

Name: Key

Quiz #3

Time: 10 minutes

Show all work. Check your answers.

Consider the function  $Q(x) = -2x^2 - 2x + 4$ . (a) Find the  $x$ - and  $y$ -intercepts of the graph of  $Q$ . (b) Does  $Q(x)$  have a maximum or minimum value for some  $x$ ? If yes, find this  $x$  and the corresponding value  $Q(x)$ . (c) Using (a) and (b), sketch the graph of  $Q$ .

(a) \*  $Q(0) = 4$ , so the  $y$ -intercept is  $(0, 4)$ .

\* To find the  $x$ -intercepts, solve  $Q(x) = 0$ :

$$-2x^2 - 2x + 4 = 0 \quad \text{or} \quad -x^2 - x + 2 = 0$$

$$\text{Quadratic formula: } \Delta = (-1)^2 - 4(-1)(2) = 9, \quad x = \frac{-b \pm \sqrt{\Delta}}{2a} = \frac{1 \pm 3}{-2} \\ = 1 \text{ or } -2$$

so the  $x$ -intercepts are  $(-2, 0)$  and  $(1, 0)$ .

(b) We know that the graph of  $Q$  is a parabola facing down, so there will be a maximum value at the apex (or vertex) of the parabola. We know that this happens when  $x = -\frac{b}{2a} = -\frac{-2}{-4} = -\frac{1}{2}$ .

$$\text{The corresponding value is } Q\left(-\frac{1}{2}\right) = -2\left(-\frac{1}{2}\right)^2 - 2\left(-\frac{1}{2}\right) + 4 \\ = -\frac{1}{2} + 1 + 4 = \frac{9}{2} (= 4.5)$$

(c) We mark the 4 special points from (a) and (b):

