

Pattern & Rule Detective: Case Files for Grades 3–5

6 complete activities from Pattern & Rule Detective, each with a worked answer.

Figure	1	2	3	4
Dots	5	9	13	?

HOW TO USE

1. Read the situation and the evidence first.
2. Show your thinking in the work boxes, not only an answer.
3. Explain how you know your answer makes sense.
4. Try the new problem at the bottom of the page.

6 activities • 3 answer pages • From the 36-activity collection

10 US Letter pages • Print at 100% / Actual Size

Original Bobotemp educational printable • Fictional names, places and prices

Name _____ Date _____

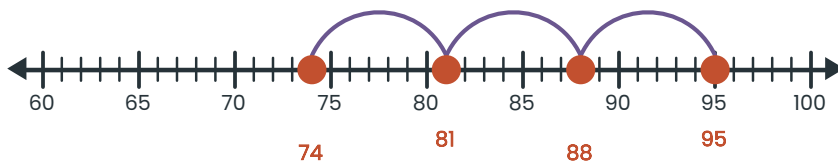
LEVEL 1



Find the difference between each pair of neighbors. State the rule in words, then extend the sequence.

Detective Ruiz found a countdown drawn as hops on a number line: 95, 88, 81, 74, __, __. The numbers get smaller with each hop. Find the size of each hop and write the rule as a complete sentence. Then find the next two terms. Keep extending the countdown, and stop at the last term that is not below zero.

THE COUNTDOWN AS HOPS



EVIDENCE TO USE

- Sequence: 95, 88, 81, 74, __, __
- Shown as hops on a number line
- The numbers get smaller
- Stop before any value below 0

1. Write the difference between each pair of neighbors.

[illegible]

2. State the rule in a complete sentence.

[illegible]

3. Write the next two terms and the last term that is not below 0.

TRY IT • Find the rule and the next two terms: 100, 92, 84, 76, __, __.

Name _____ Date _____

LEVEL 1



Check every step of each trail. Sort the trails into adding rules and multiplying rules.

Four suspects each left a number trail. Trail A: 3, 6, 12, 24. Trail B: 3, 6, 9, 12. Trail C: 2, 6, 18, 54. Trail D: 4, 10, 16, 22. Two trails grow by adding the same amount each time. Two trails grow by multiplying by the same number each time. Sort the trails, write each rule, and find each next term. Careful: Trails A and B start the same way, so check every step before you decide.

TRAIL SORTER

Trail	Terms	Adds or multiplies?	Rule	Next term
A	3, 6, 12, 24			
B	3, 6, 9, 12			
C	2, 6, 18, 54			
D	4, 10, 16, 22			

1. Sort the trails into Adding and Multiplying.

2. Write the rule for each trail in words.

[illegible]

3. Write the next term of each trail.

TRY IT • Two trails both begin 7, 14. Trail P continues with 28. Trail Q continues with 21. Give the rule and the next term for each trail.

Name _____ Date _____

LEVEL 2 ●●○

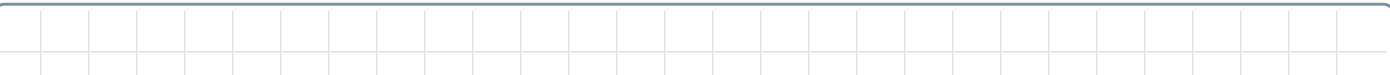
Find the total change, count the jumps, and split the change equally.

Three terms in the middle are missing: 18, __, __, __, 50. The sequence adds the same amount each time. Find the total change from the first term to the last term. Count the jumps, not the blanks. Split the change equally and fill every gap. Then explain how you split it.

EVIDENCE TO USE

- Sequence: 18, __, __, __, 50
- Constant step (the same amount is added each time)
- Number of blanks: 3
- Count the jumps between terms

1. Find the total change and the number of jumps.



2. Find the step and fill in all three gaps.

A blank sheet of graph paper with a light gray background and a dark gray grid. The grid consists of 10 columns and 10 rows of squares. The top-left corner of the grid is slightly rounded.

3. Explain in one sentence how you split the total change.

[illegible]

TRY IT • Fill the gaps in this constant-step sequence: 60, __, __, 39.

Name _____ Date _____

LEVEL 2 ●●○

Judge each claim as true or false. Every false claim needs one specific counterexample from the list.

