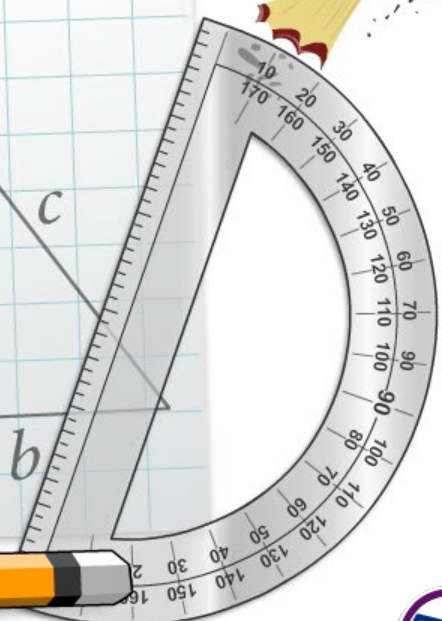
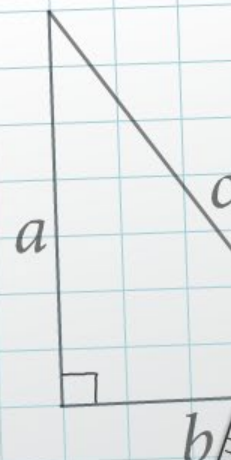
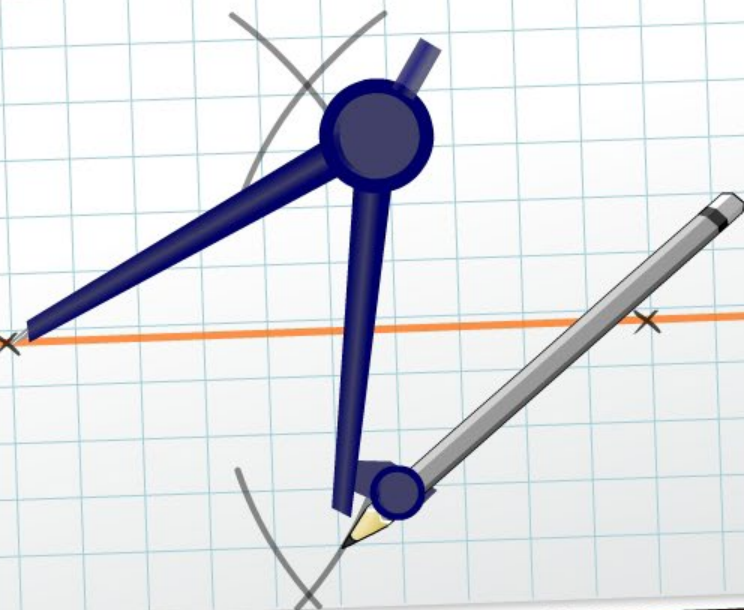


Area and Perimeter in the Coordinate Plane



Common core icons



This icon indicates a slide where the Standards for Mathematical Practice are being developed. Details of these are given in the Notes field.



Slides containing examples of mathematical modeling are marked with this stamp.



This icon indicates an opportunity for discussion or group work.

The **Standards for Mathematical Practice** outlined in the Common Core State Standards for Mathematics describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

These are:

- 1) **Make sense of problems and persevere in solving them.**
- 2) **Reason abstractly and quantitatively.**
- 3) **Construct viable arguments and critique the reasoning of others.**
- 4) **Model with mathematics.**
- 5) **Use appropriate tools strategically.**
- 6) **Attend to precision.**
- 7) **Look for and make use of structure.**
- 8) **Look for and express regularity in repeated reasoning.**



This icon indicates that the slide contains activities created in Flash. These activities are not editable.

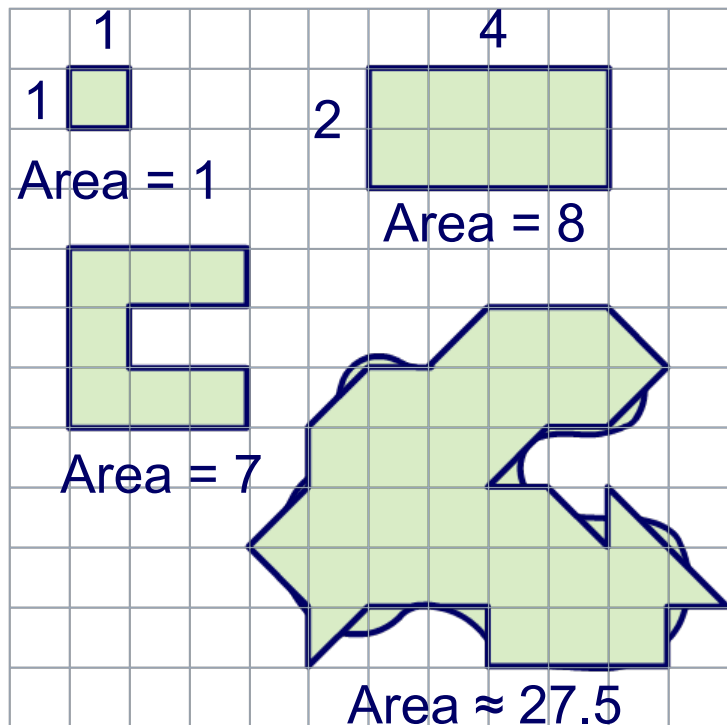


This icon indicates teacher's notes in the Notes field.



