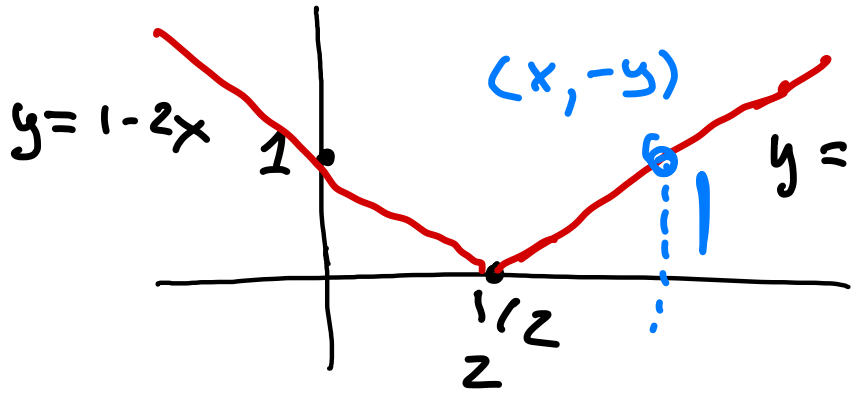
Lesson 10

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



$y = |1 - 2x|$

$y = -(1 - 2x)$

x intercept: $0 = 1 - 2x$, $2x = 1$, $x = \frac{1}{2}$

2) Multipart formula

$$|1 - 2x| = \begin{cases} 1 - 2x & \text{if } x \le \frac{1}{2} \\ -(1 - 2x) & \text{if } x > \frac{1}{2} \end{cases}$$

$$f(x) = |1 - 2x|$$

$$|1 - 2x| = \begin{cases} 1 - 2x & \text{if } (1 - 2x \geq 0) \\ & x \leq \frac{1}{2} \\ -(1 - 2x) & \text{if } (1 - 2x < 0) \\ & x > \frac{1}{2} \end{cases}$$

