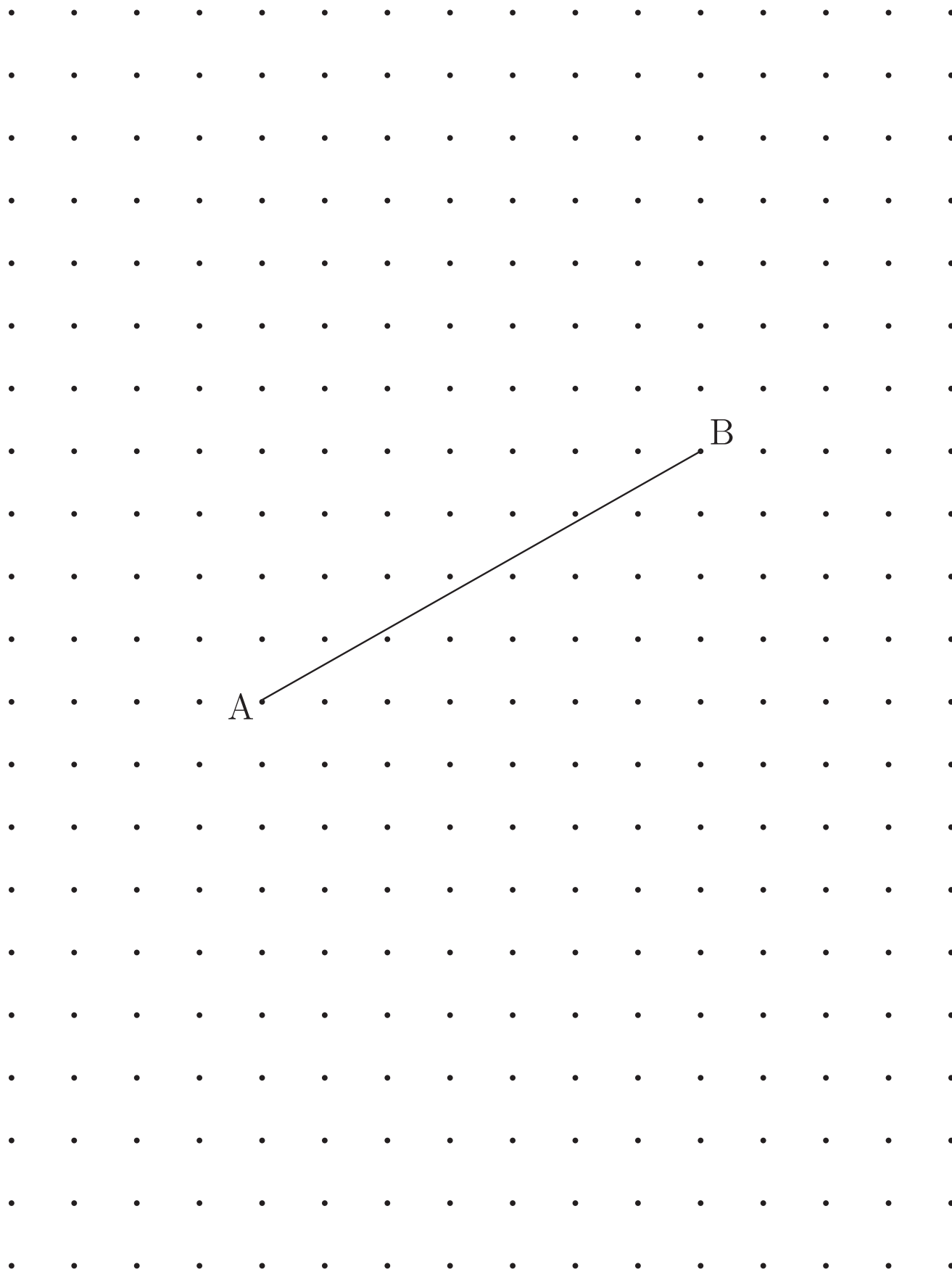


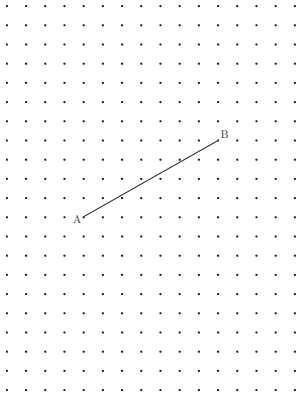
Find the length of AB.



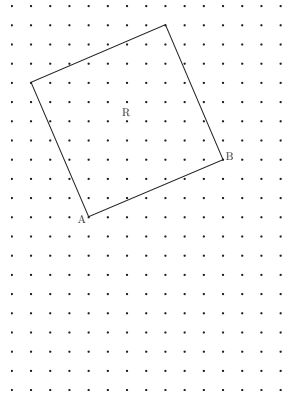
From the opening exercise we saw two ways of find the length of a line on the grid page.

One way to find the length of a line.

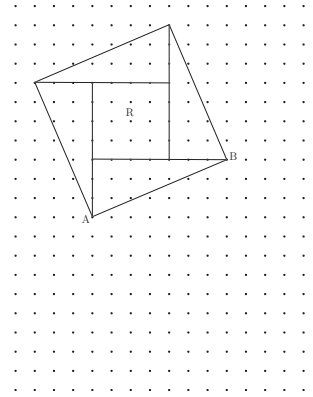
1. Find the length of the segment AB.



