

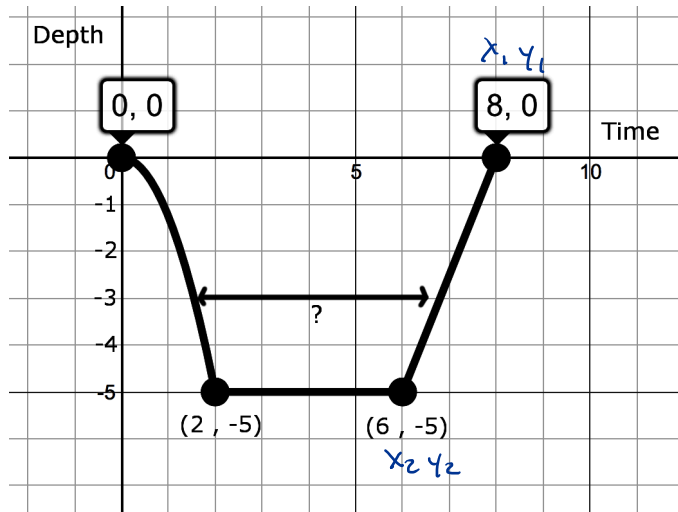
Name: SOLUTIONS.

Date: _____

1) Lifeguard certification requires a lifeguard to swim underwater and stay **below 3 m** of depth for **at least 5.5 seconds**.

Megan's underwater swim is described below.

a) Did Megan get her lifeguarding certification? Justify your answer.



$$y = \begin{cases} y = -1.25x^2, & 0 \leq x \leq 2 \\ y = -5, & 2 \leq x \leq 6 \\ y = 2.5x - 20, & 6 \leq x \leq 8 \end{cases}$$

$$a = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-5 - 0}{6 - 2} = \frac{-5}{4} = -1.25$$

$$y = ax + b$$

$$y = 2.5x + b$$

$$0 = 2.5(8) + b$$

$$0 = 20 + b$$

$$-20 = -20$$

$$-20 = b$$

$$y = 2.5x - 20$$

$$-3 = 2.5x - 20$$

$$+20 \quad +20$$

$$\frac{17}{2.5} = \frac{2.5x}{2.5}$$

$$6.8 = x$$

$$y = ax^2$$

$$-5 = a(2)^2$$

$$\frac{-5}{4} = \frac{a(4)}{4}$$

$$-1.25 = a$$

$$y = -1.25x^2$$

$$y = -1.25x^2$$

$$-3 = -1.25x^2$$

$$\frac{-3}{-1.25} = \frac{-1.25x^2}{-1.25}$$

$$\sqrt{2.4} = \sqrt{x^2}$$

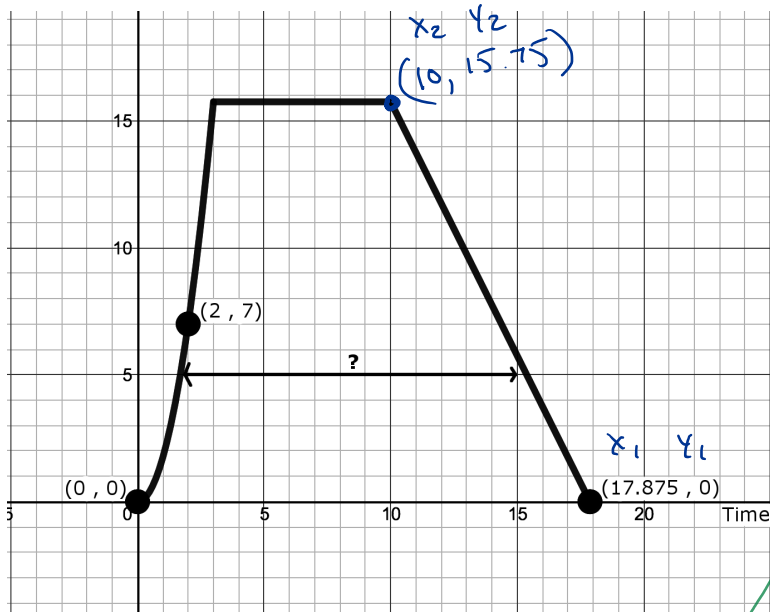
$$1.549 = x$$

$$\text{Diff} = 6.8 - 1.549$$

$$= 5.251 \text{ seconds}$$

Answer: Megan does not get her certification.
She spent 5.251 seconds underwater.