$$1 - 2x \geq 0$$

$$1 \geq 2x$$

$$\frac{1}{2} \geq x$$

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

1) $1 - 2x = x - 3$ if $x \leq \frac{1}{2}$

$4 = 3x$

$\frac{4}{3} = x$

Is $\frac{4}{3} \leq \frac{1}{2}$? NO

DISCARD

2) $-(1 - 2x) = x - 3$ if $x > \frac{1}{2}$

$-1 + 2x = x - 3$

$x = -2$

is $-2 > \frac{1}{2}$? NO

DISCARD

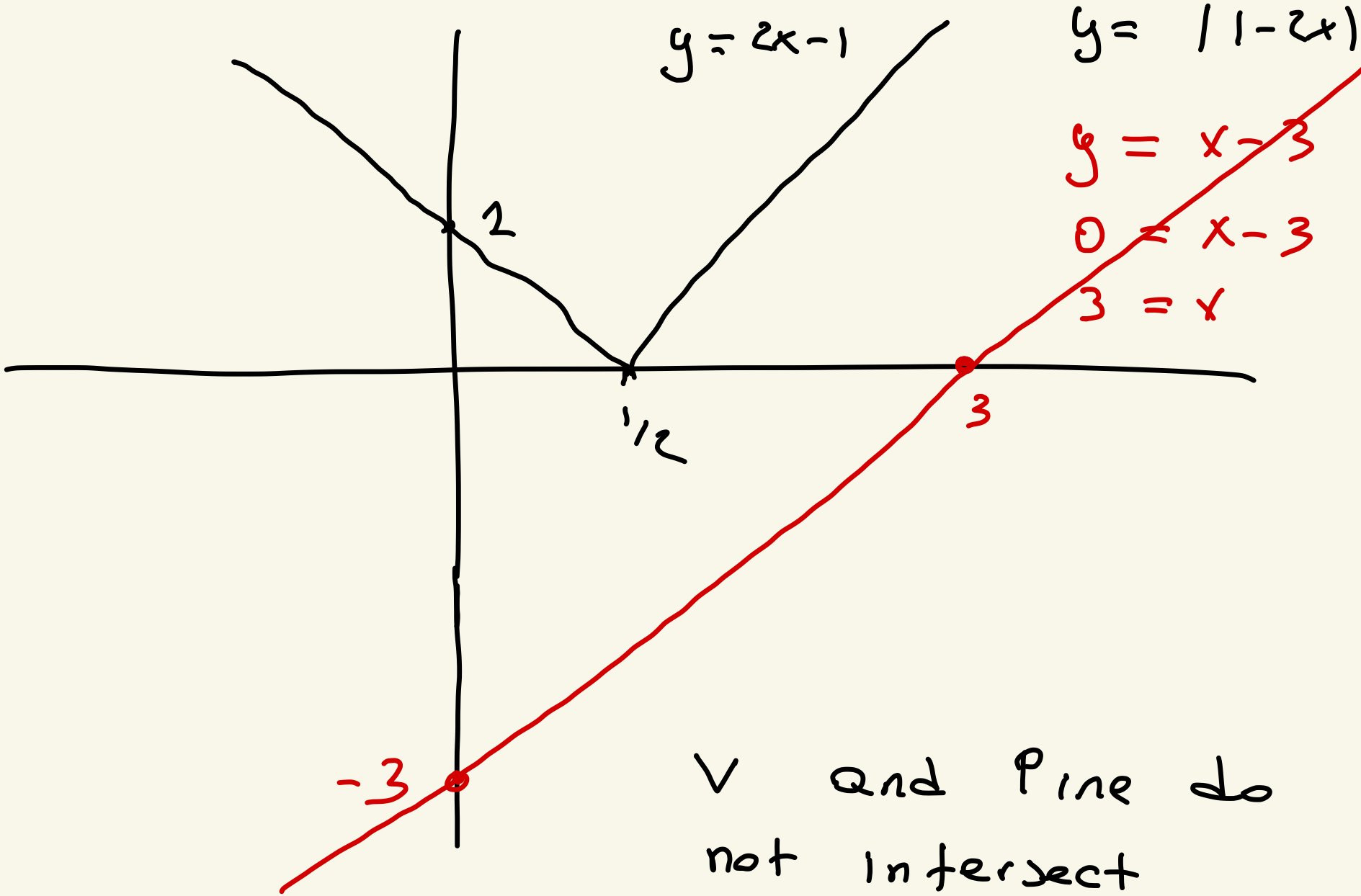
NO SOLUTIONS

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

$f(x) = g(x)$

$y = |1-2x|$

$y = x-3$



V and P ine do not intersect

How do I find intersections between curve $y = |2x-1|$ and $y = x-3$ $P(x, y)$

I need to solve system.

$$\begin{cases} y = |2x-1| \\ y = x-3 \end{cases} \Rightarrow |2x-1| = x-3$$

Solving this gives me the x coordinates of points of intersection between V curve and line.