The area addition postulate:

The area of a region is the sum of the areas of its nonoverlapping parts.



For example, a unit square has an area of 1. A rectangle with side lengths 2 and 4 is eight unit squares placed next to each other. It has an area of 8.

The area of a shape on a coordinate grid can be found by counting the grid squares in the shape or approximating it with regular shapes and using the area formulas.



Area formulas

Press a button to reveal a formula for the area of that shape.

square

rectangle

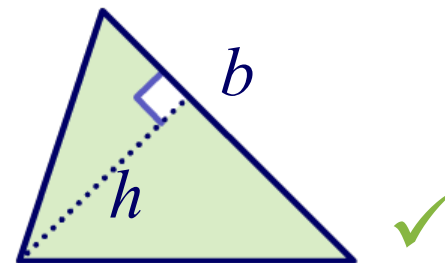
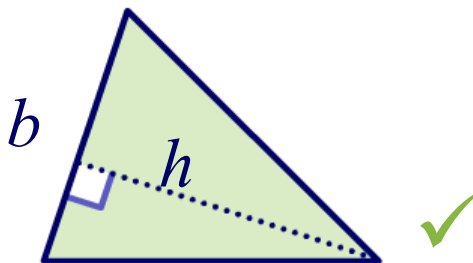
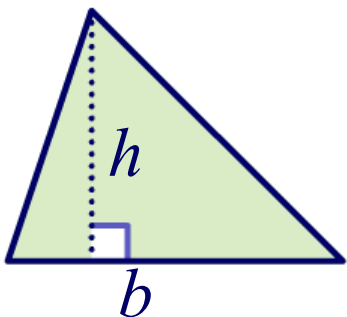
triangle

parallelogram

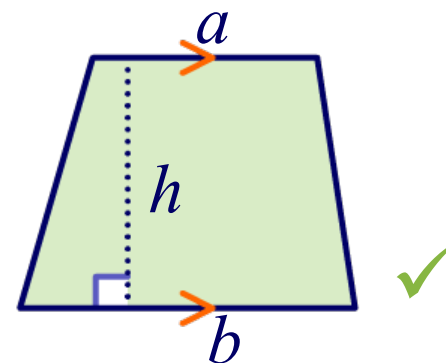
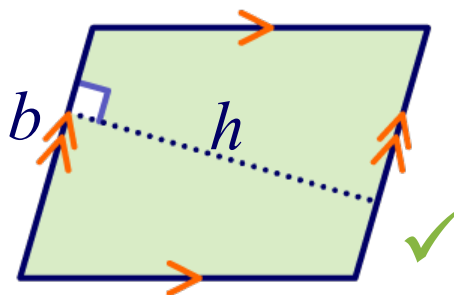
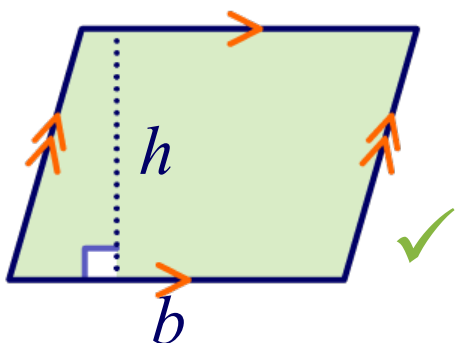
trapezoid



When using area formulas, any side of the triangle can be taken as the base, as long as the height is perpendicular to it.



The same applies to parallelograms.



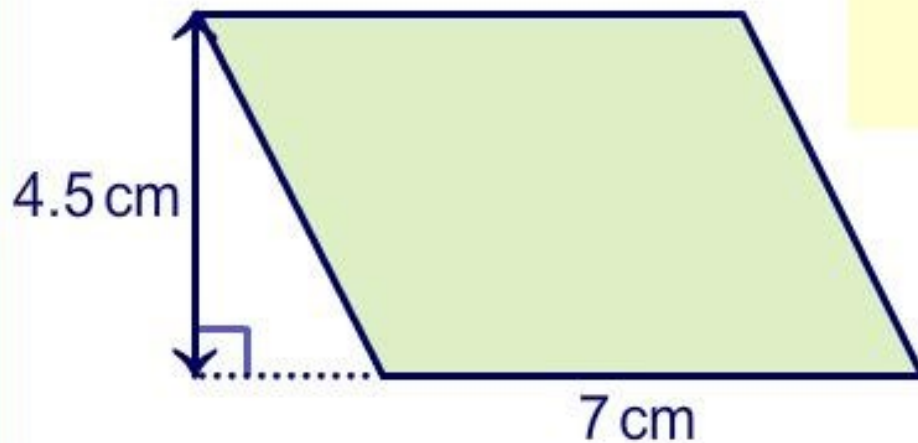
This is **not** the case for trapezoids. The height of a trapezoid is always perpendicular to the only pair of parallel sides.



