Writing Equations for Lines

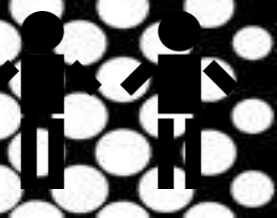
Lesson 11

Building on	**6.G.A.3** Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems. **7.RP.A.2** Recognize and represent proportional relationships between quantities. **8.G.A** Understand congruence and similarity using physical models, transparencies, or geometry software.
Addressing	**8.EE.B.6** Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b. **8.G.A** Understand congruence and similarity using physical models, transparencies, or geometry software.

Let’s explore the relationship between points on a line and the **slope** of the line!

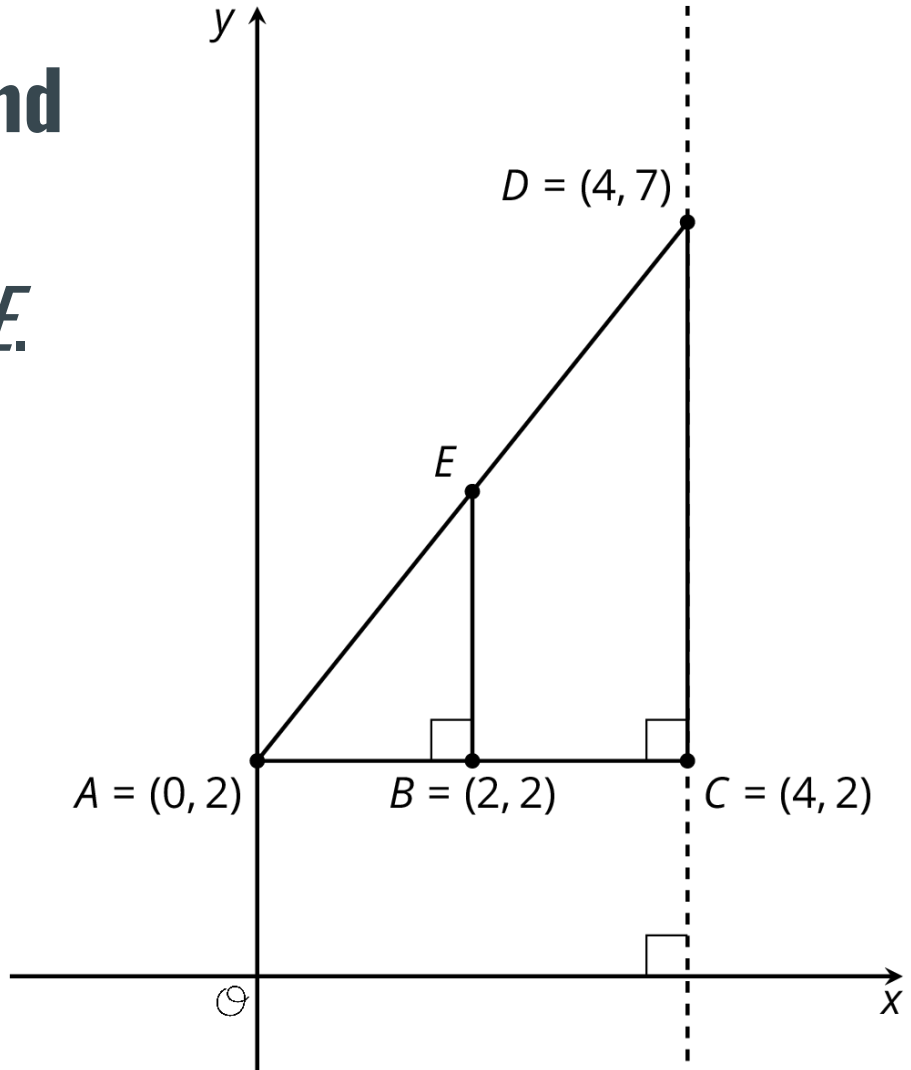
Coordinates and Lengths in the Coordinate Plane

- Warm Up 11.1
- Think Pair Share



Find each of the following and explain your reasoning:

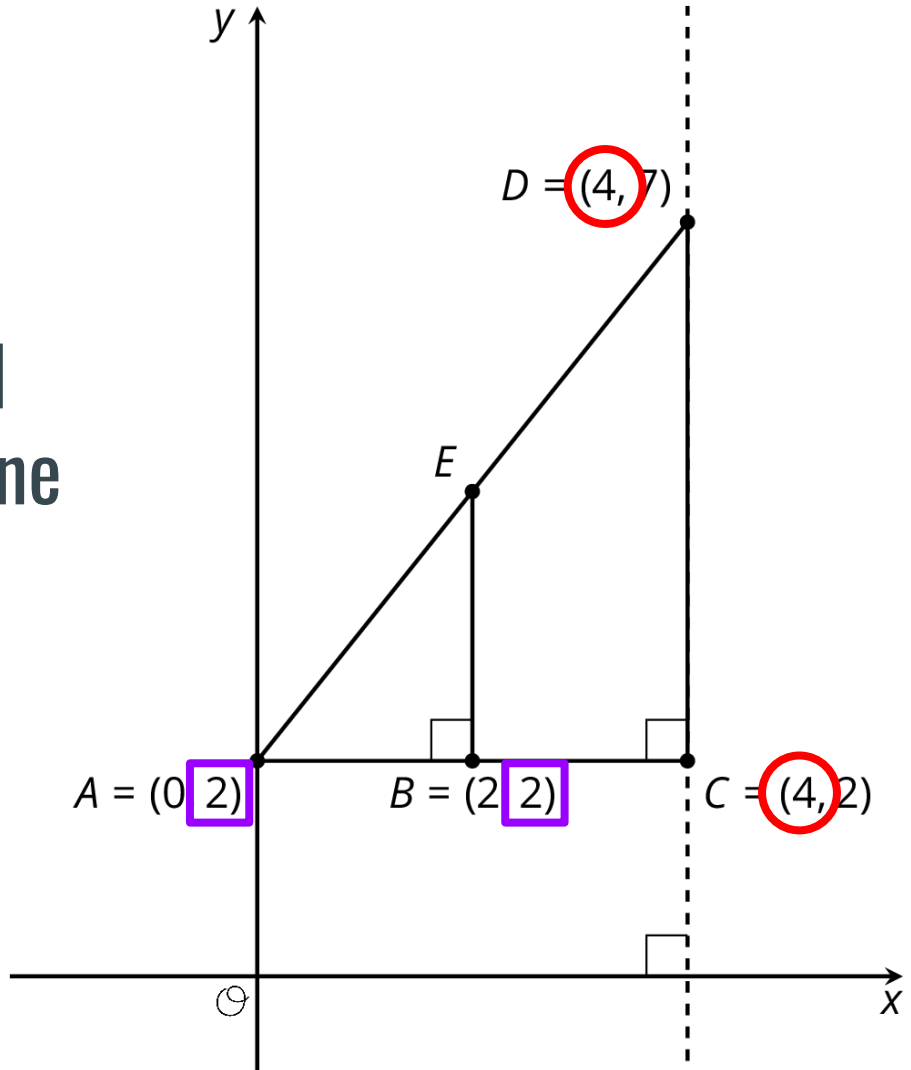
1. The length of segment *BE*.
2. The coordinates of *E*.