The sequence 3, 7, 11, 15, 19, 23 adds 4 each time. Three witnesses make claims about these six terms. Claim A: Every term is odd. Claim B: Every term is a prime number. Claim C: Every term ends in 3. Judge each claim as true or false for these six terms. For each false claim, give one specific counterexample. Which term is the only counterexample to Claim B?

TEST EVERY TERM: MARK ✓ OR ✗

Term	Claim A: odd	Claim B: prime	Claim C: ends in 3
3			
7			
11			
15			
19			
23			

EVIDENCE TO USE

- Terms: 3, 7, 11, 15, 19, 23
- Claim A: Every term is odd.
- Claim B: Every term is prime.
- Claim C: Every term ends in 3.

1. Judge Claim A and explain why.

[illegible]

2. Judge Claim B and name its only counterexample with proof.

[illegible]

3. Judge Claim C and give one counterexample.

TRY IT • Claim: Every multiple of 4 is also a multiple of 8. Is the claim true or false? Give a counterexample if it is false.

Name _____ Date _____

LEVEL 3



Generate two sequences, pair the matching terms, and describe how the pairs are related.

Sequence A starts at 0 and adds 4. Sequence B starts at 0 and adds 12. Write terms 1 through 7 of each sequence; term 1 is the first number after the start of 0. Pair the corresponding terms. Describe how each B term relates to its A term, and explain why the relationship works. Then give the 7th pair.

TWIN RULES (TERM 1 IS THE FIRST NUMBER AFTER 0)

Term	1	2	3	4	5	6	7
A (add 4)							
B (add 12)							
Pair (A, B)							

EVIDENCE TO USE

- Sequence A: start 0, add 4
- Sequence B: start 0, add 12
- Term 1 is the first number after 0
- Pairs are written as (A term, B term)

1. List terms 1 to 7 of both sequences.

[illegible]

2. Write the first four pairs and describe the relationship.

[illegible]

3. Explain why the relationship works and give the 7th pair.

TRY IT • Sequence A starts at 0 and adds 5. Sequence B starts at 0 and adds 20. Give the 6th pair and the relationship.

Name _____ Date _____

Case 26: Pair Plotter

LEVEL 3



Form ordered pairs from two rules, plot them, and use the pattern to predict new points.

Rule x: start at 1, add 2. Rule y: start at 2, add 3. Form ordered pairs (x, y) from terms 1 to 5 and plot them on a first-quadrant grid. Describe the pattern the points make. Then, without plotting, find the 7th pair. Decide whether the point $(12, 18)$ belongs to the pattern.

PAIRS FROM THE TWO RULES

Term	1	2	3	4	5	7
x (start 1, add 2)						
y (start 2, add 3)						

EVIDENCE TO USE

- Rule x: start 1, add 2
- Rule y: start 2, add 3
- Pairs: $(x \text{ term}, y \text{ term})$ with the same term number
- Grid: 0 to 15 across, 0 to 25 up

1. List the pairs for terms 1 to 5. Draw axes from 0 to 15 across and 0 to 25 up, then plot the pairs.

2. Describe the pattern of the points.

3. Find the 7th pair and decide whether $(12, 18)$ belongs.

TRY IT • Is the point $(17, 26)$ part of the same pattern? If it is, which term is it?

1. Case 1: Step Sleuth Countdown

LEVEL 1

Rule: start at 95 and subtract 7 each time. The next two terms are 67 and 60. The last term that is not below zero is 4.

WORKED REASONING • $95 - 88 = 7$, $88 - 81 = 7$, and $81 - 74 = 7$. Every hop goes down 7, so the rule is: start at 95 and subtract 7 each time. Next terms: $74 - 7 = 67$ and $67 - 7 = 60$. Continuing gives 53, 46, 39, 32, 25, 18, 11, 4. The next hop ($4 - 7$) would go below zero, so 4 is the last term we write.

WATCH FOR • Some students notice the 7 but write 'add 7' because they ignore the direction, or they check only the first pair. Always check every difference and ask whether the numbers are going up or down.

TRANSFER • Subtract 8 each time. The next two terms are 68 and 60.

2. Case 2: Double or Add?

LEVEL 1

A: multiply by 2, next term 48. **B:** add 3, next term 15. **C:** multiply by 3, next term 162. **D:** add 6, next term 28.

WORKED REASONING • **A:** $6 - 3 = 3$ but $12 - 6 = 6$, so the differences change. Instead, $3 \times 2 = 6$, $6 \times 2 = 12$, and $12 \times 2 = 24$, so the rule is multiply by 2: $24 \times 2 = 48$. **B:** the differences are 3, 3, 3, so add 3: $12 + 3 = 15$. **C:** $2 \times 3 = 6$, $6 \times 3 = 18$, and $18 \times 3 = 54$, so multiply by 3: $54 \times 3 = 162$. **D:** the differences are 6, 6, 6, so add 6: $22 + 6 = 28$. Adding trails: B and D. Multiplying trails: A and C.

