4. Make a conjecture about the next item in each sequence.

1. 4, \( \frac{11}{2}, \frac{9}{2}, 4, \frac{7}{2} \)
2. \(-4, -1, 2, 5, 8\)
3. \(1, 2, 5, 8\)
4. \(-2, 4, -8, 16, -32, 64\)

5. Points \(A, B, C,\) and \(D\) are collinear.
   Conjecture: \(A, B, C,\) and \(D\) are collinear.

6. Point \(P\) is the midpoint of \(NQ\).
   Conjecture: \(P\) is the midpoint of \(NQ\).

7. \(\angle 1, \angle 2, \angle 3,\) and \(\angle 4\) form four linear pairs.
   Conjecture: \(\angle 1, \angle 2, \angle 3,\) and \(\angle 4\) are formed by two intersecting lines.

8. \(\angle 3 \cong \angle 4\)
   Conjecture: \(\angle 3 \cong \angle 4\)

Determine whether each conjecture is true or false. Give a counterexample for any false conjecture.

9. Given: \(\angle ABC\) and \(\angle CBD\) form a linear pair.
   Conjecture: \(\angle ABC \cong \angle CBD\)
   False; one of the angles could be acute and the other obtuse.

10. Given: \(AB, BC,\) and \(AC\) are congruent.
    Conjecture: \(A, B,\) and \(C\) are collinear.
    False; \(AB, BC,\) and \(AC\) could form a triangle.

11. Given: \(AB + BC = AC\)
    Conjecture: \(AB = AC\)
    False; counterexample: \(A \neq B \neq C\)

12. Given: \(\angle 1\) is complementary to \(\angle 2,\) and \(\angle 1\) is complementary to \(\angle 3.
    Conjecture: \(\angle 2 \cong \angle 3\)
    True

Determine whether each conjecture is true or false. Give a counterexample for any false conjecture.

9. Given: \(S, T,\) and \(U\) are collinear and \(ST = TU\).
   Conjecture: \(T\) is the midpoint of \(SU\).
   True

10. Given: \(\angle 1\) and \(\angle 2\) are adjacent angles.
    Conjecture: \(\angle 1\) and \(\angle 2\) form a linear pair.
    False; \(\angle 1\) and \(\angle 2\) could each measure 60°.

11. Given: \(GH\) and \(JK\) form a right angle and intersect at \(P\).
    Conjecture: \(GH \perp JK\)
    True

12. Allergies
    Each spring, Rachel starts sneezing when the pear trees on her street blossom.
    She reasons that she is allergic to pear trees. Find a counterexample to Rachel’s conjecture.
    Sample answer: Rachel could be allergic to other types of plants that blossom when the pear trees blossom.
**Skills Practice**

### Logic

Use the following statements to write a compound statement for each conjunction and disjunction. Then find its truth value.

- **p**: $-3 - 2 = -5$
- **q**: Vertical angles are congruent.
- **r**: $2 + 8 > 10$
- **s**: The sum of the measures of complementary angles is $90^\circ$.

1. **p** and **q**: $-3 - 2 = -5$ and vertical angles are congruent; true.
2. **p** or **s**: $-3 - 2 = -5$ or the sum of the measures of complementary angles is $90^\circ$; true.
3. **r** or **s**: $2 + 8 > 10$ or the sum of the measures of complementary angles is $90^\circ$; true.
4. **p** and **~q**: $-3 - 2 = -5$ and vertical angles are not congruent; false.
5. **q** or **~r**: Vertical angles are congruent or $2 + 8 \leq 10$; true.

### Construct a truth table for each compound statement.

<table>
<thead>
<tr>
<th>p</th>
<th>q</th>
<th>~p</th>
<th>~q</th>
<th>~p ∧ ~q</th>
<th>(~p ∧ q)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>T</td>
<td>F</td>
<td>F</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>T</td>
<td>F</td>
<td>F</td>
<td>T</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>F</td>
<td>T</td>
<td>T</td>
<td>F</td>
<td>F</td>
<td>T</td>
</tr>
<tr>
<td>F</td>
<td>F</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>T</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>p</th>
<th>q</th>
<th>~p</th>
<th>~q</th>
<th>p ∨ ~q</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>T</td>
<td>F</td>
<td>F</td>
<td>T</td>
</tr>
<tr>
<td>T</td>
<td>F</td>
<td>F</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>F</td>
<td>T</td>
<td>T</td>
<td>F</td>
<td>T</td>
</tr>
<tr>
<td>F</td>
<td>F</td>
<td>T</td>
<td>T</td>
<td>T</td>
</tr>
</tbody>
</table>

**Construct a truth table for each compound statement.**

<table>
<thead>
<tr>
<th>p</th>
<th>q</th>
<th>~p</th>
<th>~q</th>
<th>p ∨ ~q</th>
<th>(~p ∧ q)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>T</td>
<td>F</td>
<td>F</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>T</td>
<td>F</td>
<td>F</td>
<td>T</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>F</td>
<td>T</td>
<td>T</td>
<td>F</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>F</td>
<td>F</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>T</td>
</tr>
</tbody>
</table>

**After School**

For Exercises 9 and 10, use the following information.

The Venn diagram shows the number of students in the band who work after school or on the weekends.

9. How many students work after school and on weekends? 3
10. How many students work after school or on weekends? 25
Identify the hypothesis and conclusion of each statement.

1. If you purchase a computer and do not like it, then you can return it within 30 days.
   \[ H: \text{you purchase a computer and do not like it}; \ C: \text{you can return it within 30 days} \]

2. If \( x + 8 = 4 \), then \( x = -4 \).
   \[ H: x + 8 = 4; C: x = -4 \]

3. If the drama class raises $2000, then they will go on tour.
   \[ H: \text{the drama class raises $2000}; \ C: \text{they will go on tour} \]

Write each statement in if-then form.

4. If a polygon has four sides, then it is a quadrilateral.

   If you stand for nothing, then you will fall for anything.

6. An acute angle has a measure less than 90.
   If an angle is acute, then its measure is less than 90.

Determine the truth value of the following statement for each set of conditions.

If DVD players are on sale for less than $100, then you buy one.

5. DVD players are on sale for $95 and you buy one. \( \text{true} \)

6. DVD players are on sale for $100 and you do not buy one. \( \text{true} \)

7. DVD players are not on sale for under $100 and you do not buy one. \( \text{true} \)

8. Write the converse, inverse, and contrapositive of the conditional statement. Determine whether each statement is true or false. If a statement is false, find a counterexample.
   \[ \text{If } (-8)^2 > 0, \text{ then } -8 > 0. \]
   Converse: If \( -8 > 0 \), then \( (-8)^2 > 0 \); true.
   Inverse: If \( (-8)^2 \leq 0 \), then \( -8 \leq 0 \); true.
   Contrapositive: If \( -8 \leq 0 \), then \( (-8)^2 \leq 0 \); false.

SUMMER CAMP For Exercises 9 and 10, use the following information.
Older campers who attend Woodland Falls Camp are expected to work. Campers who are juniors wait on tables.

9. Write a conditional statement in if-then form.
   Sample answer: If you are a junior, then you wait on tables.

10. Write the converse of your conditional statement. If you wait on tables, then you are a junior.