

Check Your Understanding 1.2

Name: _____

Period: _____

Date: _____

Show all work. Use correct notation throughout.

Basic	Intermediate	Advanced
Row 1 Spiral — What Makes a Good Definition → <i>Classification and differentiation (final appearance)</i>		
<i>Basic — Spiral</i> 1. A student defines a fridge as a box that holds food. Explain what is weak about this definition and write a better one.	<i>Intermediate — Spiral</i> 2. Write a definition for 'midpoint' using classification and differentiation. Test it: does your definition include all midpoints and exclude all non-midpoints? Give one example and one non-example.	<i>Advanced — Spiral</i> 3. The undefined terms in geometry — point, line, plane — cannot be defined without circularity. Explain what this has to do with the structure of definitions you learned in Lesson 1.1. Why does every logical system need undefined terms, and what makes a term a good candidate to be undefined?
Row 2 Spiral — The Foundational Objects → <i>Naming what we reason about</i>		
<i>Basic — Spiral</i> 4. Write the correct notation for each. (a) <i>A line through M and N.</i> (b) <i>A ray starting at X through Y.</i> (c) <i>A segment from W to V.</i> 5. <i>Are the points (0,0), (2,4), and (3,6) collinear? Show work.</i>	<i>Intermediate — Spiral</i> 6. Define parallel and perpendicular lines. For each: draw a diagram, write the symbolic notation, and give a real-world example.	<i>Advanced — Spiral</i> 7. A student names a plane 'Plane AB.' Explain why this is not a valid name and what information is needed to name a plane unambiguously. Connect your answer to why two points are insufficient to define a plane.

Basic	Intermediate	Advanced
Distance and Midpoint in the Plane → <i>Measuring what we reason about</i>		
<i>Basic</i> 8. Find the taxicab distance between A(3, -2) and B(-4, 5). 9. Find the Euclidean distance between C(-1, 3) and D(4, -2). (a) Calculate the distance. (b) Explain how the Pythagorean theorem appears in your calculation. 10. Find the midpoint between E(2, 7) and F(-6, -3).	<i>Intermediate</i> 11. The midpoint between G and H(5, -4) is M(1, 2). Find G. 12. Segment AB has midpoint M(3, -1). Point A is at (-1, 4). Find B. 13. At 45°N, one degree of longitude ≈ 49 miles and one degree of latitude ≈ 69 miles. Town A is at 45.000°N, 93.000°W. Town B is at 45.500°N, 93.800°W. Find the straight-line distance in miles.	<i>Advanced</i> 14. You are planning a hike. The scenic overlook at the midpoint is at (41.500°N, -72.000°W). Your start is (41.200°N, -72.300°W). Find the endpoint. 15. Explain why the taxicab distance between two points can never be shorter than the Euclidean distance. Under what geometric condition are they equal?
Algebra Spiral <i>Solve equations</i>	<i>Algebra Spiral</i> Solve each equation. Show all steps. (a) $5x + 8 = 2x - 7$ (b) $2(3y - 4) = 4y + 10$ (c) $(1/2)m + 6 = (3/4)m - 2$	

Answers — CYU 1.2**Row 1 Spiral (final appearance)**

1. A fridge is a closed place to store food that keeps it cold.
2. A point (category) on a segment that divides it into two equal parts (differentiation). Example: M(2,3) is the midpoint of a segment from (0,0) to (4,6). Non-example: a point at (1,1) on the same segment is not the midpoint.
3. A good definition requires placing a term in a larger category. Point, line, and plane are so basic there is no larger geometric category to place them in — any attempt creates circularity. They make good undefined terms precisely because they are foundational, widely understood intuitively, and not reducible to anything simpler.

Row 2 Spiral

- 4a. Line MN (double arrow over MN)
- 4b. Ray XY (arrow over XY from X)
- 4c. Segment WV (bar over WV)
5. Slope (0,0)→(2,4) = 2. Slope (0,0)→(3,6) = 2. Equal slopes through the same point → collinear. Yes.
6. Parallel: two lines in the same plane that never intersect (notation: $l \parallel m$). Perpendicular: two lines intersecting at 90° (notation: $l \perp m$). Accept any correct diagrams and real-world examples.
7. Two points determine a line, and that line lies in infinitely many planes. 'Plane AB' names a line, not a plane. A plane requires three non-collinear points (e.g., Plane ABC) to be uniquely determined.

Distance and Midpoint

8. $7 + 7 = 14$ units.
- 9a. $\sqrt{(25+25)} = 5\sqrt{2} \approx 7.07$.
- 9b. The horizontal and vertical differences form the legs of a right triangle; the distance formula computes the hypotenuse using $a^2 + b^2 = c^2$.
10. (-2, 2).
11. G = (-3, 8).
12. B = (7, -6).
13. $\Delta\text{lat} = 34.5$ mi, $\Delta\text{lon} = 39.2$ mi. Distance = $\sqrt{(34.5^2 + 39.2^2)} \approx 52.2$ miles.
14. Endpoint = (41.800°N, -71.700°W).
15. The Euclidean path is the shortest possible — the straight line. The taxicab path follows a grid and must be at least as long. They are equal only when the two points lie on a perfectly horizontal or vertical line.

Algebra Spiral

- (a) $x = -5$
- (b) $y = 9$
- (c) $m = 32$