Grade 4 Mathematics
Patterns, Relations, and Functions: Lesson 3

Read aloud to the students the material that is printed in **boldface type** inside the boxes. Information in regular type inside the boxes and all information outside the boxes should **not** be read to students. Possible student responses are included in parentheses after the questions.

NOTE: The directions read to students may depend on the available materials. Read only those parts of the lesson that apply to the materials you are using.

Any directions that ask you to do something, such as to turn to a page or to hand out materials to students will have an arrow symbol (⇨) by them.

Purpose of Lesson 3:

- In this lesson, the tutor and the students will
  - ✓ use "function (input/output) machines" to identify or continue numerical patterns,
  - ✓ complete input/output tables that show increasing patterns, and
  - ✓ generalize pattern rules.

Equipment/Materials Needed:

- One (1) calculator of any kind. If you can get one with a large display, that kind would be great.
- Paper and pencils
- Copies of Student Sheet 67

Preparations before beginning Lesson 3:

- Locate a calculator.
- Have paper and pencils available.
- Run off 1 copy of Student Sheet 67 for each student.

Lesson 3: Patterns, Functions, and Relations

⇨ Get the calculator and place it in front of you. Enter 0 + 2 = into the calculator. You should see only the 2 on the display. Do not let the students see you perform this procedure. You are going to use a feature on the calculator called the constant key. Once you have entered a rule, such as 0 + 2 =, if you continue to press =, the calculator will keep adding 2 to the amount in the display. Zero is the starting point and 2 is the number that will be added over and over again. It is called the constant, because you are going to constantly add 2 over and over. You can change either number to get different rules. Turn the calculator so that it faces the students.

Say:

We are going to play a game. It is called "What's my Rule?" I have put a rule into my calculator. I am going to press a key on the calculator over and over. I want you to look at the number in the display. What is it now? (2)

⇨ Press the equal key.

Say:

What number is on the display now? (4) **I want you to write down 2 and 4. As I press the key, write down the numbers. When you think you know the rule in the calculator, let me know.** Continue pressing the = key. The students should have written 2, 4; the next number will be 6; the next 8 and so on. If students say that the rule is even numbers, say - **That rule is a correct one, but not the one I put into the calculator. My rule tells the calculator how many to add each time.** Does anyone know my rule? (Add 2.) **If I put 20 into the calculator, what number would show?** (22) To make this pattern, simply press 20 =. Do not clear the calculator at any point or press the + sign after you first enter 0 + 2. It will mess up the pattern.

⇨ Turn the calculator away from the students. Enter 0 + 7 = . Turn the calculator around to face the children.

Say:

What number is on the display? (7) **Write the numbers that appear on the display on your paper.** Press =. (14 will show.) Press =. (21 will show.) **What is my rule?** (Add 7.) **If I press the = key again, what number will appear?** (28) You may want to do a few more of these activities. Use 0 + some number. It is a great way to practice skip counting and multiplication facts.

⇨ Turn the calculator away from the students. This time you will do a subtraction rule. Enter 14 – 2 = . Turn the calculator around to face the children.

Say:

What number is on the display? (12) **Write the numbers that appear on the display on your paper**. Press =. (10 will show.) Press =. (8 will show.) Press =. (6 will show.) **What is my rule?** (Subtract 2.) **If I press the = key again, what number will appear?** (4).

⇨ Turn the calculator away from the students. Enter 20 – 4 = . Turn the calculator around to face the children.

Say:

What number is on the display? (16) **Write the numbers that appear on the display on your paper.** Press =. (12 will show.) Press =. (8 will show.) Press =. (4 will show.) **What is my rule?** (Subtract 4.) **If I press the = key again, what number will appear?** (0) You may want to give a few more subtraction problems. Be careful to start with numbers that will not go below zero. Otherwise you will get negative numbers.

⇨ Turn the calculator away from the students. This time you will do an addition rule, but start with a number other than 1. Enter 1 + 4 = . Turn the calculator around to face the children.

Say:

What number is on the display? (5) **Write the numbers that appear on the display on your paper.** Press =. (9 will show.) Press =. (13 will show.) Press =. (17 will show.) **What is my rule?** (Add 4.) **If I press the = key again, what number will appear?** (21) It is very important that the students write these numbers down.

⇨ Turn the calculator away from the students. Enter 100 – 10 = . Turn the calculator around to face the children.

Say:

What number is on the display? (90) **Write the numbers that appear on the display on your paper.** Press =. (80 will show.) Press =. (70 will show.) Press =. (60 will show.) **What is my rule?** (Subtract 10.) **If I press the = key again, what number will appear?** (50)

⇨ Put the calculator away. Give Student Sheet 67 to the students.