Chapter 7

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

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

standard form

Ex $f(x) = 2x^2 - x + 1$

or

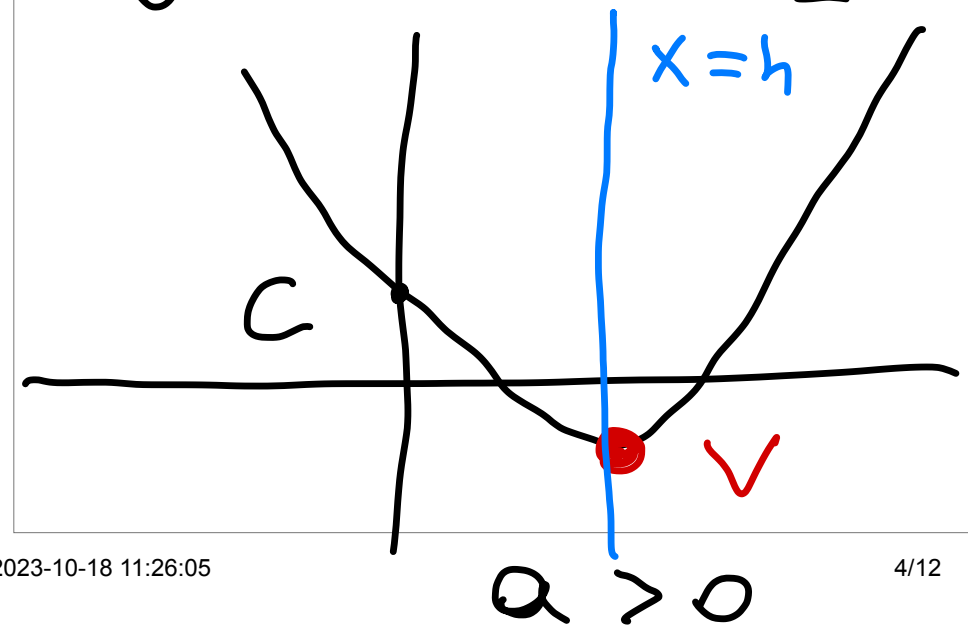
$$f(x) = a(x-h)^2 + k$$

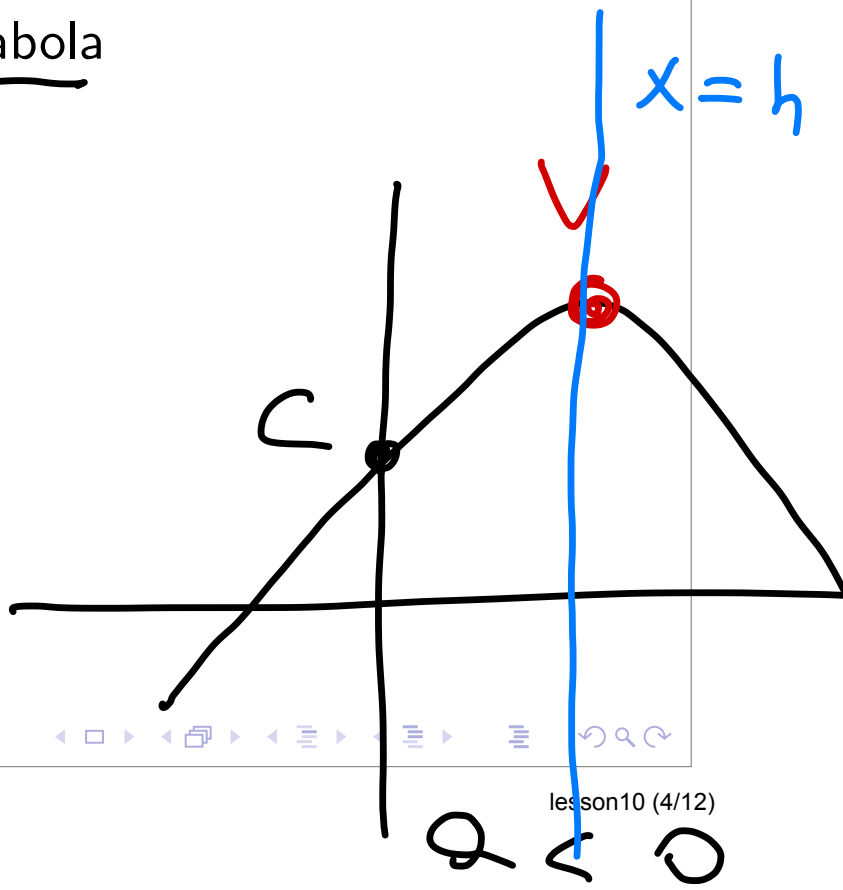
vertex form

Ex $g(x) = 2(x-5)^2 + 7$

The graph of a quadratic function is a parabola

$y = ax^2 + bx + c$





V vertex V = (h, k)

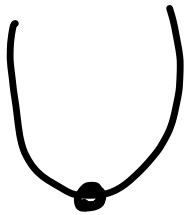
The vertex of a parabola is a point (h, k) that is either the highest (when $a < 0$) or the lowest (when $a > 0$) point of the parabola

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.



