LESSON MAKER PRO

Pattern Rule Detectives

Find the rule, then make the pattern grow or shrink.

GRADE 4 · 4.PFA.1

4.PFA.1 "The student will identify, describe, extend, and create increasing and decreasing patterns (limited to addition, subtraction, and multiplication of whole numbers), including those in context, using various representations. Identify..."

NAME _____ DATE _____

FOLLOW THE RULE

A pattern rule tells what happens from one term to the next. In an increasing pattern, the values go up. In a decreasing pattern, the values go down. Look for an amount that is added or subtracted each time, or a whole number that is multiplied each time.

WORKED EXAMPLE

Complete the pattern: 1, 11, 21, 31, ____. Write the rule.

1. Find the change: 11 - 1 = 10.
2. Check again: 21 - 11 = 10.
3. Add 10 to 31: 31 + 10 = 41.

Answer: 41; add 10 each time.

PRACTICE 6 problems

1 Complete the pattern. Then write the rule: 12, 16, 20, ___, ___.

ANSWER _____

2 Complete the pattern. Then write the rule: 81, 72, 63, ___, ___.

ANSWER _____

3 Complete the pattern. Then write the rule: 2, 6, 18, ___, ___.

ANSWER _____

4 A function machine uses the rule multiply by 5. It receives inputs 7 and 9. What are the two outputs?

ANSWER _____

5 Assume a single addition, subtraction or multiplication rule: a machine sends 4 to 28 and 9 to 63. Find the rule and the output for 12.

ANSWER _____

6 Use the rule subtract 8. Start at 70 and write the next three terms.

ANSWER _____

APPLY IT Show your work

1 Kai earns coins in a game. Each new stage gives 9 more coins than the stage before it. Use the table to find the coin totals for stages D and E. State the rule.

KAI'S GAME COINS

Stage	Coins
A	17
B	26
C	35
D	___
E	___

ANSWER

2 A game machine gives an output 7 less than its input. Choose three different whole-number inputs greater than 7. Create a labeled input/output table. Explain how each row follows the rule.

INPUT	OUTPUT

CHALLENGE One step up

A pattern is 3, 12, 48, ___, ___. Find the next two terms and explain how you know the rule.

WORK SPACE AND ANSWER

ANSWER KEY

Pattern Rule Detectives

GRADE 4 · 4.PFA.1

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Complete the pattern. Then write the rule: 12, 16, 20, ___, ___.	**24, 28; add 4 each time.**
2	Complete the pattern. Then write the rule: 81, 72, 63, ___, ___.	**54, 45; subtract 9 each time.**
3	Complete the pattern. Then write the rule: 2, 6, 18, ___, ___.	**54, 162; multiply by 3 each time.**
4	A function machine uses the rule multiply by 5. It receives inputs 7 and 9. What are the two outputs?	**35, 45**
5	Assume a single addition, subtraction or multiplication rule: a machine sends 4 to 28 and 9 to 63. Find the rule and the output for 12.	**Multiply by 7; 84**
6	Use the rule subtract 8. Start at 70 and write the next three terms.	**62, 54, 46**

PART 2 · APPLY IT

1. **Stage D: 44 coins. Stage E: 53 coins. Rule: add 9 coins each stage.** The coin totals increase by 9 from one stage to the next. Add 9 to 35, then add 9 again.
2. **Answers vary. Example: inputs 20, 30, 40 give outputs 13, 23, 33. Each output equals its input minus 7.** Check three distinct inputs above 7 and a single subtraction rule applied to every row. The rule maps each input to its output; it is not a rule between successive rows.

CHALLENGE

192, 768. The rule is multiply by 4 each time because 3 × 4 = 12 and 12 × 4 = 48.

Accept equivalent rule wording, such as "add 4" or "+4," when it matches the pattern. For the challenge, students should identify multiplication by 4 and give both correct terms.