Class Notes: Parabolas Conics – 3

$x = \frac{-b}{2a}$ axis of symmetry

locus definition of a parabola: all points equidistant from a line and a point not on the line

vertex form of a parabola $y = a(x-h)^2 + k$

standard form of a parabola $y = ax^2 + bx + c$

Sketch using transformations:

$y = x^2$

$y = \frac{1}{2}(x+2)^2 + 3$ left 2 up 3

1 → .5
3 → 1.5
5 → 2.5
7 → 3.5

vertex (-2, 3)

x	$y = x^2$		
-3	9	5	2
-2	4	3	2
-1	1	1	
0	0	1	
1	1	3	2
2	4	5	2
3	9	7	
4	16		

first difference
second difference
odd integers

Convert from standard form to vertex form by completing the square. Then sketch the graph using transformations.

example 1) $y = -2x^2 + 12x - 16$

$y = -2[x^2 - 6x\ ] - 16$

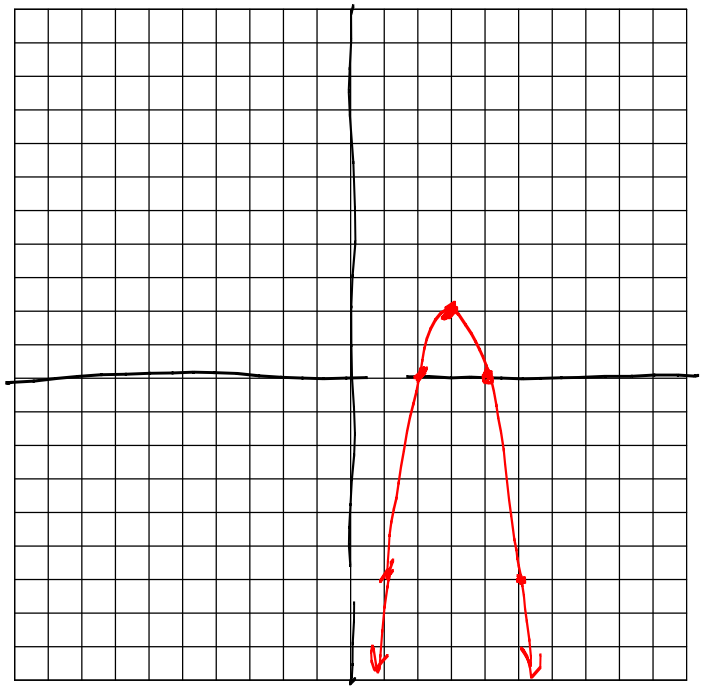
$y = -2[(x-3)^2 - 9\ ] - 16$

$y = -2(x-3)^2 + 18 - 16$

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

vertex (3, 2)

(x-2)	
1 →	-2
3 →	-6
5 →	-10
7 →	-14



2) Write the equation of the parabola with vertex (1, 3) passing through the point (3, 5).

h k x y

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

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

to find a, substitute values from the point

$5 = a(3-1)^2 + 3$

$5 = 4a + 3$

$2 = 4a$

$\frac{1}{2} = a$ ← exact value

$y = \frac{1}{2}(x-1)^2 + 3$

3) Write the equation of the parabola with vertex (3, 1) and having a point on the curve at (1, -3) in vertex and standard form.

vertex

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

$-3 = a(1-3)^2 + 1$

$-3 = 4a + 1$

$-4 = 4a$

$-1 = a$

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

standard

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

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

$y = -[x^2 - 6x + 9] + 1$

$y = -x^2 + 6x - 9 + 1$

$y = -x^2 + 6x - 8$

$y = ax^2 + bx + c$

$y = 0$

Find the roots of the following equations.

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

$0 = (x+1)^2 - 2$

$\pm\sqrt{2} = \sqrt{(x+1)^2}$

$\pm\sqrt{2} = x+1$

$-1 \pm \sqrt{2} = x$

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

$x = \frac{-2 \pm \sqrt{2^2 - 4(1)(-1)}}{2(1)}$

$x = \frac{-2 \pm \sqrt{8}}{2} = \frac{-2}{2} \pm \frac{2\sqrt{2}}{2}$

$x = -1 \pm \sqrt{2}$

8
2 4
2 2