Find the area of the shape

Question: 1/5

Press the "=" button to show the solution step-by-step.

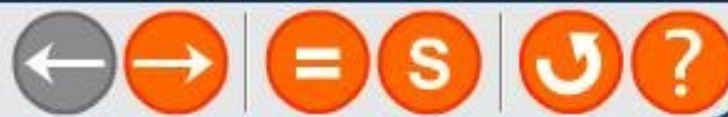


30 cm²

31.5 cm²

33.5 cm²

35 cm²



Some shapes are specified by coordinate points, not by side lengths and angles.

The shape is a rectangle. How can you find the perimeter and the area of the rectangle?

remember the formula for the distance between the points (x_1, y_1) and (x_2, y_2) :

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

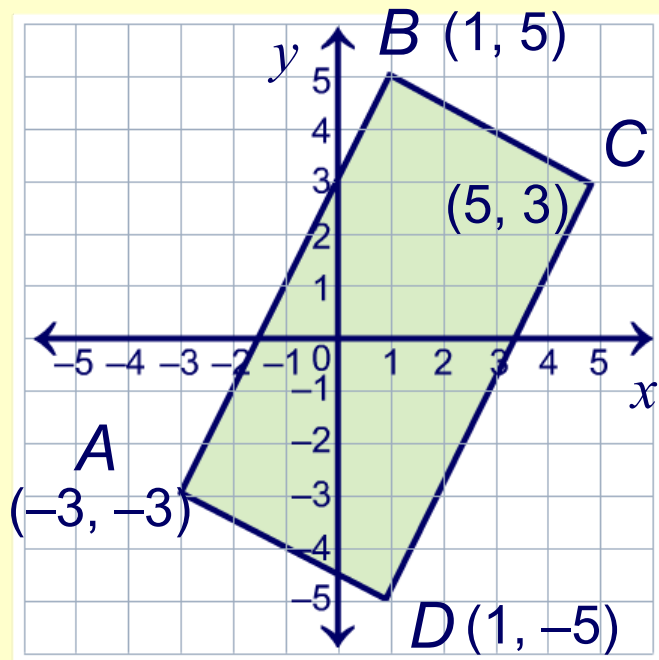
use the graph to find the vertices and then use the formula to find the length of the sides:

$$AB = \sqrt{(1 - (-3))^2 + (5 - (-3))^2} = 4\sqrt{5}$$

$$BC = \sqrt{(5 - 1)^2 + (3 - 5)^2} = 2\sqrt{5}$$

$$\text{perimeter} = 2AB + 2BC = 12\sqrt{5} \text{ units}$$

$$\text{area} = AB \times BC = 40 \text{ units}^2$$



To find the area of a triangle in the coordinate plane, count grid squares to find the height when it is vertical or horizontal.

Find the area of the triangle on the graph.

area = $\frac{1}{2}bh$, so find the length of one side and the height perpendicular to it:

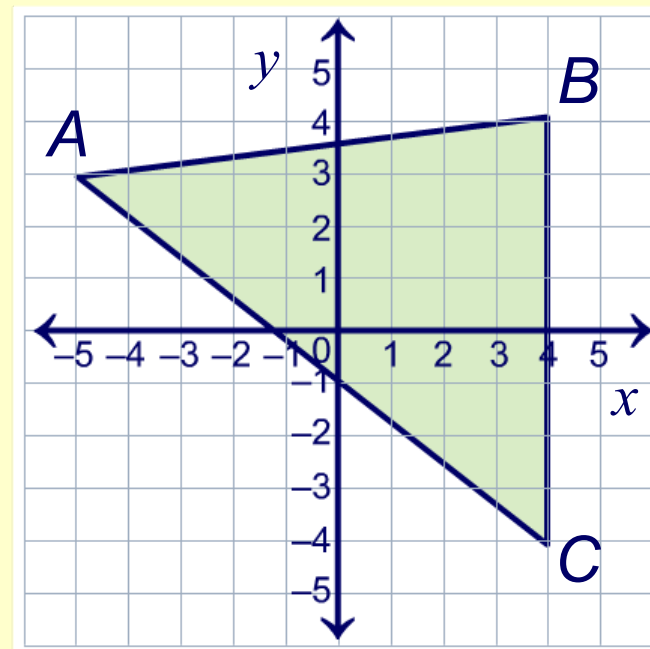
let \overline{BC} be the base, b , then find the height using the distance formula:

$$\begin{aligned} b &= y_b - y_c \\ &= 4 - (-4) = 8 \text{ units} \end{aligned}$$

find the height perpendicular to \overline{BC} :

$$\begin{aligned} h &= x_b - x_a \\ &= 4 - (-5) = 9 \text{ units} \end{aligned}$$

$$\text{area} = \frac{1}{2}bh = \frac{1}{2} \times 8 \times 9 = \mathbf{36 \text{ units}^2}$$



The area of irregular shapes or triangles with a difficult height can be found by subtracting the areas of regular shapes.

Find the area of the polygon on the graph.

