MPM 2DI Date:

Graphing Parabolas By Completing the Square

Complete the following table:

Trinomial x^2+bx+c	Value of b	Value of c	Factored Form $(x-h)^2$	Value of h
x^2+2x+1	2	1	$(x+1)^2$	-1
$x^2+8x+16$	8	16	$(x+4)^2$	-4
$x^2-14x+49$	-14	49	$(x-7)^2$	7
x^2-6x+9	-6	9	$(x-3)^2$	3

Notice each of the trinomials in the first column is a perfect square trinomial which can be expressed in the form $(x-h)^2$.

In each row of the above table, what is the relation between b and c? c is $(\frac{1}{2}b)^2$

Between b and h? $h = \frac{b}{-2}$

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Previously, we graphed parabolas written in the form $y = a(x-h)^2+k$ (vertex ~~standard~~ form).

But the equation of a parabola can also be written in the general quadratic form $y = ax^2+bx+c$. (standard form)

To graph a parabola written in this form, we must first **complete the square**.

Eg. 1 Graph $y = x^2+6x+7$ (Standard) by first completing the square.

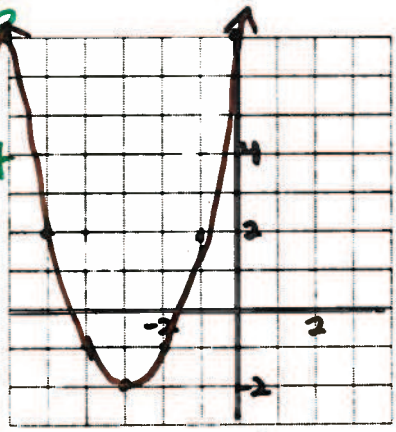
$y = x^2+6x+9-9+7$ → take $\frac{1}{2}$ of 6, square

$y = (x+3)^2-2$ ← vertex form

→ factor first 3 terms as perfect square

Add/subtract that amount

vertex $(-3,-2)$



Check: Expand & simplify to change vertex form → standard form.

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

$= (x+3)(x+3)-2$

$= x^2+6x+9-2$

$y = x^2+6x+7$

Eg. 2 Graph $y = 2x^2 - 8x + 5$ by first completing the square.

*factor out coefficient of x^2 term from first 2 terms

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

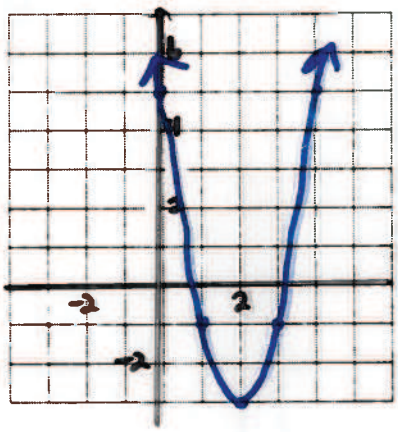
↳ take $\frac{1}{2}$ + square it add | subtract that amount

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

multiply

$y = 2(x-2)^2 - 8 + 5$

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



Eg. 3 Graph $y = 6x - 3x^2$ by first completing the square.

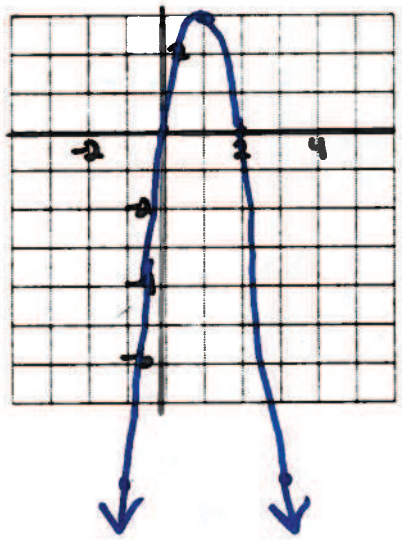
$y = -3x^2 + 6x$

$y = -3(x^2 - 2x)$

$y = -3(x^2 - 2x + 1 - 1)$

$y = -3(x-1)^2 + 3$

vertex (1, 3)



Homework:

Pg 234 # 2 ace, 3, 4 ac, 5 ac, 6 ac, 8 ace