Begin with Quiet Think Time. (2 min)

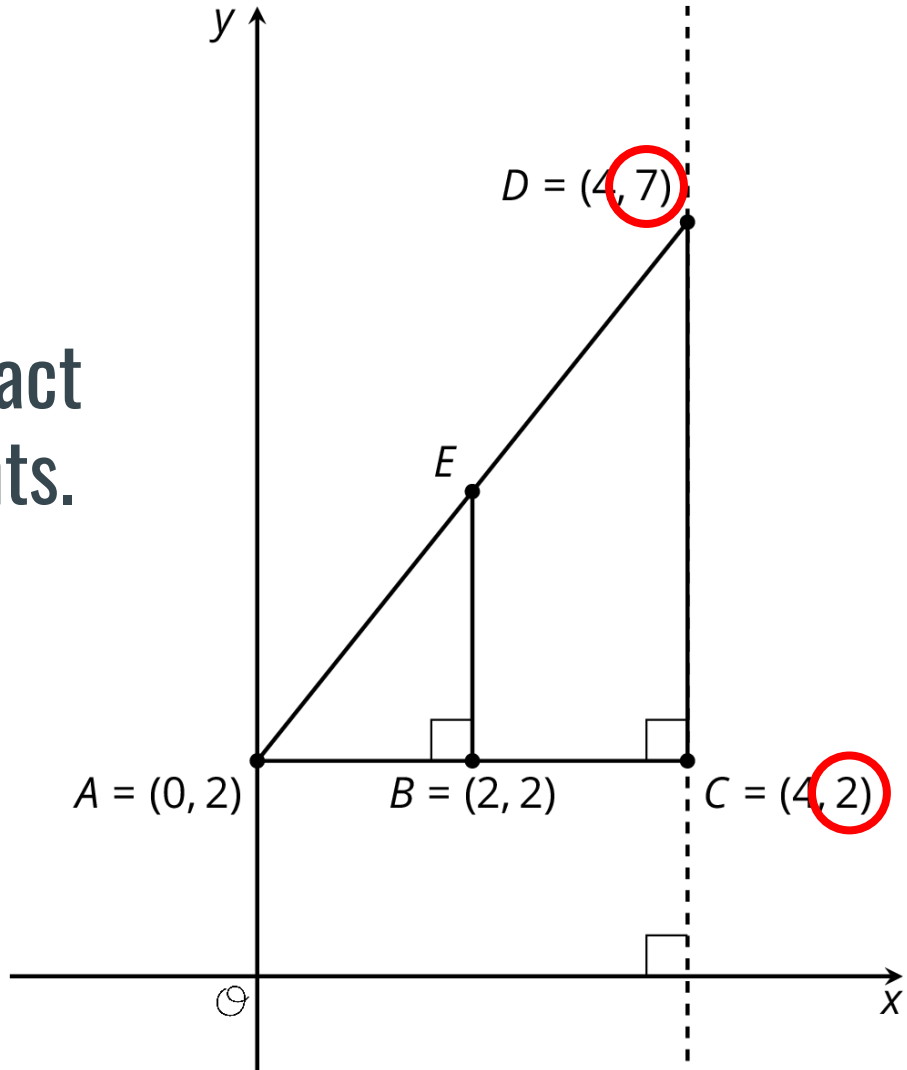
BIG IDEA:

Points on the same vertical line have the same x-coordinate and points on the same horizontal line have the same y-coordinate.



BIG IDEA:

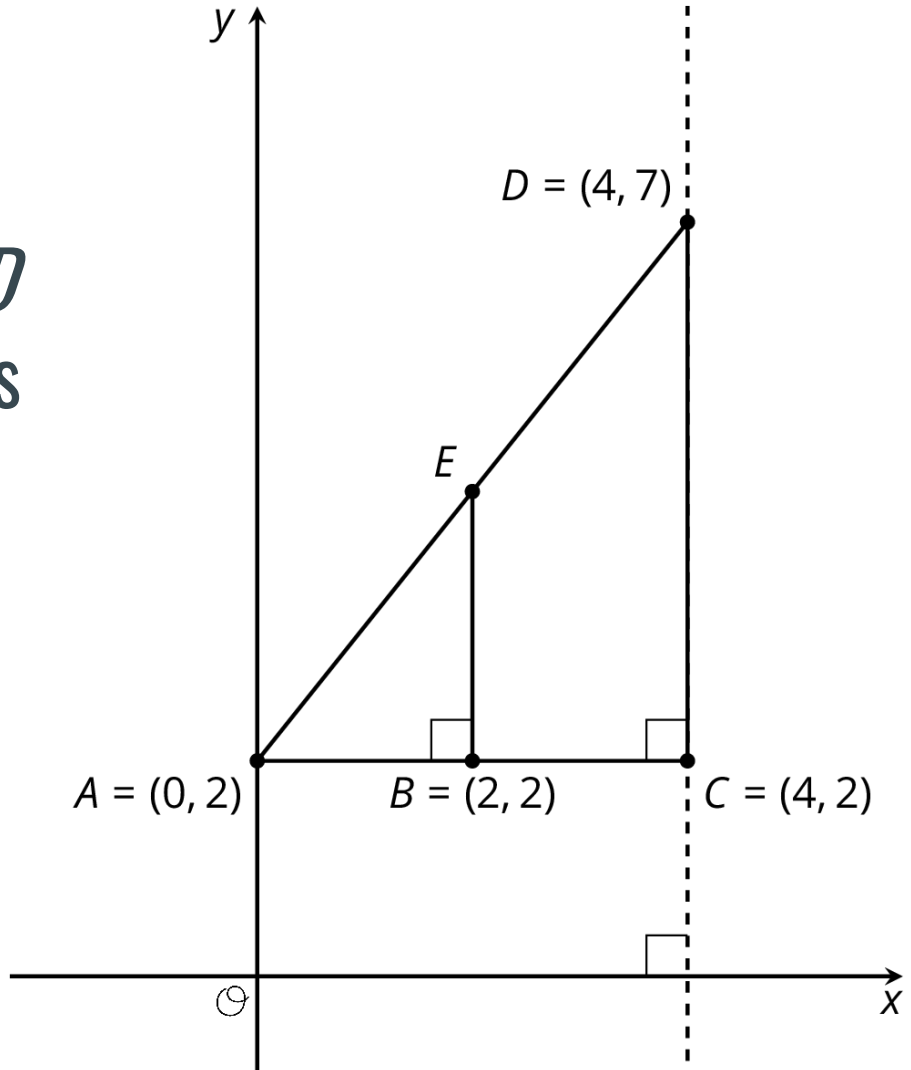
In order to find the length of a vertical segment, you can subtract the y-coordinates of its endpoints.