- 2) Steven is trying out for the New England Patriots and must run the length of a football field. The speed of his run is described by the piece-wise function shown below. For how many seconds did Steven maintain a speed greater than or equal to 5 m/s?



$$y = ax^2$$

$$7 = a(2)^2$$

$$\frac{7}{4} = \frac{a(4)}{4}$$

$$1.75 = a$$

$$y = 1.75x^2$$

$$y = \begin{cases} y = 1.75x^2, & 0 \leq x \leq 3 \\ y = 15.75, & 3 \leq x \leq 10 \\ ax + b, & 10 \leq x \leq 17.875 \end{cases}$$

$$y = -2x + 35.75$$

$$y = 1.75x^2$$

$$y = 1.75(3)^2$$

$$y = 1.75(9)$$

$$y = 15.75$$

$$a = \frac{y_2 - y_1}{x_2 - x_1} = \frac{15.75 - 0}{10 - 17.875} = \frac{15.75}{-7.875} = -2$$

$$y = ax + b$$

$$y = -2x + b$$

$$15.75 = -2(10) + b$$

$$15.75 = -20 + b$$

$$\begin{array}{r} +20 \\ 15.75 = -20 + b \\ \hline 35.75 = b \end{array}$$

$$y = -2x + 35.75$$

$$y = 1.75x^2$$

$$\frac{5.5}{1.75} = \frac{1.75x^2}{1.75}$$

$$\sqrt{3.1428} = \sqrt{x^2}$$

$$1.773 = x$$

$$y = -2x + 35.75$$

$$5.5 = -2x + 35.75$$

$$\frac{-30.25}{-2} = \frac{-2x}{-2}$$

$$15.125 = x$$

$$\text{Diff} = 15.125 - 1.773$$

$$= 13.352$$

Answer: Steven stayed at or above 5.5 m/s for 13.352 sec

3) Milan ties a squirrel to a rocket and tries to send him into outer space. The path the squirrel takes is described in the piece-wise function below.

- What is the maximum height (in km) the squirrel reaches.
- How much time will the squirrel have spent at or above 6 km of altitude?

$$f(x) = \begin{cases} y = 2(1.5)^x, & 0 \leq x \leq 4 \\ y = 10.125, & 4 \leq x \leq 10 \\ -2.5x + 35.125, & 10 \leq x \leq 14 \end{cases}$$

$$y = 2(1.5)^x$$

$$y = 2(1.5)^4$$

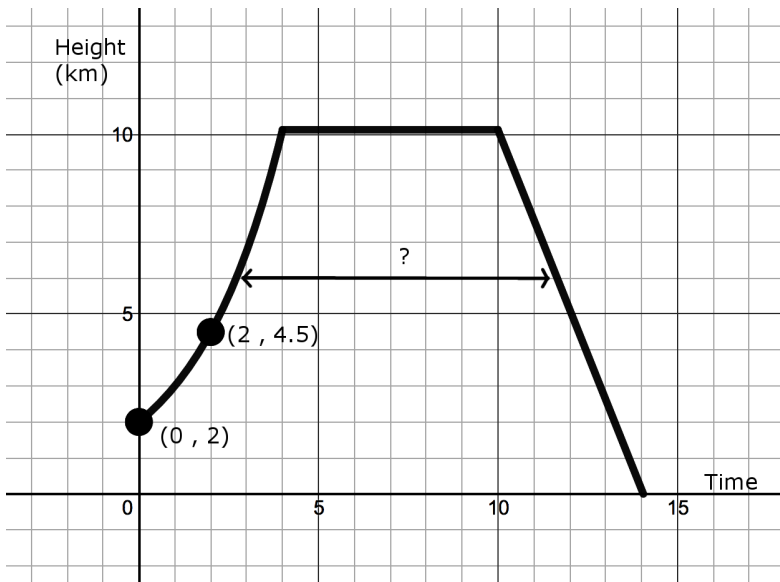
$$y = 10.125$$

$$y = -2.5x + b$$

$$10.125 = -2.5(10) + b$$

$$10.125 = -25 + b$$

$$35.125 = b$$



$$y = 2(1.5)^x$$

$$6 = 2(1.5)^x$$

Guess & check:

x	y
2.71	6.001

$$\text{Diff} = 11.65 - 2.71 = 8.94$$

$$y = -2.5x + 35.125$$

$$6 = -2.5x + 35.125$$

$$-35.125 = -2.5x + 35.125 - 35.125$$

$$\frac{-29.125}{-2.5} = \frac{-2.5x}{-2.5}$$

$$11.65 = x$$

Answer: The squirrel reaches a max height of 10.125 m
It will have spent 8.94 minutes at or above 6 km.