Know the **quadratic formula**

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a},$$

which yields the solutions to the equation $ax^2 + bx + c = 0$.

The **discriminant**, $b^2 - 4ac$, tells us how many *real solutions* there are:

(i) If $b^2 - 4ac > 0$, there are two real solutions.

(ii) If $b^2 - 4ac = 0$, there is one real solution.

(iii) If $b^2 - 4ac < 0$, there are no real solutions.

1. For each of the following quadratic functions

   - use the discriminant to determine the number of $x-$intercepts
   - find the $x-$intercepts (if applicable) by solving $ax^2 + bx + c = 0$ using a method of your choice
   - use the method of completing the square to rewrite the function in the form
     $$a(x - h)^2 + k$$
     where $(h, k)$ is the vertex of the parabola and $x = h$ is the axis of symmetry
   - find the $y-$intercept
   - graph the parabola

   (a) $f(x) = x^2 + 6x + 9$
   (b) $f(x) = x^2 - 2x + 2$
   (c) $f(x) = -2x^2 - 4x + 2$
   (d) $f(x) = -x^2 - x + 2$

2. For each of the following optimization problems

   - set up a quadratic function
   - find the vertex of the parabola
   - answer the question

   (a) A rectangular garden has a perimeter of 16 meters. What is its largest possible area?
   (b) The sum of two numbers is 10. What is the largest possible product of the two numbers?
   (c) The difference of two numbers is 2. What is the smallest possible product of the two numbers?