BIG IDEA:

The side lengths of triangle *ACD* are the same as the side lengths of the similar triangle *ABE* multiplied by the scale factor ***AC*** ÷ ***AB***.

4 ÷ 2 = 2



What We Mean by an Equation of a Line

Activity 11.2

5 Practices

Stronger and Clearer Each Time

As you work, think about what you know about **slope triangles** from our previous classwork.

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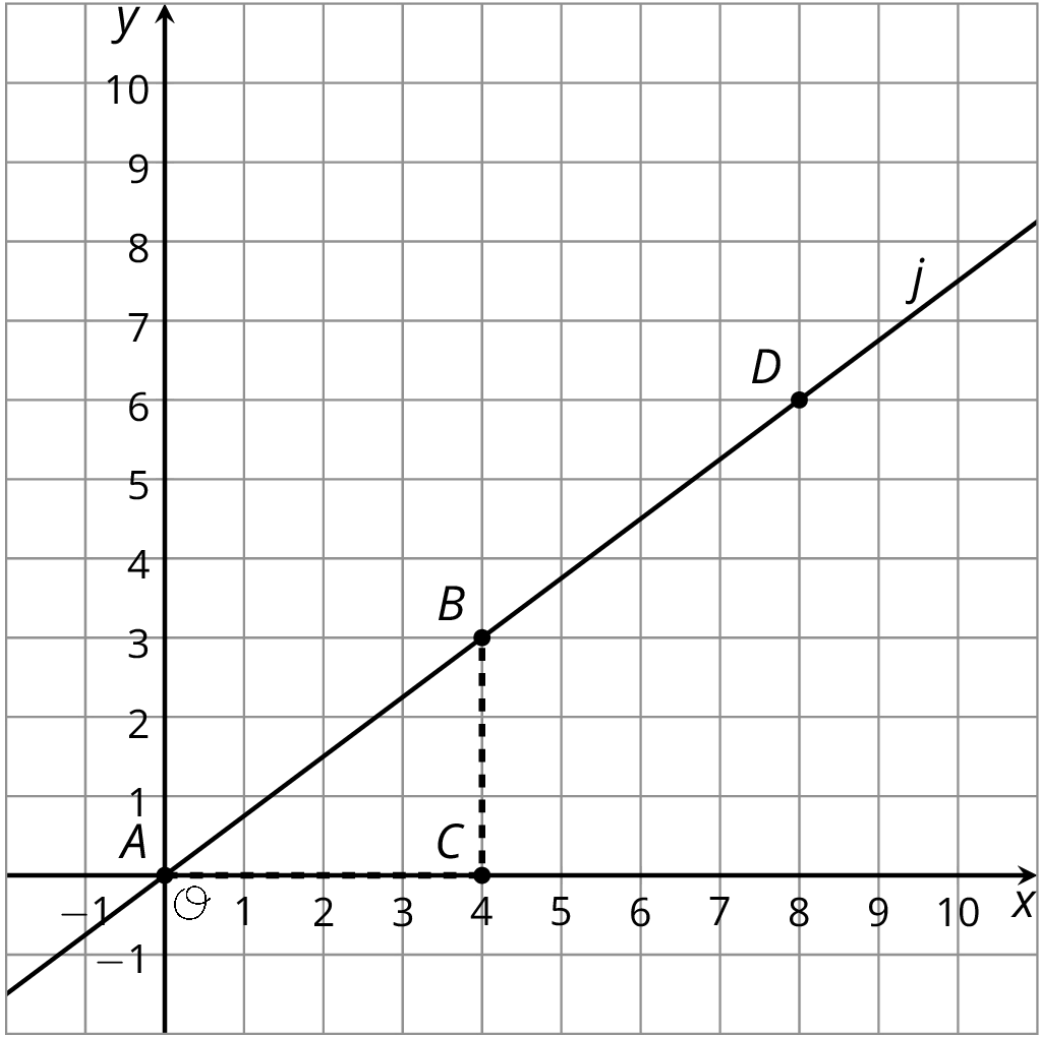
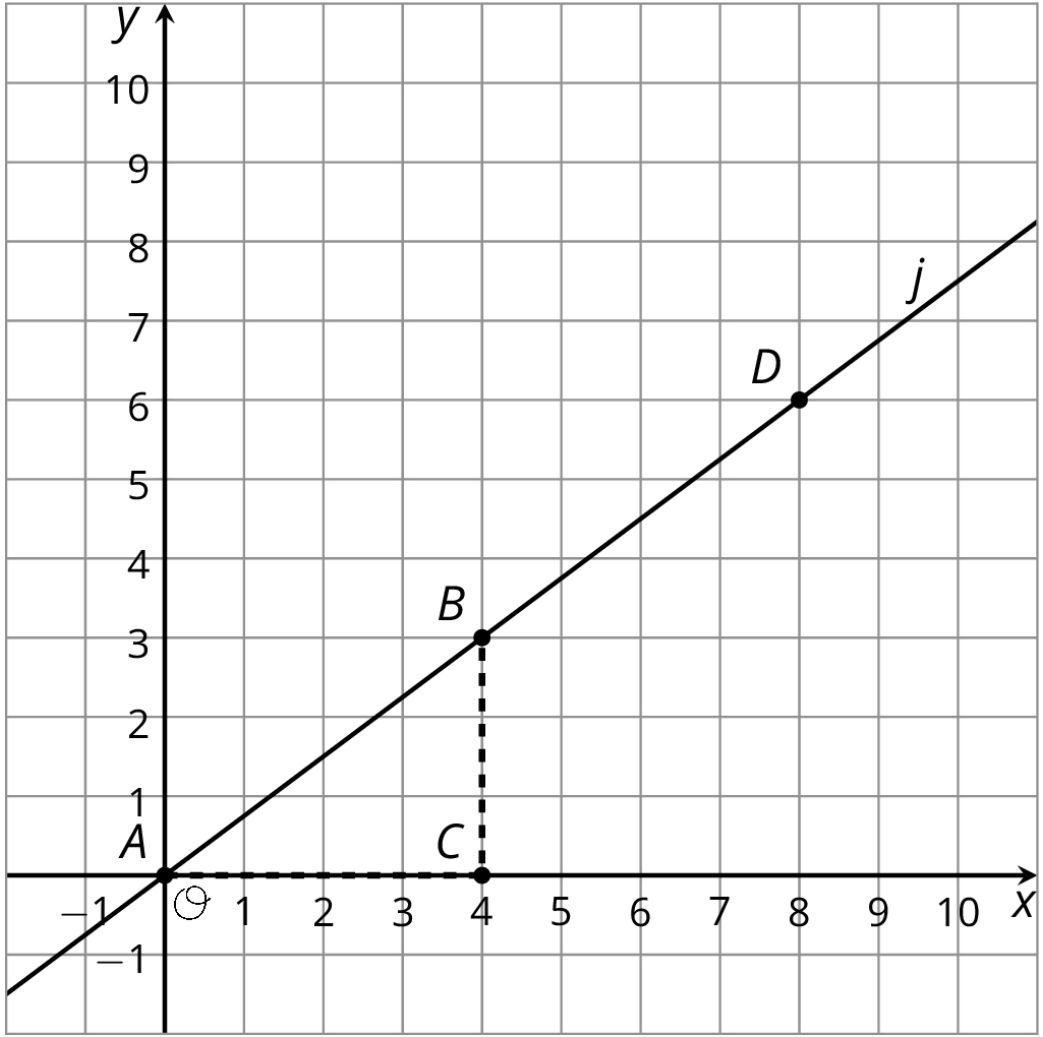
Begin with Quiet Work Time. (2-3 min)
Discuss your thinking with your team.