$V = (h, k)$

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

$$y = 3(x-h)^2 + k$$

$$y = 3(x^2 - 2hx + h^2) + k$$

$$y = 3x^2 - 2 \cdot 3\, hx + 3h^2 + k$$

$$-2 \cdot 3 \cdot h = 5$$

$$h = -\frac{5}{2 \cdot 3} = -\frac{5}{6}$$

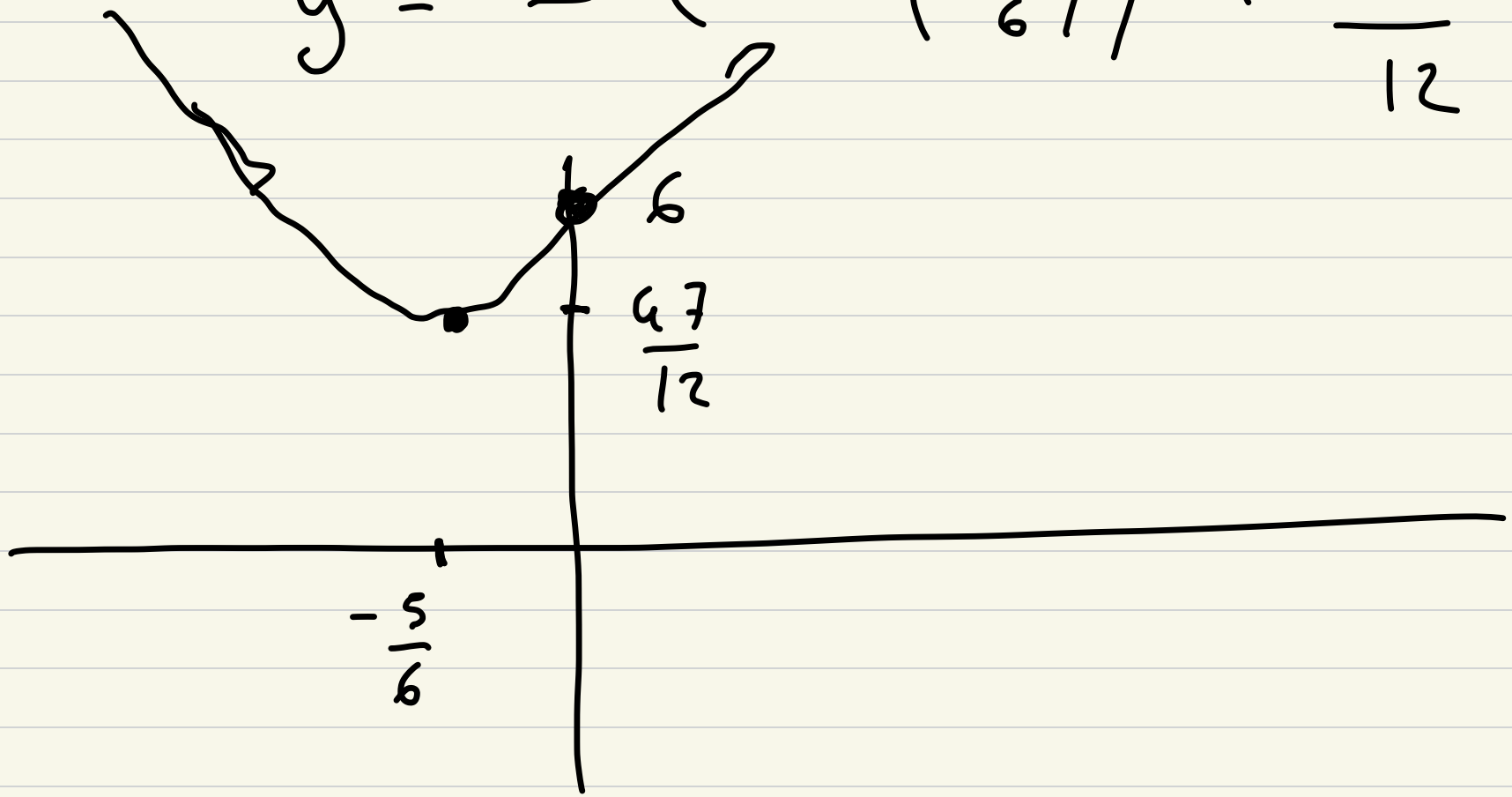
$$\boxed{h = -\frac{1}{2}\frac{b}{a}}$$

$$3h^2 + k = 6$$

$$k = 6 - 3\left[-\frac{5}{6}\right]^2 = \frac{47}{12}$$

Vertex form

$$y = 3\left(x - \left(-\frac{5}{6}\right)\right)^2 + \frac{47}{12}$$



The parabola

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

has vertex $V = (h, k = f(h))$

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

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

$$k = f(h) = ah^2 + bh + c$$