Draw a square enclosing the polygon.

Split it into regular shapes with clear vertices.

$$\text{area of square} = bh = 9 \times 9 = 81 \text{ units}^2$$

areas of other shapes:

$$A: \text{area} = \frac{1}{2}bh = \frac{1}{2} \times 3 \times 7 = 10.5 \text{ units}$$

$$B: \text{area} = \frac{1}{2}bh = \frac{1}{2} \times 2 \times 5 = 5 \text{ units}$$

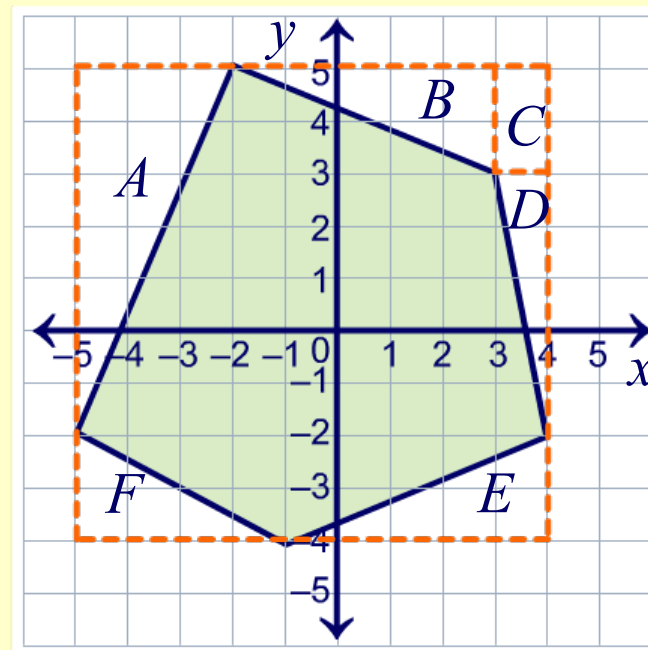
$$C: \text{area} = bh = 2 \text{ units}$$

$$D: \text{area} = \frac{1}{2}bh = \frac{1}{2} \times 1 \times 5 = 2.5 \text{ units}$$

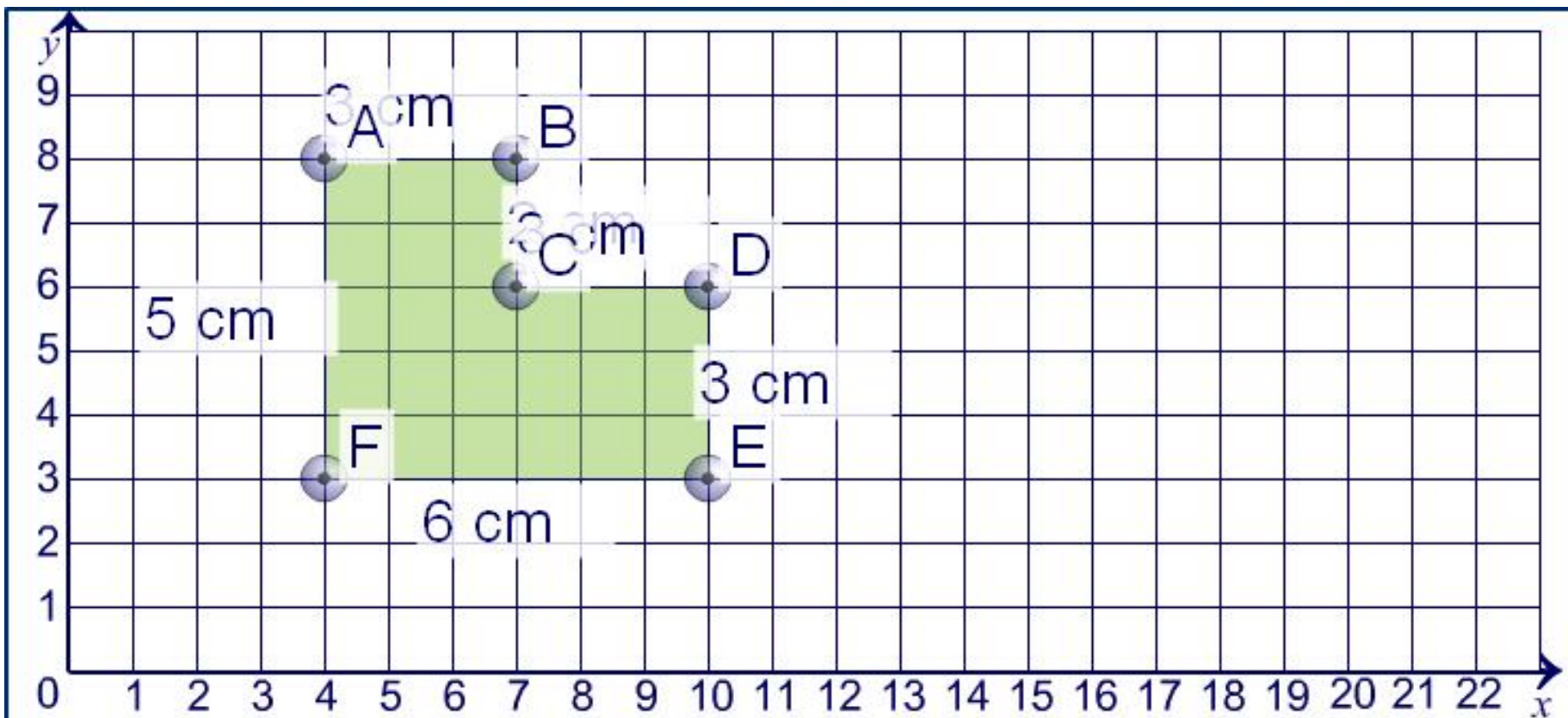
$$E: \text{area} = \frac{1}{2}bh = \frac{1}{2} \times 2 \times 5 = 5 \text{ units}$$