1. What are the coordinates of *B* and *D*?
2. Is point (20,15) on line *j*?
3. Is point (100,75) on line *j*?
4. Is point (90,68) on line *j*?



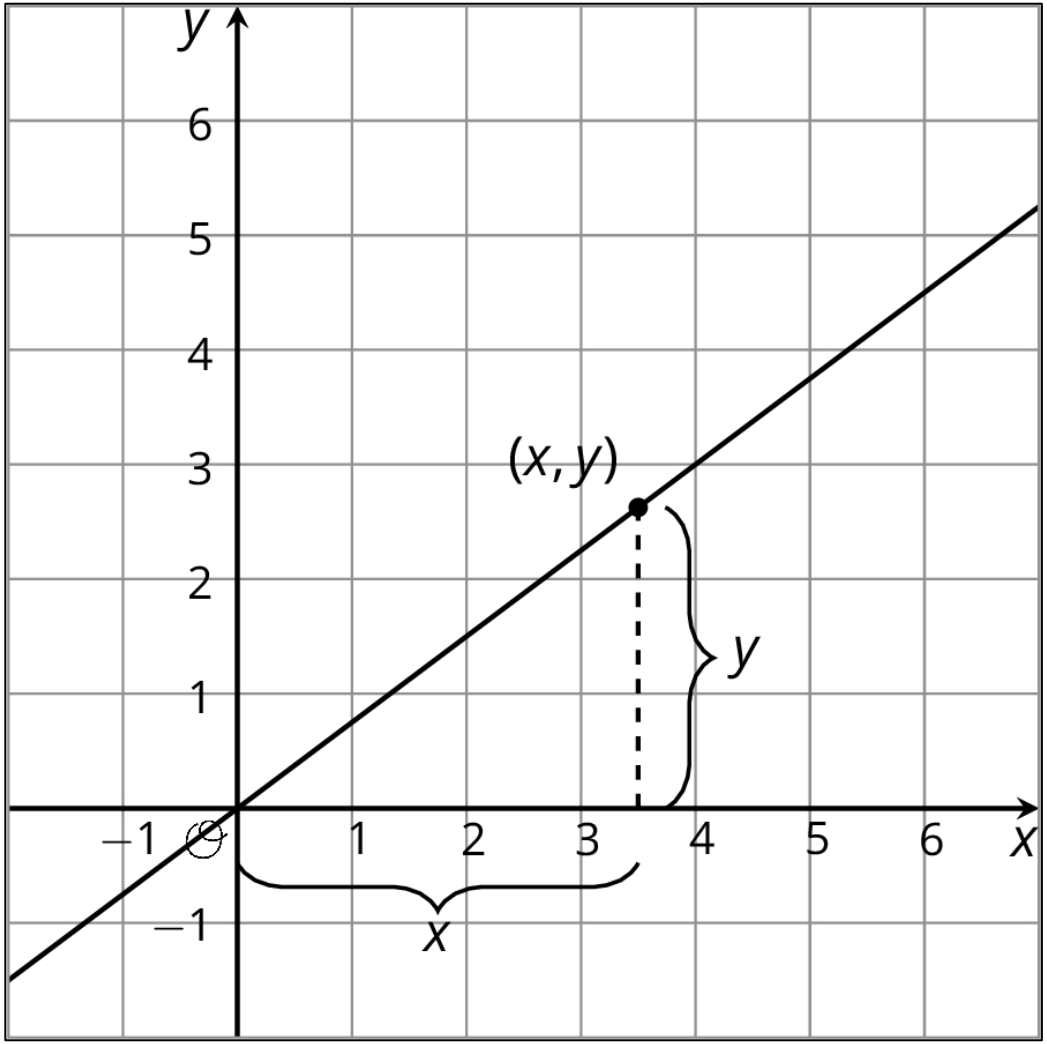
Suppose you know the x- and y-coordinates of a point.

Write a rule that would allow you to test whether the point is on line *j*.



How does the equation written below relate to this situation?

$$\frac{y}{x} = \frac{3}{4}$$



Writing Relationships from Slope Triangles

Activity 11.3

- Co-Craft Questions and Problems

Let’s find equations satisfied by points on some more lines!

These lines do not represent proportional relationships, but we can still use what we know about similar triangles to find equations.

