# 1.4B Partial Factoring

## ~Max or Min of a Quadratic Function

Recall that to find the vertex we have:

- completed the square (time consuming)
- factored (vertex falls halfway between the zeros) (gr.10 and later in the unit)

And now for something sort of brand new...

## Finding the Vertex by Partial Factoring

Partial Factoring involves finding two points on the parabola that have the same y-coordinate.

$f(x) = 3x^2 - 24x + 3$

What is the y-intercept?

it is the "c" value from standard form

( 0 , 3 )

is there another x-value with the same y-value?

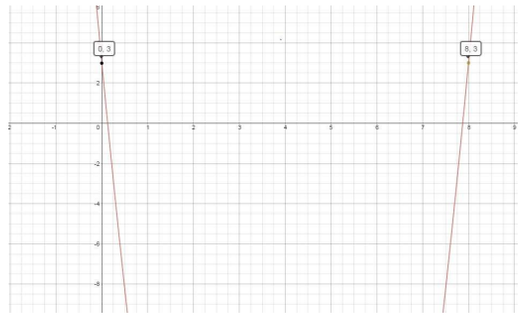
- need to have $3x^2 - 24x = 0$

Partially Factored Form:

$f(x) = 3x(x-8) + 3$

$(0,3)$ $(8,3)$

Graphically this is what is going on:




$f(x) = 3x^2 - 24x + 3$

$= 3x(x-8) + 3$

$x = 0$ $x = 8$

$(0,3)$ $(8,3)$

Now, determine the the axis of symmetry and the vertex.

Axis of symmetry

$x = \frac{0+8}{2}$

$= 4$

Vertex?

$f(4) = 3(4)^2 - 24(4) + 3$

$= 48 - 96 + 3$

$= -45$

$\therefore$ Vertex $(4, -45)$

## Partial Factored Form: $f(x) = ax(x - s) + t$

Process:

- From standard form, factor ax from the first two terms.
- Set x = 0, then y = t. (0, t) is the y-intercept.
- Set x = s, then y = t. (s, t) is a symmetrical point to the y-intercept.
- Determine the axis of symmetry.
- Determine the y-cordinate of the vertex.

The symmetrical points are NOT the Zeros!

Ex. 1 Use partial factoring to determine the vertex.

a) $f(x) = 2x^2 + 10x + 1$

$= 2x(x+5) + 1$

Pt $(0, 1)$

Pt $(-5, 1)$

Axis

$x = \frac{0+(-5)}{2}$

$= -\frac{5}{2}$

$f(-\frac{5}{2}) = 2(-\frac{5}{2})(-\frac{5}{2}+5) + 1$

$= -5(-\frac{5}{2} + \frac{10}{2}) + 1$

$= -5(\frac{5}{2}) + \frac{2}{2}$

$= -\frac{25}{2} + \frac{2}{2}$

$= -\frac{23}{2}$

$\therefore$ Vertex $(-\frac{5}{2}, -\frac{23}{2})$

b) $f(x) = -2x^2 + 8x - 13$

$= -2x(x-4) - 13$

$x = 0$ $\quad$ $x = 4$

Axis

$x = \frac{0+4}{2}$

$= 2$

$f(2) = -2(2)^2 + 8(2) - 13$

$= -8 + 16 - 13$

$= -5$

$\therefore (2, -5)$

c) $f(x) = -x^2 - 5x - 3$

$= -x(x+5) - 3$

$x = 0$ $\quad$ $x = -5$

Axis

$x = \frac{0+(-5)}{2}$

$= -\frac{5}{2}$

$f(-\frac{5}{2}) = -(-\frac{5}{2})^2 - 5(-\frac{5}{2}) - 3$

$= -(\frac{25}{4}) + \frac{25}{2} - 3$

$= -\frac{25}{4} + \frac{50}{4} - \frac{12}{4}$

$= \frac{13}{4}$

$\therefore$ Vertex $(-\frac{5}{2}, \frac{13}{4})$

d) $f(x) = 5x^2 - 2x + 1$

# Homework

## Handout 1.4B
## Part A: #1acdf, 2def
## Part B: #1,2

## Find vertex by either completing the square or partial factoring - your choice