Handout for MATH 1300 (Barsamian) Lecture L16 Mon Sep 21 Section 2.1

Forms of a Quadratic Function

A function defined by $f(x) = ax^2 + bx + c$ (with $a \neq 0$) is called a quadratic function. The form $f(x) = ax^2 + bx + c$ is called **standard form**. By completing the square, $f(x)$ can be expressed in **vertex form**, which is the form $f(x) = a(x - h)^2 + k$.

- The graph of f is a parabola with vertex (h, k).
- If $a > 0$, the parabola opens upward, and the vertex is the minimum point.
- If $a < 0$, the parabola opens downward, and the vertex is the maximum point.
- The axis of symmetry is $x = h$. This is the vertical line that passes through the vertex,

Remark: There are two ways of obtaining the vertex coordinates (h, k).

- From the vertex form, identify h, k.
- Using the standard form, compute $h = -\frac{b}{2a}$ and $k = f\left(-\frac{b}{2a}\right)$.

Do the following exercises without using technology.

[1] For the function $f(x) = 2(x + 1)^2 - 8$
(a) Determine whether the graph of the parabola opens upward or downward.
(b) Determine the (x, y) coordinates of the vertex.
(c) Determine the y intercept.
(d) Determine the x intercepts. (There may be 2, or 1, or none!)
(e) Sketch the function. Label important locations (vertex, axis intercepts) with their (x, y) coordinates.
(f) Determine the axis of symmetry. (Write its line equation.)
(g) Determine the maximum or minimum value of the function
(h) Write the domain and range using interval notation.

[2] For the function $f(x) = -2x^2 - 12x - 19$
(a) Write the function in vertex form.
(b) Determine the (x, y) coordinates of the vertex.
(c) Determine the y intercept.
(d) Determine the x intercepts. (There may be 2, or 1, or none!)
(e) Sketch the function. Label important locations (vertex, axis intercepts) with their (x, y) coordinates.
(f) Determine the axis of symmetry. (Write its line equation.)
(g) Determine the maximum or minimum value of the function
(h) Write the domain and range using interval notation.

[3] For the function $f(x) = 3x^2 - 42x - 91$
(a) Determine the (x, y) coordinates of the vertex.
(b) Write the domain and range using interval notation.