Maximum Area of Rectangle Inscribed Inside Triangle

Name & Period:_____ Date:_____

Problem 90. (from the book *Learning Isn't Linear*) See the diagram below. What is the rectangle of largest area that can be inscribed in the triangle such that one side lies along the x-axis and the other side lies along the y-axis? Also, write a Desmos program that finds the area of the largest rectangle.

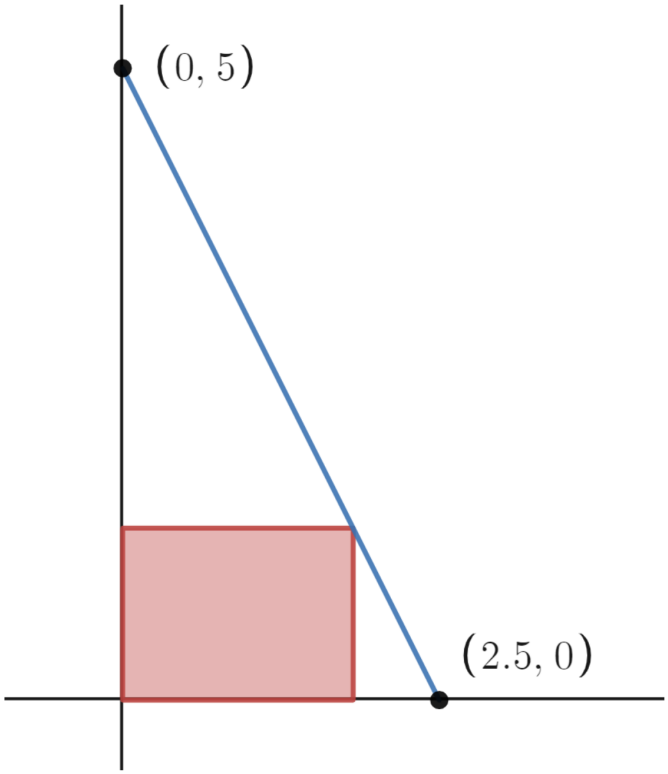


Figure 1: Rectangle inscribed in triangle.

Part I: Play & Experiment

Construct three different rectangles inscribed in the triangle and find their areas. To do this, first find the equation of the line that contains the points $(0, 5)$ and $(2.5, 0)$.

1. Find the equation of the line.

Work:

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Solutions.

Part I. Play & Experiment

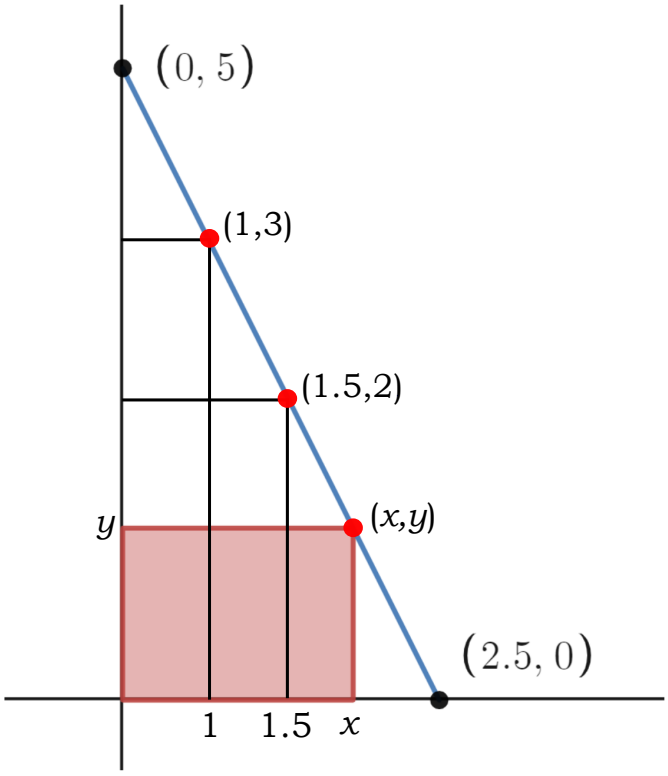


Figure 2: Rectangle inscribed in triangle.

1. The equation of any straight line can be put in the form $y = mx + b$. Find the slope first. By definition, the slope

$$m = \frac{\text{rise}}{\text{run}} = -\frac{\text{length of vertical leg of triangle}}{\text{length of bottom leg of triangle}} = -\frac{5}{2.5} = -2.$$

Then, $b = 5$ since the y-int is $(0, 5)$. Thus, the equation of the line is

$$y = -2x + 5.$$

Note. Of course, one can alternatively plug in the points to obtain slope:

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{5 - 0}{0 - 2.5} = -2.$$

2. We have many choices for rectangles. The area A of any rectangle is given by $A = LW$ (Length×Width). Using the equation of the line, we observe the x-coordinate is the width and the y-coordinate is the length/height. Therefore, if we pick $x = 2$, then $y = -2(2) + 5 = 1$, and the area of Rectangle #1 will be $A = 2 \cdot 1 = 2$.

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6. We construct the rectangle using the $\mathsf{polygon}(\cdot,\cdot,\cdot,\cdot)$ function, which in this case takes in four parameters: the vertices of the polygon.

7. This vertex $A = (0, 0)$ is fixed.

8. The vertex $B = (a, 0)$ animates.

9. This corner of the rectangle intersects the line.

15. We shift the parabola 3 units to the left so it is out of the way of the diagram.

If you have enjoyed working through this problem, then check out the book that started it all:
Learning Isn't Linear

And consider subscribing to the YouTube channel:
LIL YT Channel

Website: learningisntlinear.com

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