2. Make a square with side AB:



3. Find the area of the square:



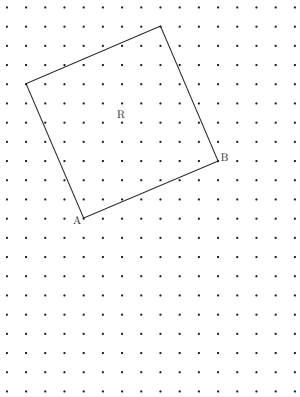
Area = _____

4. Then find the length of the side by taking the square root.

AB = _____

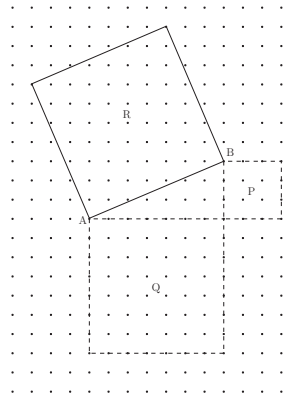
Another way (a shortcut to finding the area)

5. Make a square with side AB.



6. Find the areas of P and Q.

Area P: _____, Area Q: _____



7. Then find the length of the side by taking the square root.

AB = _____

So the length of AB is the same as

$$AB = \sqrt{\text{Area P} + \text{Area Q}}$$

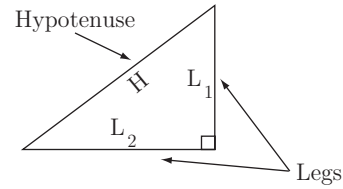
How do the areas relate to the area of R?

So the area of square R is the sum of the areas of P and Q.

The Pythagorean Theorem

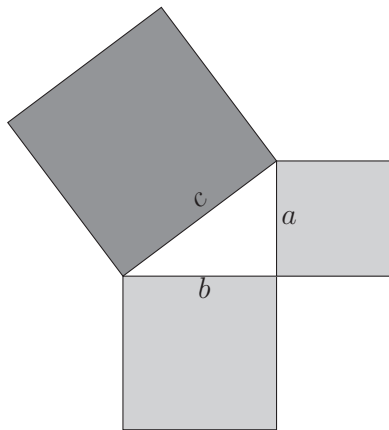
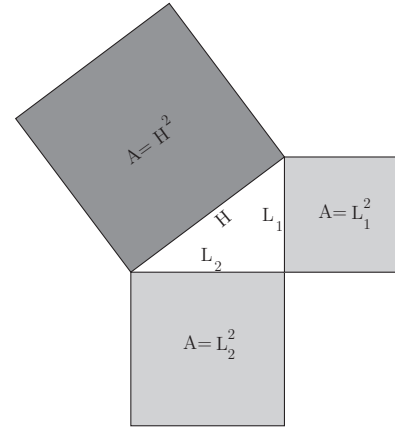
In the previous exercises you saw how we use area to find the length of a line segment. The shortcut in step 6 is the key to what is called the Pythagorean Theorem, one of the oldest and most useful relationships in numbers. In order to describe it completely we need some definitions.

In a right triangle (a triangle with a 90° angle) the two sides that form the 90° angle are called the Legs.
The side opposite the 90° angle is called the Hypotenuse.



From the previous exercises we saw that the three sides of the right triangle are related by $L_1^2 + L_2^2 = H^2$

The Pythagorean Theorem says that:
The area of the square made from the hypotenuse is equal to the sum of the areas of squares made from the two legs.



Equivalently, we take the three areas:

The area of the square made from the hypotenuse: _____

The area of the square made from one leg (a): _____

The area of the square made from the other leg (b): _____

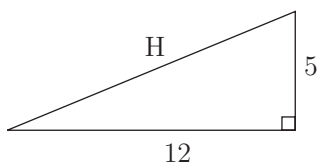
and according to Pythagoras,

$$\underline{\hspace{2cm}} + \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

Which means that the length of hypotenuse is $c =$

$$\sqrt{\underline{\hspace{2cm}} + \underline{\hspace{2cm}}}$$

Example: Find the length of the hypotenuse of the triangle below.



$$H^2 = 5^2 + 12^2$$

$$H^2 = 25 + 144$$

$$H^2 = 169$$

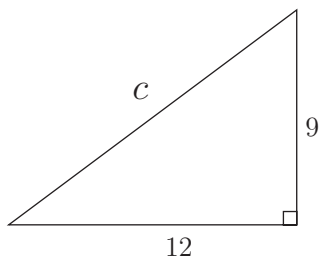
$$H = \sqrt{169}$$

$$H = 13$$

So the hypotenuse is 13.

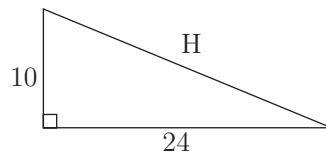
Exercises

1. Find the length of the hypotenuse.



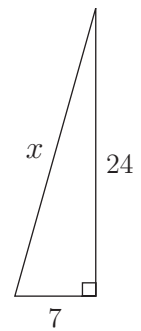
$$c = \underline{\hspace{2cm}}$$

2. Find the length of the hypotenuse.



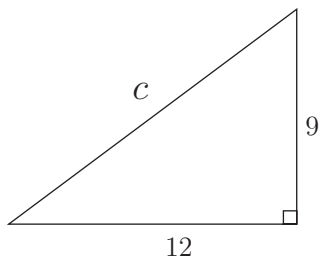
$$H = \underline{\hspace{2cm}}$$

3. Find the length of the hypotenuse.



$$x = \underline{\hspace{2cm}}$$

4. Find the length of the hypotenuse.



$$c = \underline{\hspace{2cm}}$$

5. Find the perimeter of a right triangle if the legs are 8cm and 15cm long.

6. Find the perimeter of this triangle.

