Chapter 2

$\Delta \leq 0$

Quadratic Function:

$\Delta = 0$

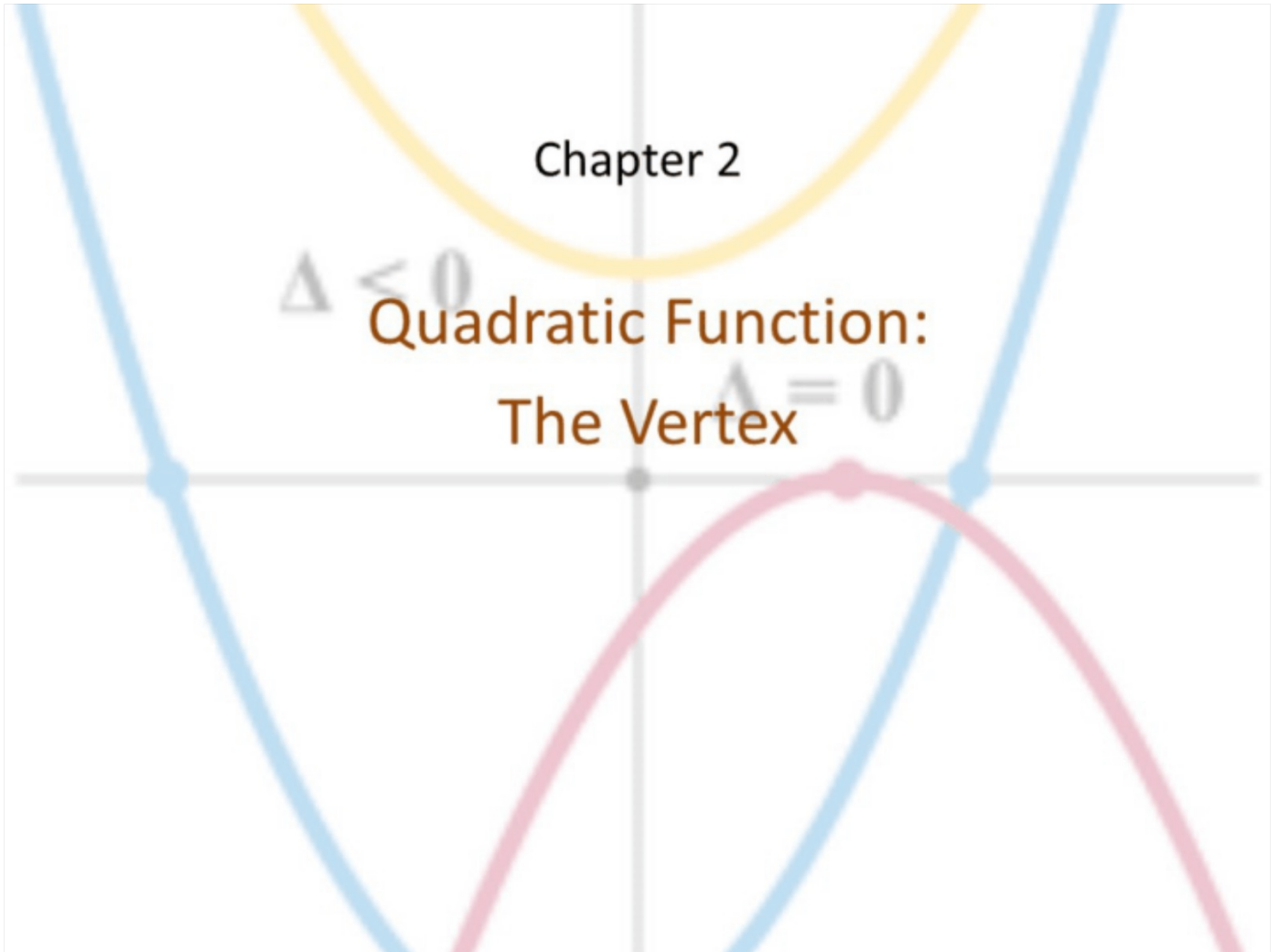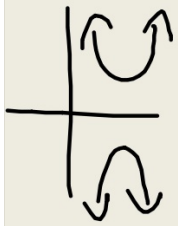The Vertex

Objective

Students will...

- Be able to write standard form of a quadratic function into its vertex form by completing the square, and identify the vertex.
- Be able to solve to find the vertex of a quadratic from its standard form by using $x = \dfrac{-b}{2a}$

Standard form of a Quadratic Function

Recall that the standard form of a quadratic function is:

$$f(x) = ax^2 + bx + c,$$

where a, b, and c are real numbers and $a \neq 0$

⊗ $b = 0$, $c = 0$ is a possibility.

Vertex Form

Also, recall that the standard vertex form of a quadratic function is

$f(x) = a(x - h)^2 + k$, with the vertex being (h, k).

Ex. $f(x) = (x - 2)^2 - 4 = (x - 2)(x - 2) - 4$

Vertex: $(2, -4)$ $= x^2 - 2x - 2x + 4 - 4$

$= x^2 - 4x$

$a = 1, \ b = -4, \ c = 0$

Vertex from the Standard Form?

Question arises, is there a way to derive the vertex directly from the standard form? Well, there is. You may recall the formula from before, but it can be rather easily derived by completing the square of the general standard form. Consider,

$$f(x) = ax^2 + bx + c$$

Vertex Formula: $h = \dfrac{-b}{2a}$, $k = f\left(\dfrac{-b}{2a}\right)$

x-coordinate of vertex

y-coordinate of vertex

So, the general form of vertex from the standard form turns out to be $\left(\dfrac{-b}{2a}, f\left(\dfrac{-b}{2a}\right)\right)$.

$a(x-h)^2+k.$

Vertex from the Standard Form?

$-\frac{1}{3}\cdot\frac{1}{3}$

Ex. Find the vertex of the following quadratic functions, and write the equation in vertex form.

$f(x)=-3(x+\frac{1}{3})^2+13\frac{3}{3}$

1. $f(x) = x^2 + 6x + 3$

Vertex: $(-3,-6)$

$h=\frac{-b}{2a}=\frac{-6}{2(1)}=\frac{-6}{2}=-3$

$k=f(-3)=(-3)^2+6(-3)+3$

$=9-18+3=-6$

$\boxed{f(x)=1(x+3)^2-6}$

2. $f(x) = -3x^2 - 2x + 4$

Vertex: $(-\frac{1}{3},\frac{13}{3})$

$h=\frac{-b}{2a}=\frac{2}{2(-3)}=\frac{2}{-6}=-\frac{1}{3}$

$k=f(-\frac{1}{3})=-3(\frac{-1}{3})^2-2(-\frac{1}{3})+4$

$=-3(\frac{1}{9})+\frac{2}{3}+4\cdot\frac{3}{3}$

$=-\frac{1}{3}+\frac{2}{3}+\frac{12}{3}=\frac{13}{3}$

Homework Due 9/4

Vertex WKSHT