$$F: \text{area} = \frac{1}{2}bh = \frac{1}{2} \times 2 \times 4 = 4 \text{ units}$$

$$\text{area of polygon} = 81 - 10.5 - 5 - 2 - 2.5 - 5 - 4 = 52 \text{ units}^2$$



Shapes made from rectangles



grid off

perimeter =

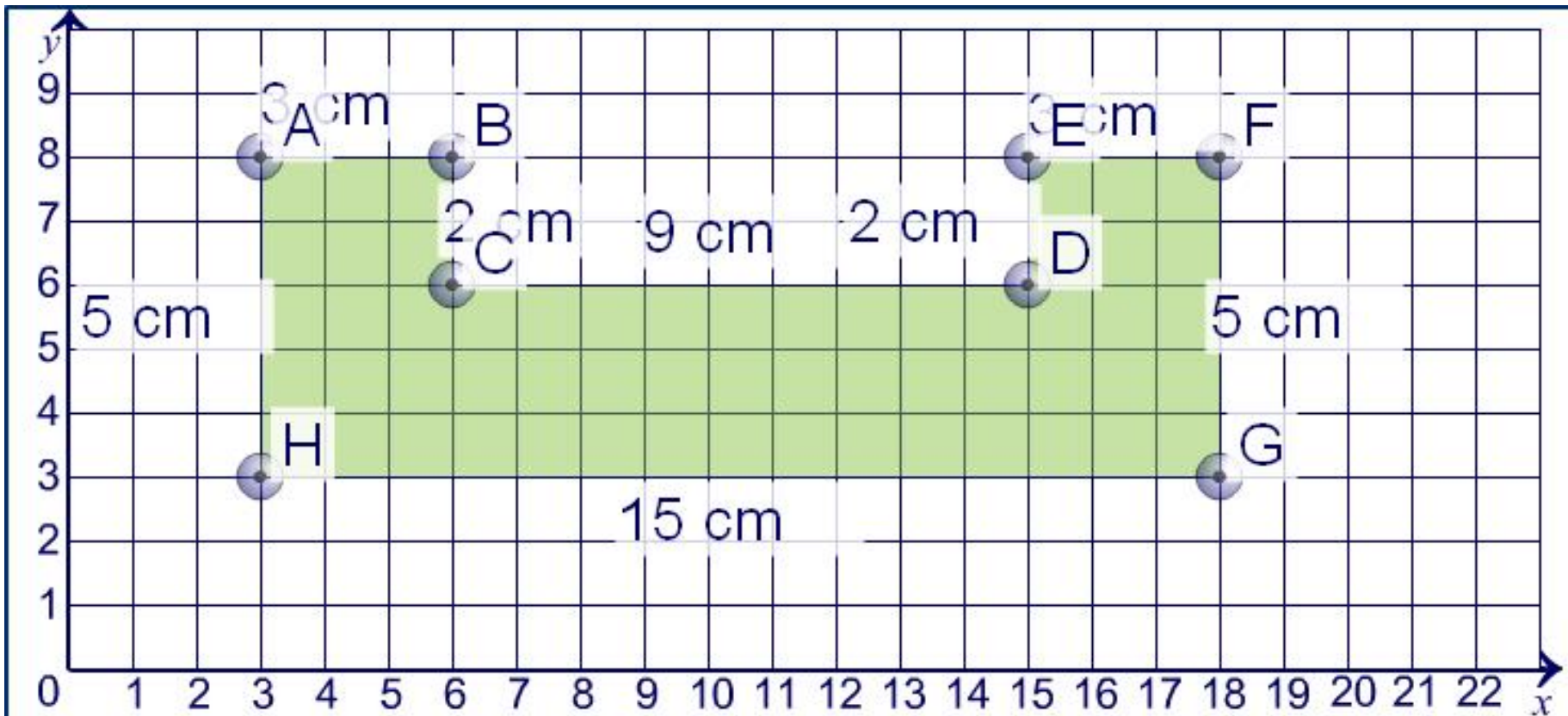
reveal

area =

reveal



Shapes made from rectangles



grid off