WATCH FOR • Students who check only the first step call Trail A 'add 3' because 3 to 6 is +3. A rule must work for every step, and $12 + 3$ is 15, not 24.

TRANSFER • **P:** multiply by 2, next term 56. **Q:** add 7, next term 28.

13. Case 13: Interior Gap Detective

LEVEL 2

The total change is 32 over 4 jumps, so the step is 8. The missing terms are 26, 34, and 42.

WORKED REASONING • Total change: $50 - 18 = 32$. There are 5 terms, so there are 4 jumps between them. $32 \div 4 = 8$, so each step adds 8. $18 + 8 = 26$, $26 + 8 = 34$, $34 + 8 = 42$, and $42 + 8 = 50$, which matches the last term. Sample explanation: 'The sequence went up 32 in 4 equal jumps, so each jump is 8.'

WATCH FOR • Many students divide by the number of blanks: $32 \div 3$. That does not give a whole number, which is a warning sign. There is always one more jump than there are blanks.

TRANSFER • The rule is subtract 7 ($60 - 39 = 21$, and $21 \div 3 = 7$). The missing terms are 53 and 46.

14. Case 14: Claim Court

LEVEL 2

Claim A is true. Claim B is false, and its only counterexample is 15. Claim C is false; 7, 11, 15, or 19 is an acceptable counterexample.

WORKED REASONING • A: 3 is odd, and adding 4 (an even number) to an odd number keeps it odd. So all six terms are odd, and Claim A is true. B: 3, 7, 11, 19, and 23 each have only the factors 1 and itself. But $15 = 3 \times 5$, so 15 is not prime. Claim B is false, and 15 is its only counterexample. C: 7 ends in 7, so Claim C is false. Any one of 7, 11, 15, or 19 is an acceptable counterexample.

WATCH FOR • Students sometimes write 'Claim B is false because not all numbers are prime.' A counterexample must be a specific term from the list, such as 15, with proof ($15 = 3 \times 5$).

TRANSFER • False. 12 is a multiple of 4, but $12 \div 8$ is not a whole number. Also accept 4, 20, 28, or any other multiple of 4 that is not a multiple of 8.

25. Case 25: Twin Rules

LEVEL 3

Each B term is 3 times its A term. The 7th pair is (28, 84).

WORKED REASONING • A: 4, 8, 12, 16, 20, 24, 28. B: 12, 24, 36, 48, 60, 72, 84. Pairs: (4, 12), (8, 24), (12, 36), (16, 48), ... Each B term is 3 times its A term: $4 \times 3 = 12$, $8 \times 3 = 24$, and $28 \times 3 = 84$. This works because after the same number of steps, B has added 12 each time while A has added 4, and $12 = 3 \times 4$. The differences $B - A$ are 8, 16, 24, ..., which change, so 'B is 8 more than A' is not the relationship.

WATCH FOR • Students often compare only the first pair and write 'B is 8 more than A.' The difference grows (8, 16, 24), so check the relationship on several pairs.

TRANSFER • The 6th pair is (30, 120). Each B term is 4 times its A term.

26. Case 26: Pair Plotter

LEVEL 3

The pairs are (1, 2), (3, 5), (5, 8), (7, 11), and (9, 14). The points lie on a straight line, moving right 2 and up 3 each time. The 7th pair is (13, 20), so its y-value is 20. The point (12, 18) does not belong because every x-value is odd.

WORKED REASONING • x: 1, 3, 5, 7, 9. y: 2, 5, 8, 11, 14. From point to point, x grows by 2 and y grows by 3, so the points step evenly along a straight line. 7th pair: $x = 1 + 2 \times 6 = 13$ and $y = 2 + 3 \times 6 = 20$, so the pair is (13, 20). For (12, 18): the x-terms start at 1, which is odd, and adding 2 keeps them odd, so 12 never appears.

WATCH FOR • Students may pair x term 1 with y term 2, or plot (y, x) instead of (x, y). Corresponding terms share the same term number, and the first number in the pair tells how far to go across.

TRANSFER • Yes, it is term 9: $x = 1 + 2 \times 8 = 17$ and $y = 2 + 3 \times 8 = 26$.