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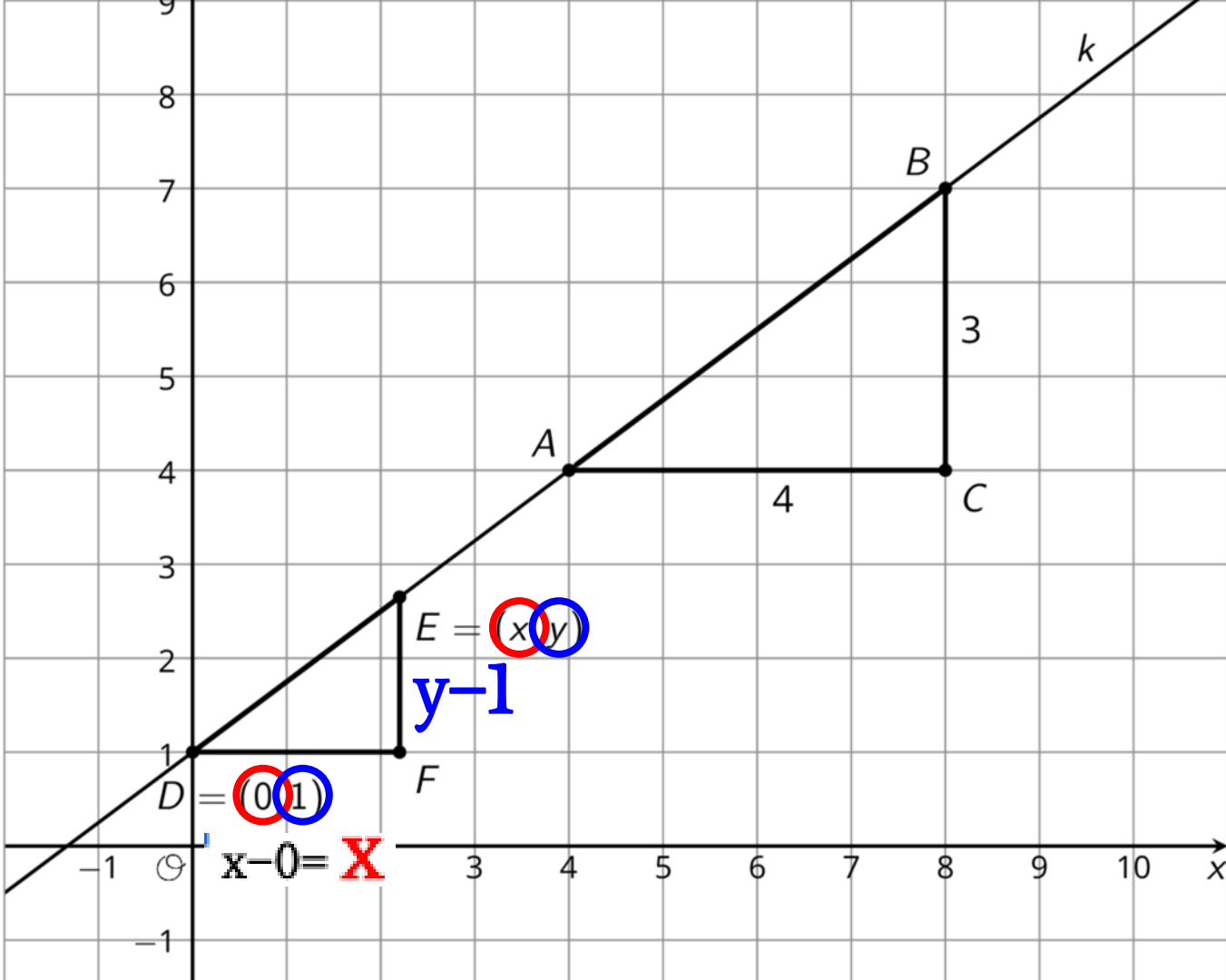
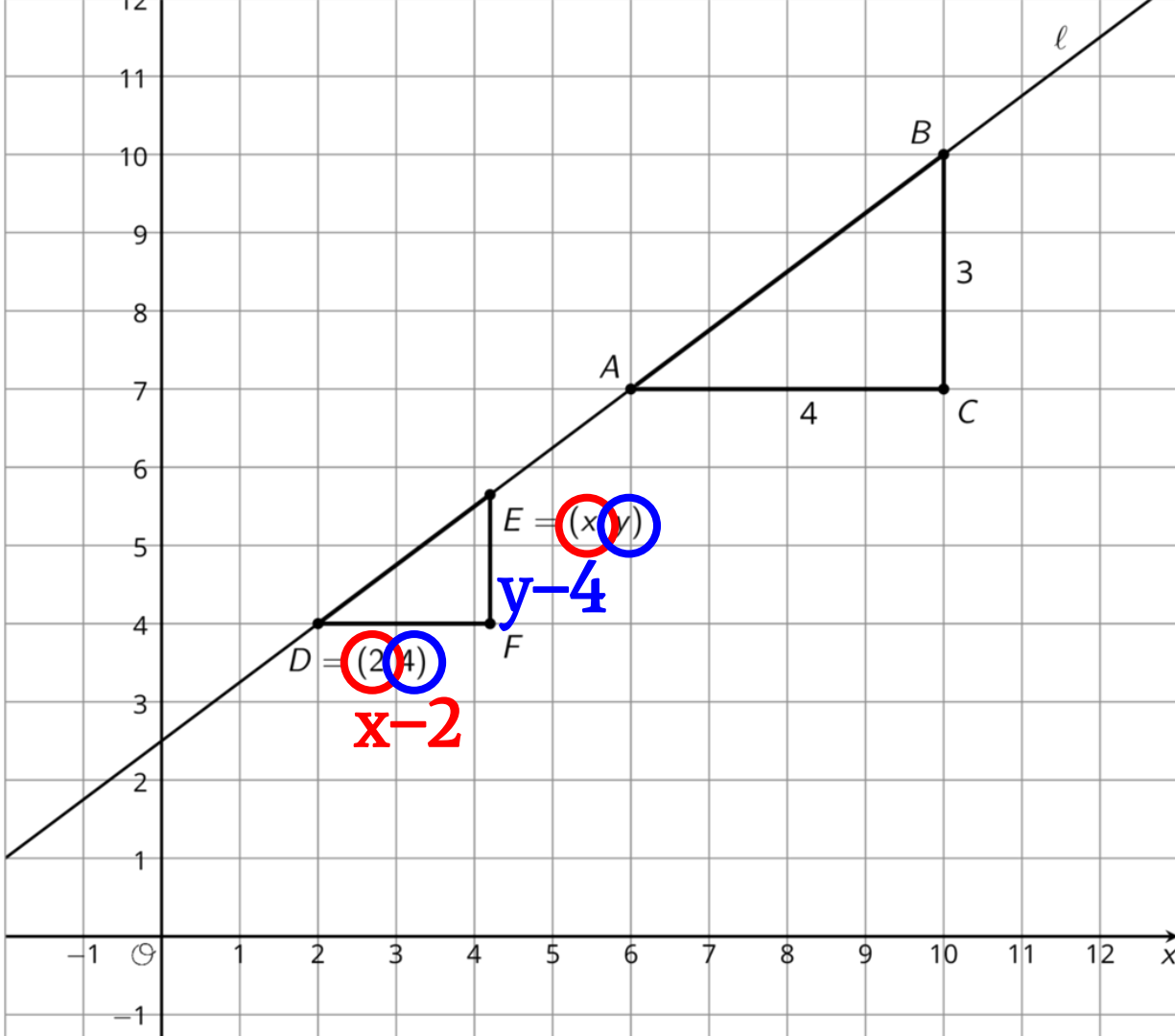
Complete Question 1, then we’ll discuss your findings as a class!

