Day 6: Completing the Square

Based on our experiences from last day, a quadratic equation is easier to sketch if it is in the form $y = a(x-p)^2 + q$. The problem we have is that most times quadratic functions are in standard form $y = ax^2 + bx + c$. To transform a quadratic equation into this form we use a method called completing the square:

Steps:

1) Group the x^2 and x terms. Make sure that the coefficient in front of x^2 is 1 (by factoring from the grouped x^2 and x terms).
2) Take half of the coefficient of x and square it. Then add and subtract this value in the bracket.
3) Remove the negative constant from the bracket (Take out the Trash!!).
4) Factor the perfect square trinomial thereby writing the quadratic in the form $y = a(x - p)^2 + q$.

$y = x^2 + 7x + 12$

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

Examples:
Describe the following graphs with respect to $y = x^2$ algebraically.

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

-2

4

$$y = (\underbrace{x^2 - 4x + 4} - 4) + 5$$

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

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

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

$$y = 2x^2 - 12x + 20$$

$\times 2$

$$y = 2(x^2 - 6x + 9 - 9) + 20$$

-3

$$y = 2(x^2 - 6x + 9) - 18 + 20$$

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

$$y = 3x^2 - 6x + 5$$

$$y = 3(x^2 - 2x + 1 - 1) + 5$$

-1

$$y = 3(x^2 - 2x + 1) - 3 + 5$$

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

$y = 2(x^2 - 13x \qquad)$

-6.5

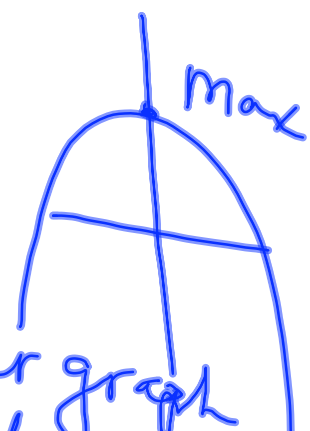
$42.\underline{\underline{25}}$

Consider the function $y = -2x^2 - 8x + 1$.
Determine the maximum or minimum value of 'y' and state which it is and why. Also, for what value of 'x' does the maximum or minimum value occur?

$y = -2(x^2 + 4x + 4 - 4) + 1$
$+2$

$y = -2(x+2)^2 + 9$

V: $(-2, 9)$



Max: 9 because our graph is concave down.

at $x = -2$

Assignment:
Pg. 124 #1, 3, 4, 5, 7 → odds.

odds