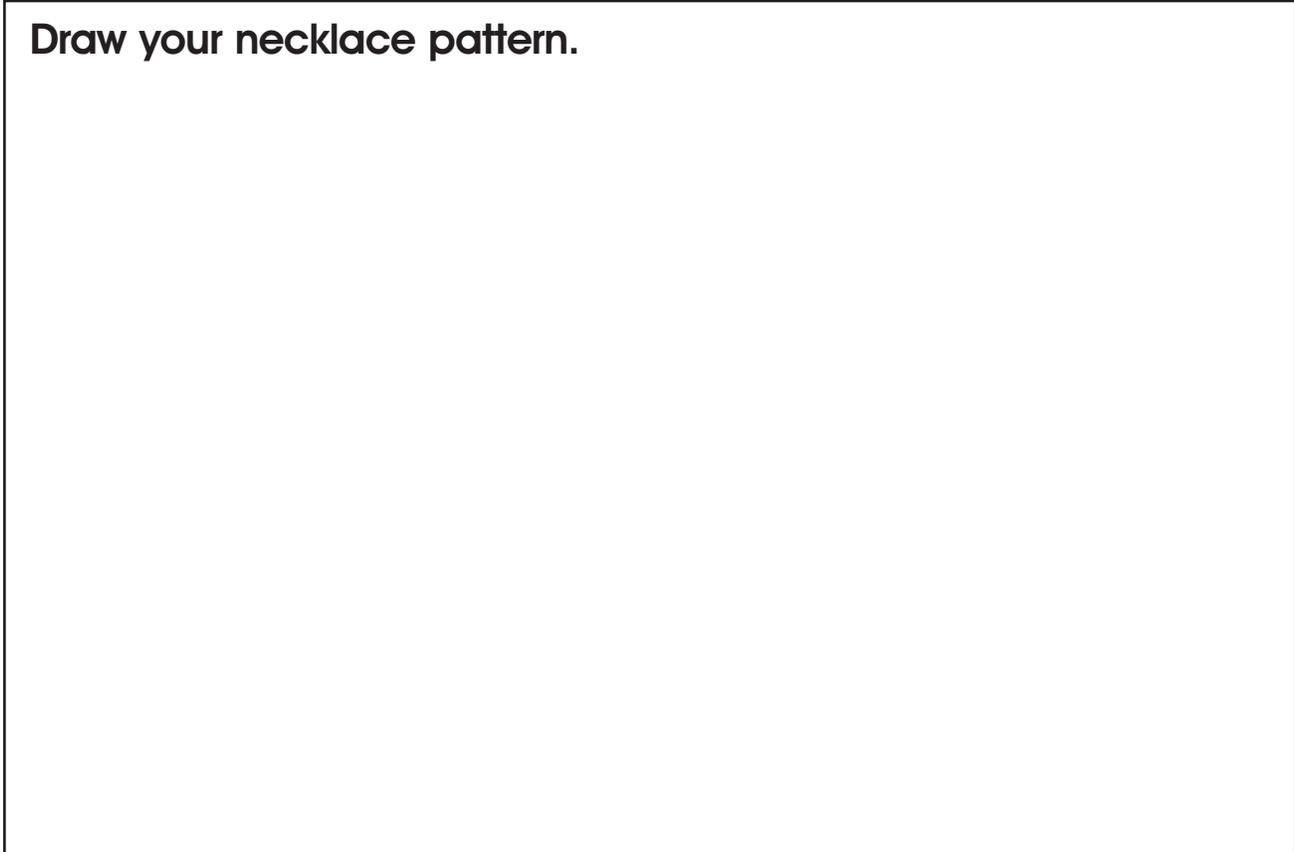
I used \_\_\_\_\_ Froot Loops. 

# How Many Froot Loops Did I Use to Make My Necklace?



# My Pasta Necklace

Draw your necklace pattern.



I used \_\_\_\_\_ pieces of yellow pasta.

I used \_\_\_\_\_ pieces of \_\_\_\_\_ pasta.

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