Say:

Let's play "What's My Rule?" in a different way. We are going to pretend that I am putting numbers into the calculator. I will call out a number and tell you what the calculator would have done. To help you see patterns, we are going to put the numbers in a table. We will call it an in/out table. On your sheet, you have 6 blank tables. We are going to see whether we can find a rule.

Say:

Let's start with table 1. The number that I put in is 1; 7 comes out. You would write the one in the column called in and write the 7 in the column called out. I have written these numbers in the table for you. As I call out numbers, write them in the table until you see a rule. I put in 2; out came 8. I put in 3; out came 9. I put in 4; out came 10. What's my rule? (Add 6, or add 6 to the *in* number to get the *out* number.) If you need a few more examples, use 5,11; 6, 12; 7, 13.

Say:

Let's go to table 2. The first number that I put in is 20; 18 came out. Write these numbers in the table. As I call out other numbers, write them in the table until you see a rule. I put in 19; out came 17. I put in 18; out came 16. I put in 17; out came 15. What's my rule? (Subtract 2, or subtract 2 from the *in* number to get the *out* number.) If you need a few more examples, use 16, 14; 15, 13; 14, 12.

Say:

Let's go to table 3. The first number that I put in is 20; 50 came out. Write these numbers in the table. As I call out other numbers, write them in the table until you see a rule. I put in 30; out came 60. I put in 35; out came 65. I put in 40; out came 70. What's my rule? (Add 30, or add 30 to the *in* number to get the *out* number.) If you need a few more examples, use 45, 75; 50, 80; 100, 130.

Say:

Let's go to table 4. The first number that I put in is 100; 95 came out. Write these numbers in the table. As I call out other numbers, write them in the table until you see a rule. I put in 75; out came 70. I put in 50; out came 45. I put in 17; out came 12. What's my rule? (Subtract 5, or subtract 5 from the *in* number to get the *out* number.)

Say:

Let's go to table 5. The first number that I put in is 2; 6 came out. Write these numbers in the table. As I call out other numbers, write them in the table until you see a rule. I put in 3; out came 9. I put in 4; out came 12. I put in 5; out came 15. What's my rule? (Multiply by 3, or the *out* number is the *in* number multiplied by 3.) If you need a few more examples, use 6, 18; 7, 21; 8, 24.

Say:

Let's go to table 6. The first number that I put in is 20; 10 came out. Write these numbers in the table. As I call out other numbers, write them in the table until you see a rule. I put in 18; out came 9. I put in 16; out came 8. I put in 14; out came 7. What's my rule? (Divide by 2, or the *out* number is the *in* number divided by 2.)

⇨ Give this problem to the students.

Say:

Bonnie's parents own a store. They have a chart that shows the cost of large boxes of nuts. The chart is at the bottom of the worksheet, table number 7. The chart shows the number of boxes of nuts and the price that that many boxes of nuts would cost. If the pattern continues, how much will 5 boxes of nuts cost? ($25) **6 boxes** ($30). **This procedure is just like our in/out tables. Can you tell me the rule?**

(Multiply the number of boxes by $5.) **If they sold 100 boxes of nuts, how much would the 100 boxes cost?** ($500) Note: There are lots of patterns in these tables. Some may see that the number of boxes goes up by 1. The cost goes up by 5. This information is fine if all you want is the next number in the pattern; but what if you wanted to know the cost of 20 or 50 or 100 boxes? We need to see a rule. The rule is multiply the number of boxes by 5.

Say:

Ms. Hebert is labeling her blocks for the next class. She does not want the students to know how many blocks are in the bags, but she wants to know herself. She has made a chart to help her remember how many she puts in a bag. She will label the bags as 1, 2, 3, 4, etc. The chart is at the bottom of the worksheet, table number 8. If the pattern continues, how many blocks would be in bag 5? (8), **bag 6?** (9) **Can you tell me the rule?** (To find the number of blocks in a bag, add 3 to the bag number.) **If the pattern continues, how many blocks would be in a bag labeled 20.** (23)

Say:

The students performing in the Saints halftime show will be placed in groups. The chart in table 9 shows how many students will be in each group. If the pattern continues, how many students will be in group 5? (25), **group 6?** (36) **Can you tell me the rule?** (To find the number of students, multiply the group number times itself.) **If the pattern continues, how many students would be in group 10?** (100)

Have one student summarize today's lesson.

Student Sheet 67 (Patterns: Lesson 3)

In/Out Tables

1.

In	Out
1	7

2.

In	Out

3.

In	Out

4.

In	Out

5.

In	Out

6.

In	Out

7.

Number of boxes of nuts	Total Cost
1	$5
2	$10
3	$15
4	$20
5	
6	
100	

8.

Number on Zip Lock bags	Number of blocks in bags
1	4
2	5
3	6
4	7
5	
6	
20	

9.

Group Number	Number of Students
1	1
2	4
3	9
4	16
5	
6	
10	