

Name:

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Answer the questions in the spaces provided. Don't hesitate to ask me or your peers for help, this is not a quiz.

## 1. Skills

- (a) Put the following quadratic function in vertex form, and sketch a graph.

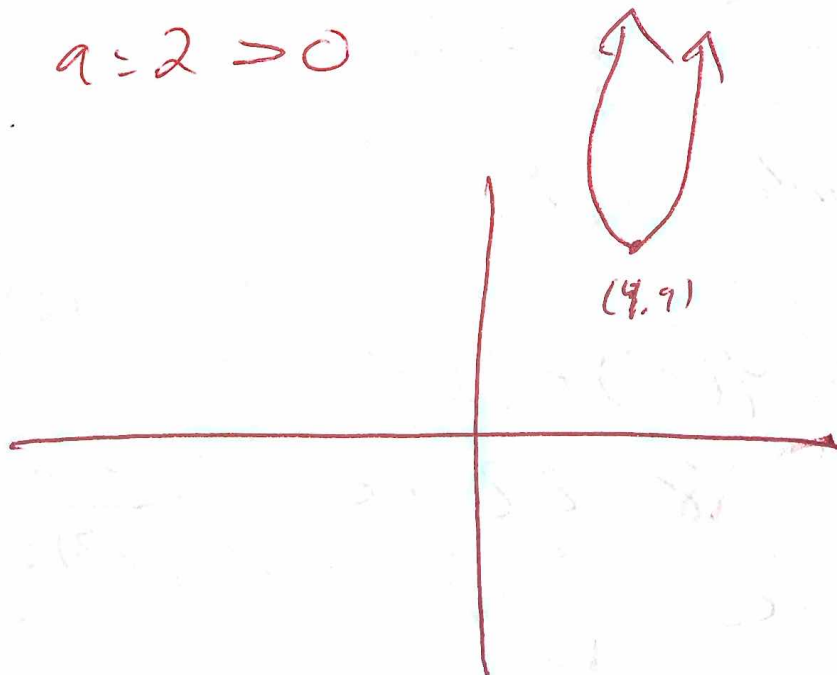
$$f(x) = 2x^2 - 16x + 41.$$

① Find vertex

$$h = -\frac{b}{2a} = \frac{16}{4} = 4$$

$$\begin{aligned} k = f(h) = f(4) &= 2(4)^2 - 16 \cdot 4 + 41 \\ &= 32 - 64 + 41 \\ &= 9 \end{aligned}$$

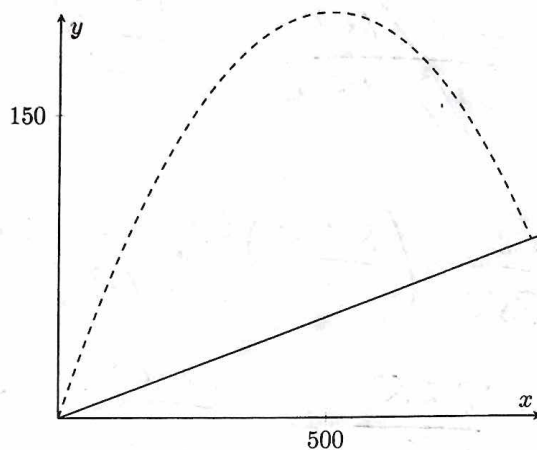
$$a = 2 > 0$$



2. A hot air balloon take off from the edge of a mountain lake. Impose the coordinates with takeoff at (0,0). The balloon takes a path given by:

$$y = \frac{-2}{2500}x^2 + \frac{4}{5}x.$$

A hill rises from the lake ascending 1 vertical foot for every 10 horizontal feet.



- (a) What is the maximum height of the balloon above the lake?

$$\text{max @ } h = -\frac{b}{2a} = \frac{-4/5}{-2/2500} = \frac{2500}{5} = 500$$

$$f(500) = \frac{-2}{2500}(500)^2 + \frac{4}{5}(500)$$

$$= -200 + 400 = 200$$

- (b) Write a function  $g(x)$  which returns the height of the balloon above the ground when it is  $x$  feet (horizontally) from the lake.

Equation for ground:  $h(x) = \frac{1}{10}x$

$$g(x) = f(x) - h(x)$$

$$= \frac{-2}{2500}x^2 + \frac{4}{5}x - \frac{1}{10}x$$

$$= \frac{-2}{2500}x^2 + \frac{7}{10}x.$$

(c) What is the maximum height of the balloon above the ground?

$$\text{Max @ } \frac{-b}{2a}$$

$$= \frac{-7/10}{-4/2500} = \frac{1750}{4} = \frac{875}{2}$$

$$\begin{aligned} h\left(\frac{875}{2}\right) &= \frac{-2}{2500} \left(\frac{875}{2}\right)^2 + \frac{7}{10} \left(\frac{875}{2}\right) \\ &= \frac{-1225}{8} + \frac{1225}{4} = \frac{1225}{8} \approx 153.125 \end{aligned}$$

(d) Where does the balloon land on the ground?

$$\frac{-2}{2500} x^2 + \frac{7}{10} x = 0$$

$$x \left( \frac{-2}{2500} x + \frac{7}{10} \right) = 0$$

$$x = \frac{7/10}{2/2500} = 875$$

$$y = \frac{1}{10} x = 87.5$$

$$(875, 87.5)$$