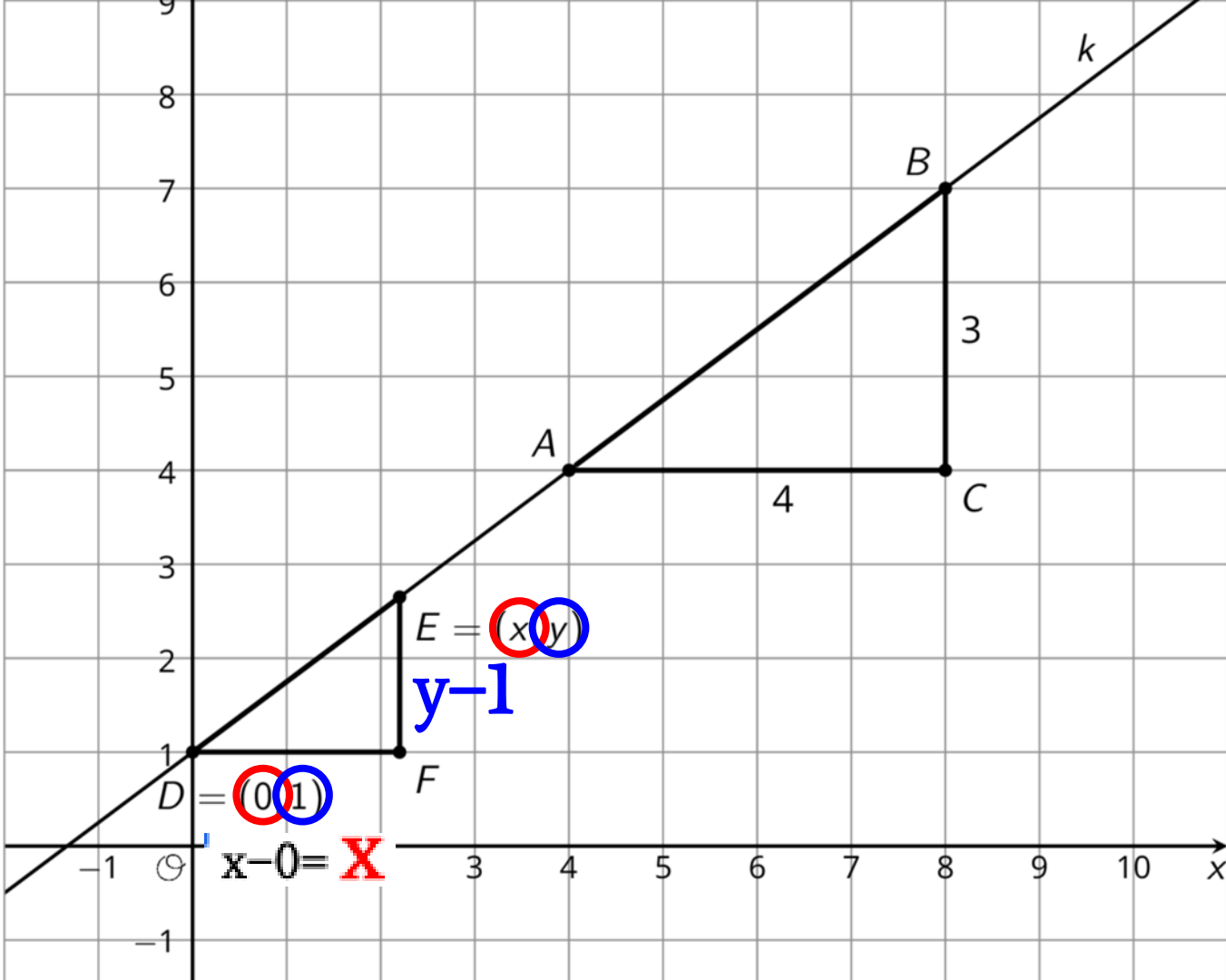

k
B
3
A
4
C
E = (x y)
y−1
F
D = (0 1)
x−0= X
−1
3
4
5
6
7
8
9
10
x
9
8
7
6
5
4
3
2
1
−1


ℓ
B
3
A
4
C
E = (x, y)
y−4
F
D = (2, 4)
x−2
x
y

Now, complete Question 2!