perimeter =

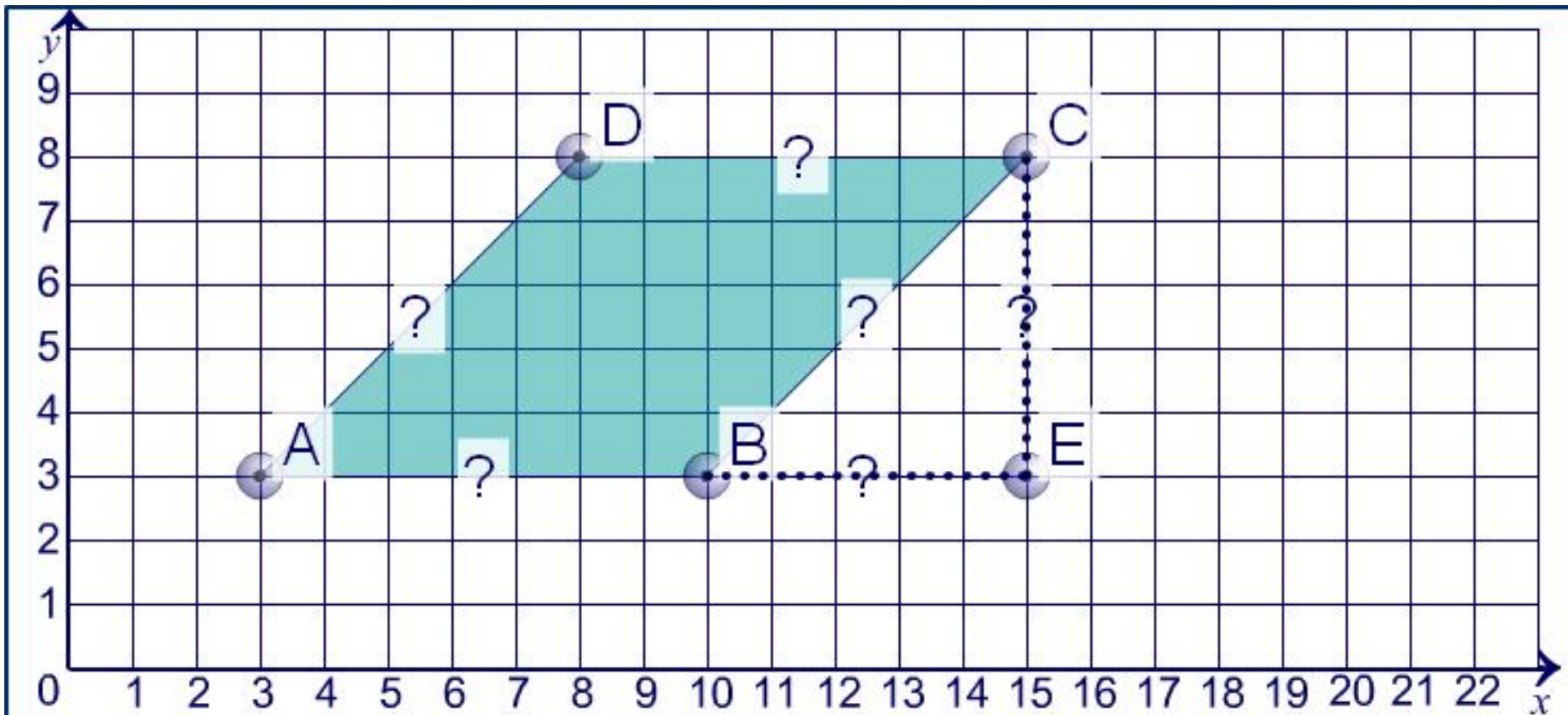
reveal

area =

reveal



Parallelograms



grid off

perimeter =

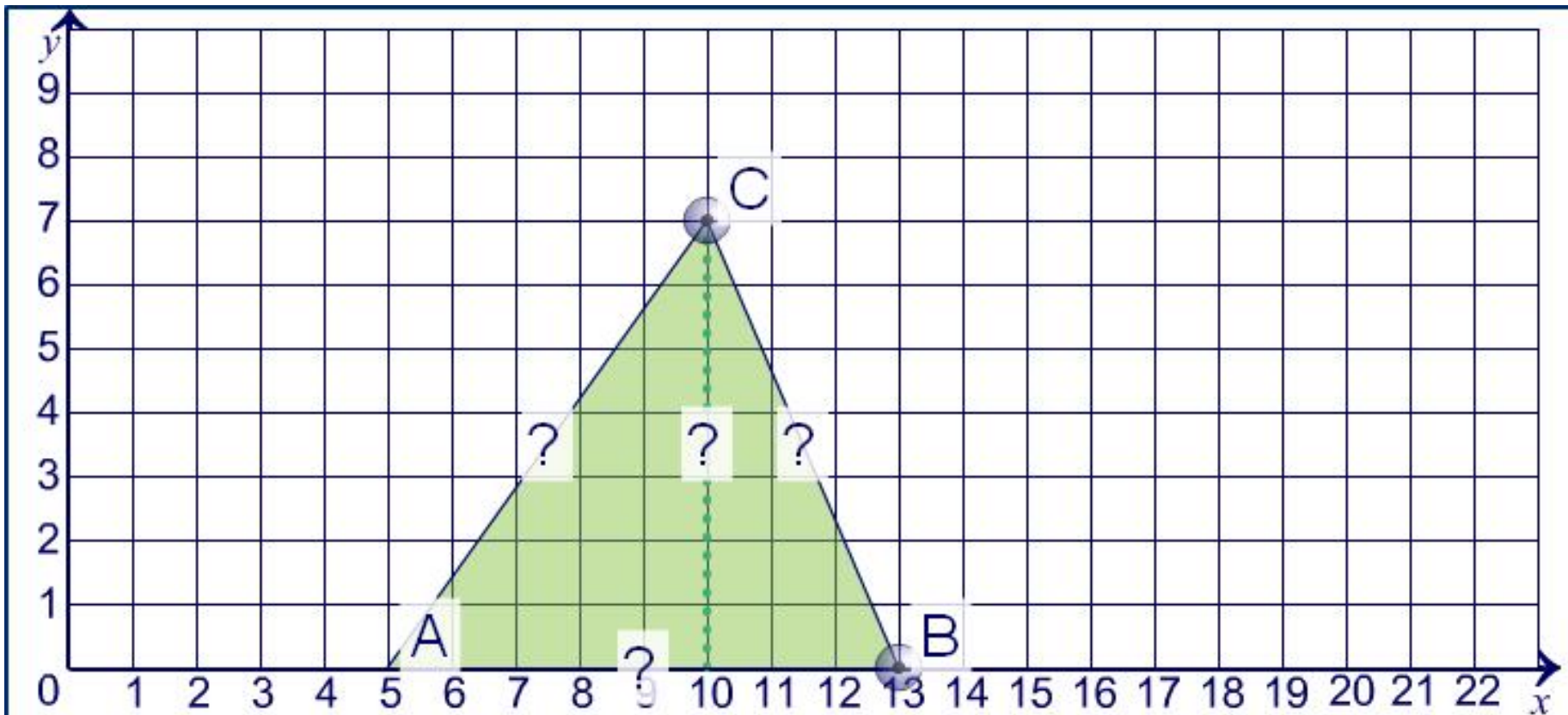
reveal

area =

reveal



Triangles



grid off

perimeter =

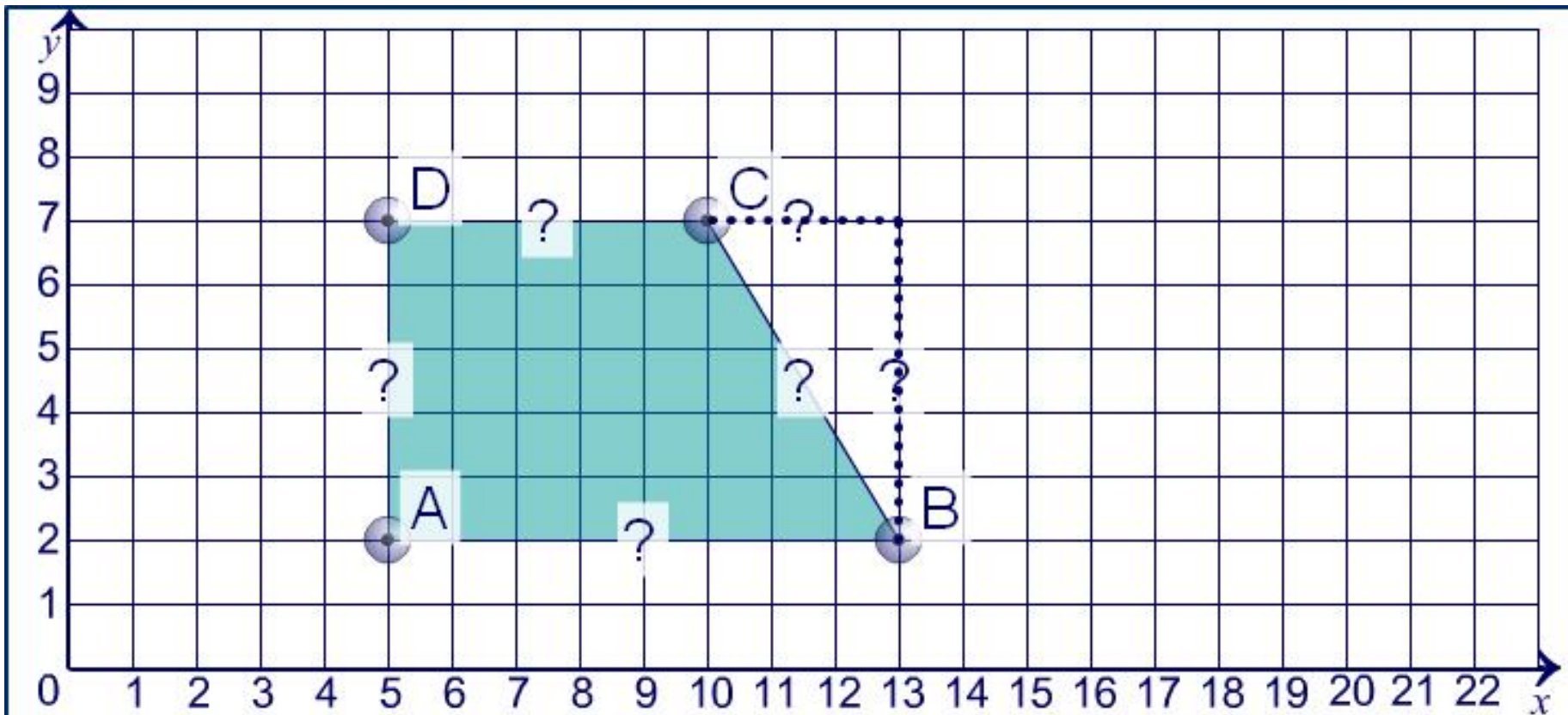
reveal

area =

reveal



Trapezoids



grid off

perimeter =

