

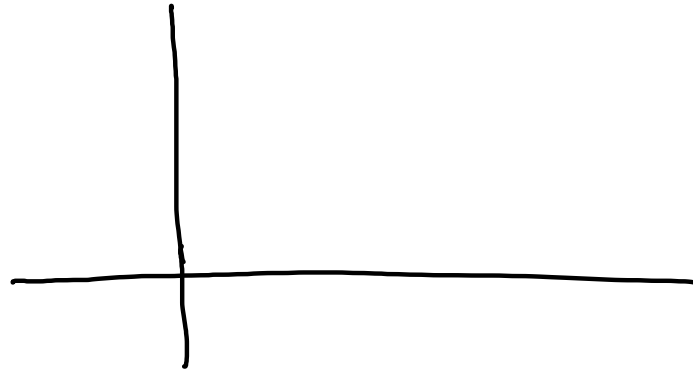
Lesson 10

Start Chapter 7

Quadratic functions. Parabolas

$f(x) = |1 - 2x|$. Find a multipart formula for f , draw the graph of f and solve $f(x) = x - 3$.

1) Graph



2) Multipart formula

$$|1 - 2x| = \left\{ \begin{array}{l} \end{array} \right.$$

$$|1 - 2x| = x - 3$$

A quadratic function is a function given by a quadratic formula :

$$f(x) = ax^2 + bx + c \quad a \neq 0$$

or

$$f(x) = a(x - h)^2 + k$$

The graph of a quadratic function is a parabola

The vertex of a parabola is a point (h, k) that is either the highest (when $a < 0$) or the lowest (when $a > 0$) point of the parabola

Vertex form: $y = a(x - h)^2 + k$

$x = h$ is the axis of symmetry for a parabola with vertex (h, k)

From standard form to vertex form

Given the parabola $y = 3x^2 + 5x + 6$, put it in vertex form and draw it.

The parabola

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

has vertex

$$h = -\frac{b}{2a}$$

$$k = f\left(-\frac{b}{2a}\right) = \frac{-(b^2 - 4ac)}{4a}$$

Parabola through three points

Find the equation of the parabola through $(1,2)$, $(-1,1)$ and $(2,3)$

$$\begin{cases} 2 = a + b + c \\ 1 = a - b + c \\ 3 = 4a + 2b + c \end{cases}$$

$$\begin{cases} a = 2 - b - c \\ 1 = (2 - b - c) - b + c \\ 3 = 4(2 - b - c) + 2b + c \end{cases}$$

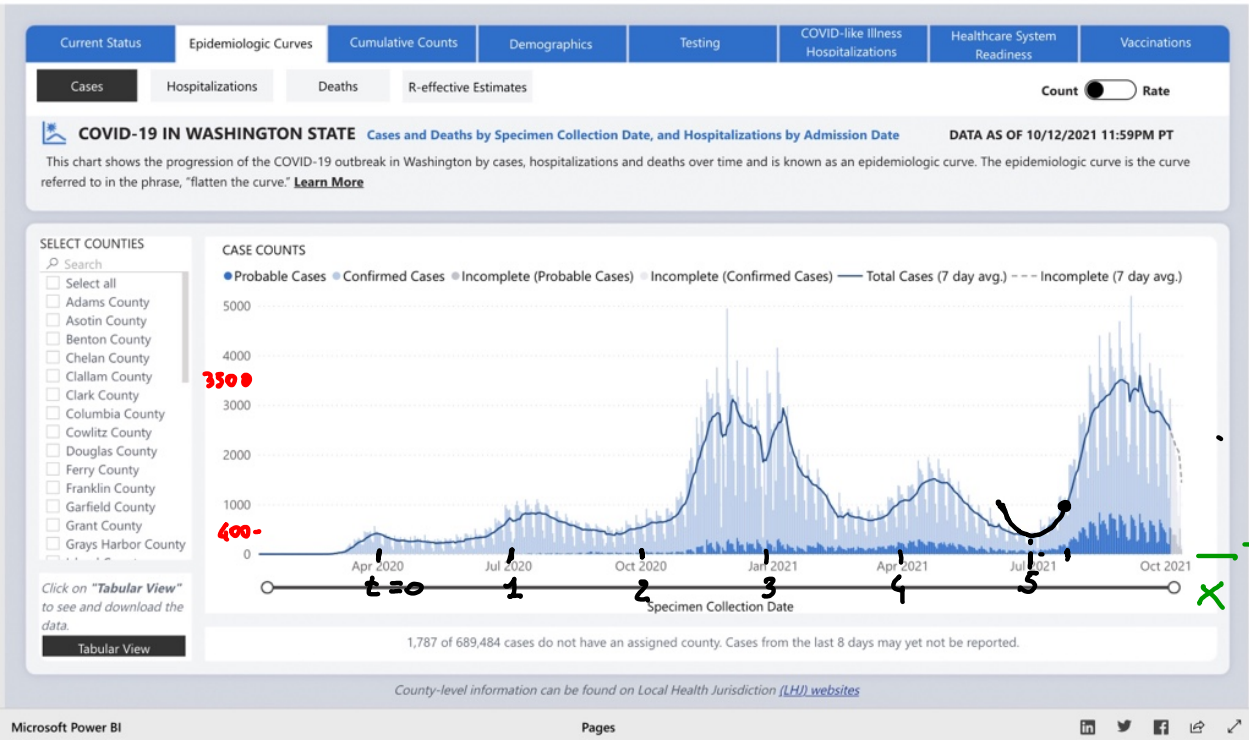
$$\begin{cases} a = 2 - b - c \\ 1 = 2 - 2b \\ 3 = 8 - 2b - 3c \end{cases}$$

$$\begin{cases} a = 2 - b - c \\ b = \frac{1}{2} \\ 3 = 8 - 2\left(\frac{1}{2}\right) - 3c \end{cases}$$

$$\begin{cases} a = 2 - b - c \\ b = \frac{1}{2} \\ \frac{3 - 8 + 1}{3} = c \end{cases}$$

$$\begin{cases} b = \frac{1}{2} \\ c = \frac{4}{3} \\ a = 2 - \frac{1}{2} - \frac{4}{3} = \frac{1}{6} \end{cases}$$

$$y = \frac{1}{6}x^2 + \frac{1}{2}x + \frac{4}{3}$$



Summary Data Tables

Find equation of parabola with vertex at $(5, 400)$
 and through $(5.25, 1000)$

A drainage canal has a cross section in the shape of a parabola. Suppose that the canal is 10 feet deep and 20 feet wide at its top. If the water depth in the ditch is 5 feet, how wide is the surface of the water in the ditch ?

$$\text{Let } f(x) = |x^2 - 5x + 6|$$

Give the multipart rule for $f(x)$
sketch the graph of $f(x)$

See video.