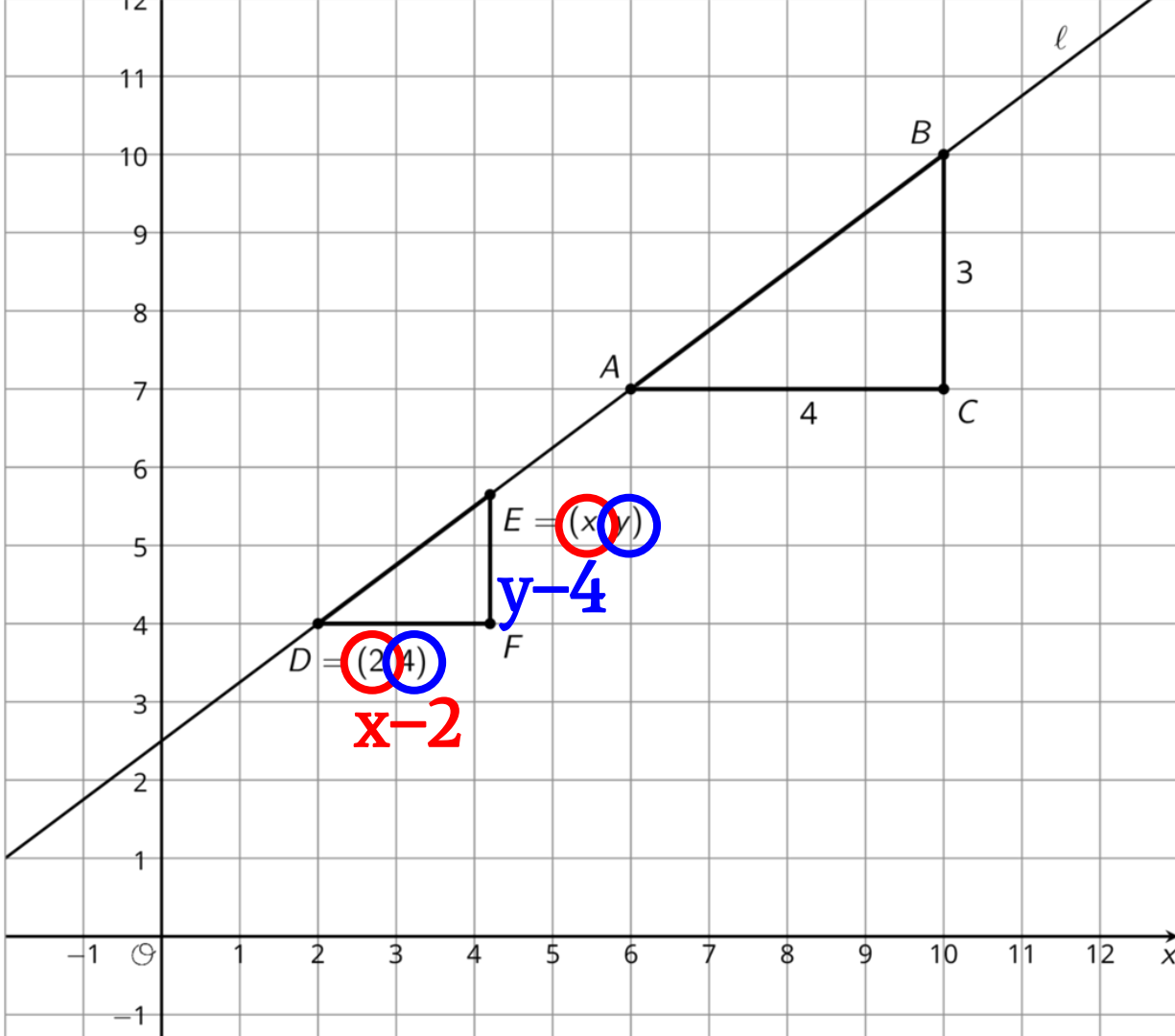
Find an equation for the quotient of the vertical and horizontal side lengths of $\triangle DFE$.

$$\frac{y-1}{x} = \frac{3}{4}$$

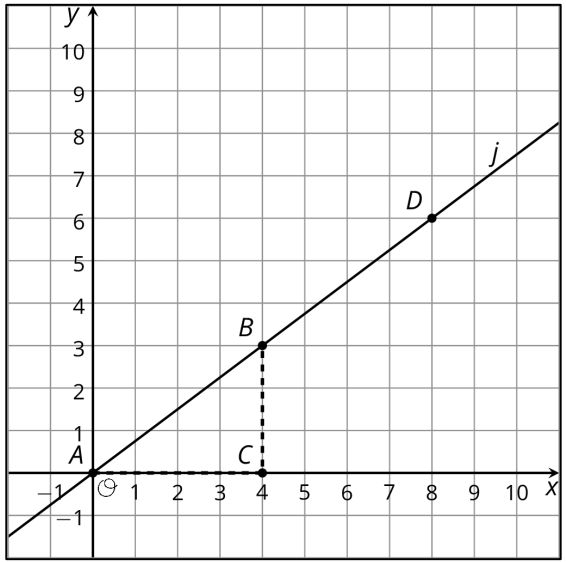


Find an equation for the quotient of the vertical and horizontal side lengths of $\triangle DFE$.

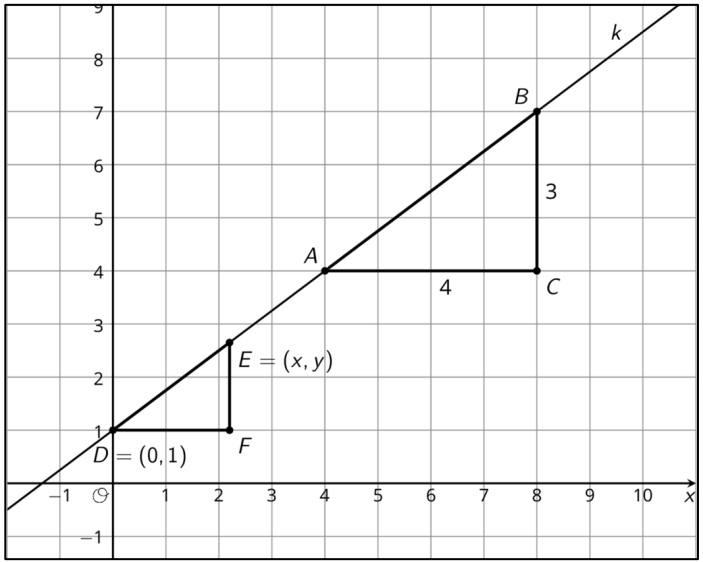
$$\frac{y-4}{x-2} = \frac{3}{4}$$



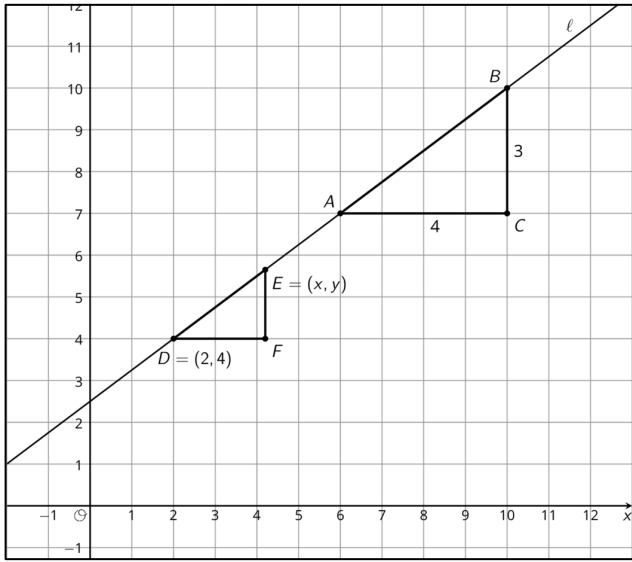
How are the **equations** for j, k, and ℓ alike and different?



