LESSON MAKER PRO

# Sequence Switchboard

*Move between recursive rules, explicit formulas, and real situations.*

**HIGH SCHOOL · HSF-BF.A.2**

**CCSS.Math.Content.HSF-BF.A.2** "Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. *"

NAME _____ DATE _____

## TWO WAYS TO DESCRIBE A SEQUENCE

An arithmetic sequence changes by adding or subtracting the same difference each time. A geometric sequence changes by multiplying by the same ratio each time. A recursive rule gives a starting term and a rule using the previous term, while an explicit formula gives any term directly.

### WORKED EXAMPLE

An arithmetic sequence has a_1 = 11 and common difference -8. Write a recursive rule and an explicit formula.

1. Start with a_1 = 11.
2. Subtract 8 from each previous term: a_n = a_(n-1) - 8 for n >= 2.
3. Use a_n = 11 + (n-1)(-8).
4. Simplify: a_n = 19 - 8n.

**Answer: Recursive: a_1 = 11, a_n = a_(n-1) - 8 for n >= 2. Explicit: a_n = 11 + (n-1)(-8), or a_n = 19 - 8n.**

## PRACTICE 6 problems

**1** An arithmetic sequence has a_1 = 5 and common difference 6. Write a recursive rule and an explicit formula.

**ANSWER** _____

**2** A geometric sequence has b_1 = 2 and common ratio 4. Write a recursive rule and an explicit formula.

**ANSWER** _____

**3** The explicit formula is c_n = 9 - 2(n-1). Write a recursive rule. Then list the first four terms.

**ANSWER** _____

**4** The explicit formula is d_n = 3(5)^(n-1). Write a recursive rule and find d_4.

**ANSWER** _____

**5** The sequence begins 64, 32, 16, ... Write a recursive rule and an explicit formula.

**ANSWER** _____

**6** A sequence is defined by e_1 = -4 and e_n = e_(n-1) + 7 for n >= 2. Write an explicit formula and find e_6.

**ANSWER** _____

## APPLY IT Show your work

**1** A student council scholarship fund has $120 at the end of week 1. The council adds $35 each week. Let F_n represent the total amount in the fund at the end of week n. Write a recursive rule and an explicit formula. How much will be in the fund at the end of week 6?

WORK SPACE

**ANSWER** _____

**2** A school club's video receives 7 shares on day 1. The number of shares each day is twice the number from the day before. Let S_n represent the number of shares on day n. Write a recursive rule and an explicit formula. How many shares will the video receive on day 5?

WORK SPACE

**ANSWER** _____

## CHALLENGE One step up

An arithmetic sequence has a_3 = 18 and a_7 = 42. Write a recursive rule and an explicit formula. Then find a_12 and explain how you found the common difference.

WORK SPACE AND ANSWER

ANSWER KEY

# Sequence Switchboard



## PART 1 · PRACTICE

| # | PROBLEM | ANSWER |
|---|---|---|
| 1 | An arithmetic sequence has a_1 = 5 and common difference 6. Write a recursive rule and an explicit formula. | **Recursive: a_1 = 5, a_n = a_(n-1) + 6 for n >= 2. Explicit: a_n = 5 + 6(n-1), or a_n = 6n - 1.** |
| 2 | A geometric sequence has b_1 = 2 and common ratio 4. Write a recursive rule and an explicit formula. | **Recursive: b_1 = 2, b_n = 4b_(n-1) for n >= 2. Explicit: b_n = 2(4)^(n-1).** |
| 3 | The explicit formula is c_n = 9 - 2(n-1). Write a recursive rule. Then list the first four terms. | **Recursive: c_1 = 9, c_n = c_(n-1) - 2 for n >= 2. First four terms: 9, 7, 5, 3.** |
| 4 | The explicit formula is d_n = 3(5)^(n-1). Write a recursive rule and find d_4. | **Recursive: d_1 = 3, d_n = 5d_(n-1) for n >= 2. d_4 = 375.** |
| 5 | The sequence begins 64, 32, 16, ... Write a recursive rule and an explicit formula. | **Recursive: a_1 = 64, a_n = (1/2)a_(n-1) for n >= 2. Explicit: a_n = 64(1/2)^(n-1).** |
| 6 | A sequence is defined by e_1 = -4 and e_n = e_(n-1) + 7 for n >= 2. Write an explicit formula and find e_6. | **Explicit: e_n = -4 + 7(n-1), or e_n = 7n - 11. e_6 = 31.** |

## PART 2 · APPLY IT

1. **Recursive: F_1 = 120, F_n = F_(n-1) + 35 for n >= 2. Explicit: F_n = 120 + 35(n-1). F_6 = $295.** This is arithmetic because the fund increases by a constant $35 each week. Substitute n = 6 into the explicit formula.
2. **Recursive: S_1 = 7, S_n = 2S_(n-1) for n >= 2. Explicit: S_n = 7(2)^(n-1). S_5 = 112 shares.** This is geometric because the number of shares is multiplied by 2 each day. Substitute n = 5 into the explicit formula.

## CHALLENGE

**The common difference is (42 - 18)/(7 - 3) = 6. Recursive: a_1 = 6, a_n = a_(n-1) + 6 for n >= 2. Explicit: a_n = 6 + 6(n-1), or a_n = 6n. a_12 = 72.**

Accept equivalent explicit formulas, including expanded or factored forms. A recursive rule must include both the starting term and the condition n >= 2.