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 $Q(x) = 0$:

$$-2x^2 - 2x + 4 = 0 \quad \Rightarrow \quad -x^2 - x + 2 = 0$$

Using the quadratic formula, $\Delta = (1)^2 - 4(-1)(2) = 9$, $x = \frac{-b \pm \sqrt{\Delta}}{2a} = \frac{-1 \pm 3}{-2}$

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 $x = -\frac{b}{2a} = -\frac{-2}{-4} = -\frac{1}{2}$. The corresponding value is $Q(-\frac{1}{2}) = -2(-\frac{1}{2})^2 - 2(-\frac{1}{2}) + 4$

$= -\frac{1}{2} + 1 + 4 = \frac{9}{2} = 4.5$

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