$$\frac{y}{x} = \frac{3}{4}$$



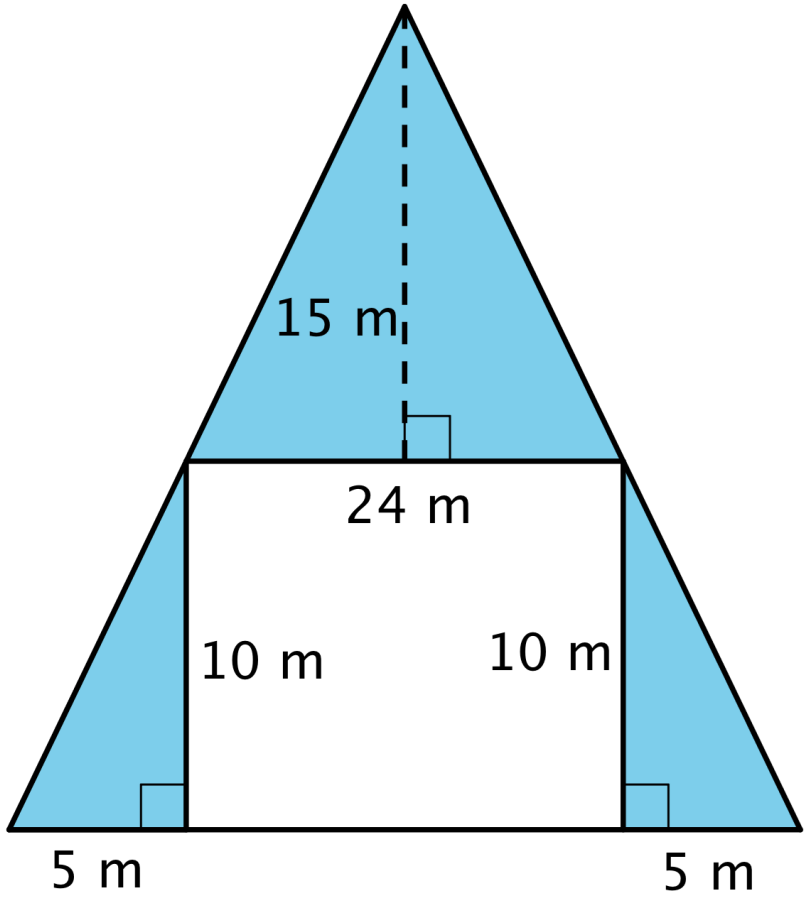
$$\frac{y-1}{x} = \frac{3}{4}$$



$$\frac{y-4}{x-2} = \frac{3}{4}$$

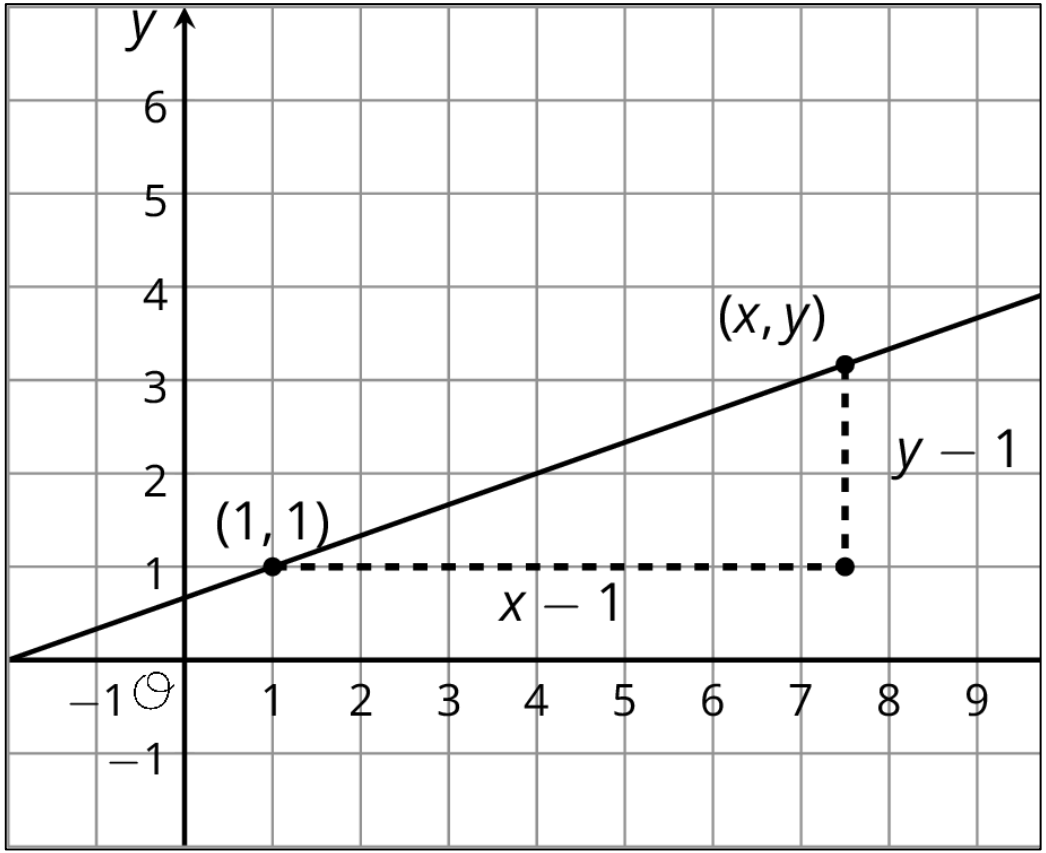
“Are you ready for more?”

1. Find the area of the shaded region by summing the areas of the shaded triangles.
2. Find the area of the shaded region by subtracting the area of the unshaded region from the large triangle.
3. What is going on here?



Today, we used **slope triangles** to find a relationship satisfied by the coordinates of *all* points on a line.

What is the slope of this line?



Today's Goals

- I can decide whether a point is on a line by finding quotients of horizontal and vertical distances.

Matching Relationships to Graphs

Cool Down 11.4