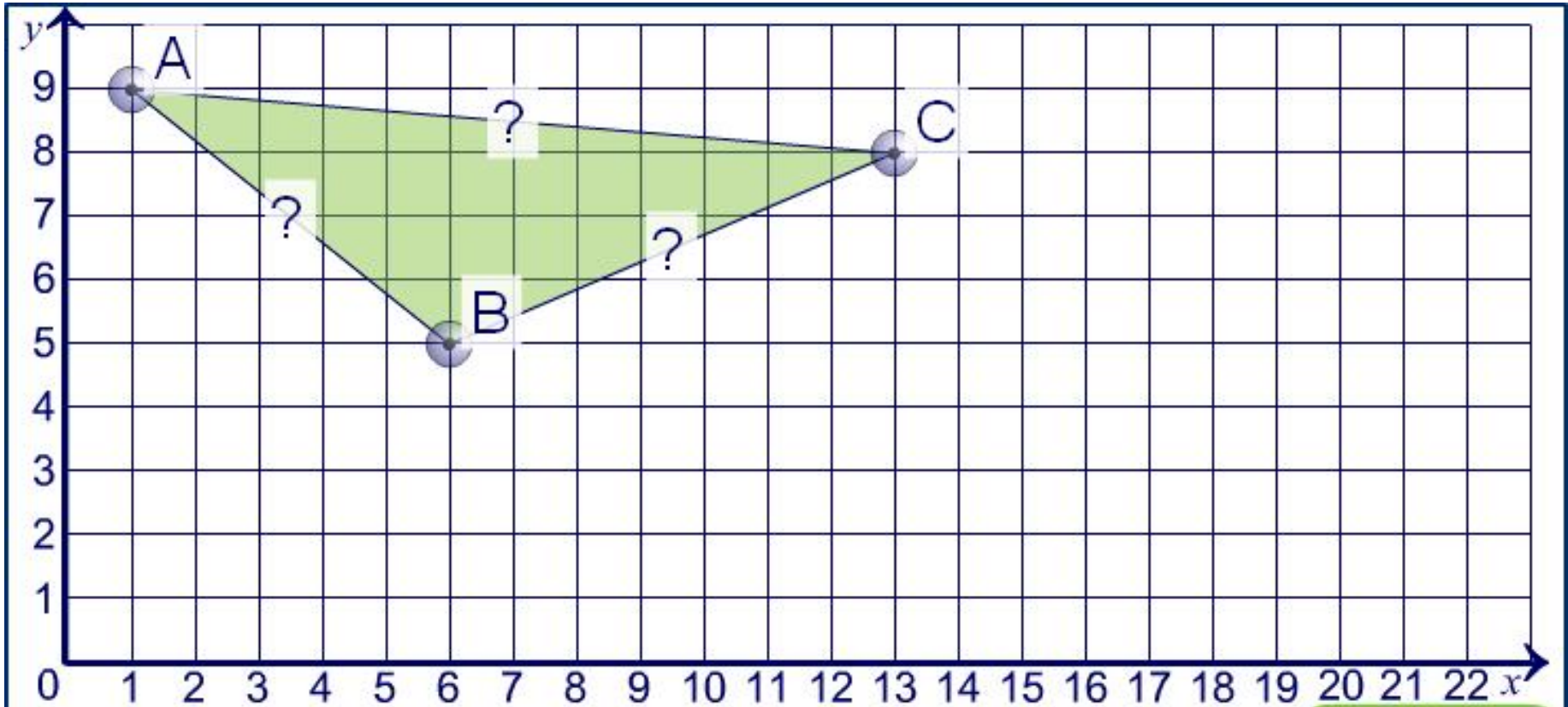
reveal

area =

reveal



Irregular polygons



vertices:



Go

perimeter =

area =





Forest fire problem

A fire starts in a forest and is spread by the wind. A river runs from east to west 500 m south of the place the fire starts. The fire spreads south to the edge of the river and then travels 300 m east along the river bank and 200 m west. The fire covers a roughly triangular area.



1) Firefighters clear firebreaks along the perimeter of the fire. They do not need to clear a break along the edge of the river. How long is the perimeter they need to clear?



2) Ignoring the breaks, what area of forest is destroyed?

