3.3 Completing the Square – Part 1

From grade 10, we can expand a squared binomial to find a pattern for factoring perfect square trinomials.

$(x+6)^2$
$= (x+6)(x+6)$
$= x^2+12x+36$ → perfect square trinomial

Recall: vertex form → $y = a(x-p)^2+q$
standard form → $y = ax^2+bx+c$

A technic called "Completing the Square" is used to change equations from standard form into vertex form. Vertex form is preferred because it is much easy to graph than standard form.

Example 1: Rewrite the following quadratic functions in vertex form.

a) $y = x^2+12x$

bring neg. term out of brackets by multiplying what's in front of brackets

$y = 1(x^2+12x+36-36)$
$y = (x^2+12x+36)-36$
$y = (x+6)^2-36$
vertex $(-6,-36)$

b) $y = x^2-4x-3$

$y = (x^2-4x+4-4)-3$
$y = (x^2-4x+4)-4-3$
$y = (x-2)^2-7$
vertex $(2,-7)$

① group terms including variable (1st two)

② add a constant term that makes it perfect square trinomial & to not change original function subtract the constant too.

$c = \left(\frac{b}{2}\right)^2 = \left(\frac{12}{2}\right)^2$

③ factor perfect square trinomial & CLT

collect like terms

Example 2: Rewrite the following quadratic functions in vertex form.

a) $y = 2x^2 + 8x$

must find GCF of terms with variable.

$y = 2(x^2 + 4x)$

$y = 2(x^2 + 4x + 4 - 4)$

$= 2(x^2 + 4x + 4) - 8$

$= 2(x + 2)^2 - 8$

b) $y = -3x^2 + 4x - 1$

c) $y = 5x^2 + 30x + 41$

$y = 5(x^2 + 6x) + 41$

$y = 5(x^2 + 6x + 9 - 9) + 41$

$y = 5(x^2 + 6x + 9) - 45 + 41$

$y = 5(x + 3)^2 - 4$

Practice: p.192 # 2 - 4, 5ad p192 # 2ac, 3ac, 4c, 6c