Vertex Form by Completing the Square

May 4/2010

How can we find the vertex of a quadratic relation in standard form, $y = ax^2 + bx + c$?

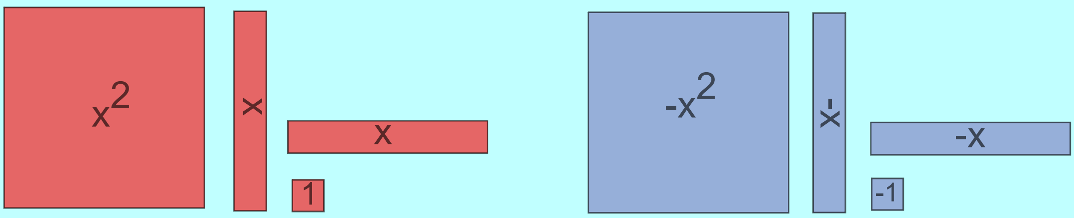
1. Factored Form → Find zeroes
   → Symmetry to find x_v

2. Partial Factoring → sub y-intercept
   → find matching point
   → symmetry to find x_v

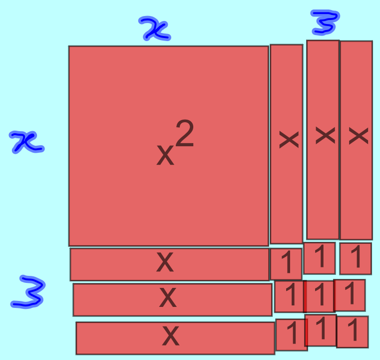
or,

3. Complete the Square → Vertex Form

May 2-4:13 PM



$x^2 + 6x + \underline{9} = (x+3)^2$



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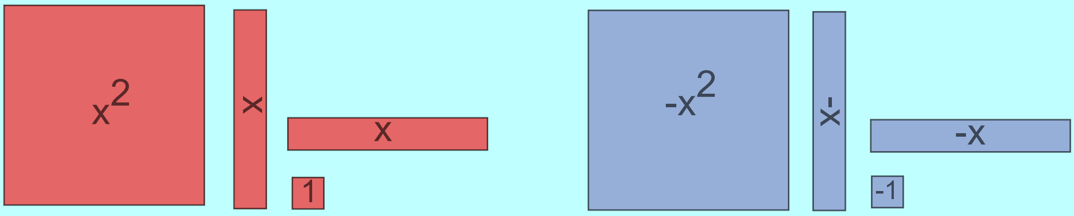
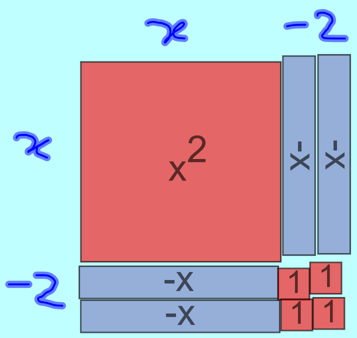


$x^2 - 4x + \underline{\ 4\ } = (x - 2)^2$



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

Note that $(x - h)^2$ is a <u>perfect square</u>. What is missing from these perfect squares?

(a) $x^2 + 10x + \underline{\ 25\ } = (x + 5)^2$

$\frac{10}{2} = 5 \quad 5^2 = 25$

(b) $x^2 - 18x + \underline{\ 81\ } = (x - 9)^2$

$-\frac{18}{2} = -9 \quad (-9)^2 = 81$

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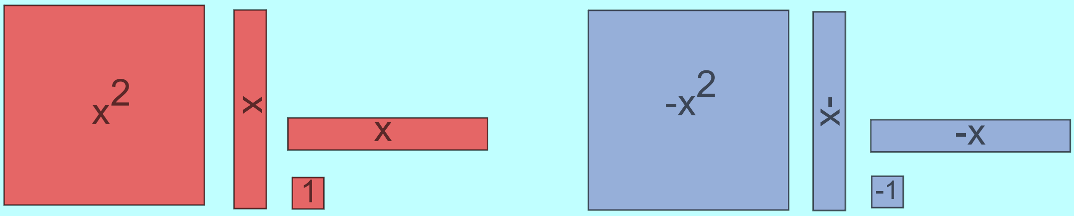
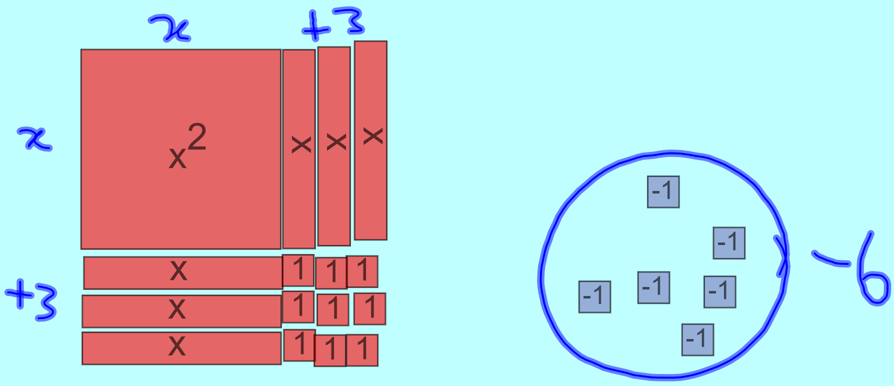


$x^2 + 6x + 3 = (x+3)^2 - 6$



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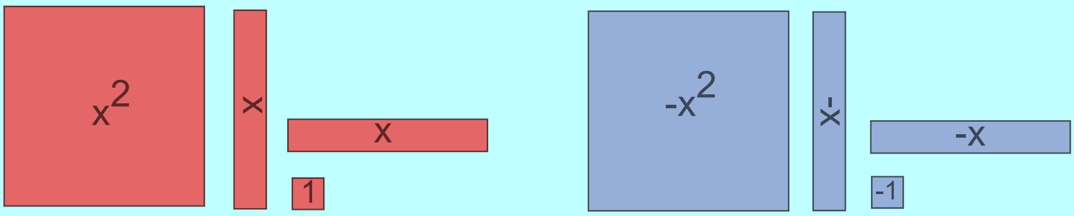
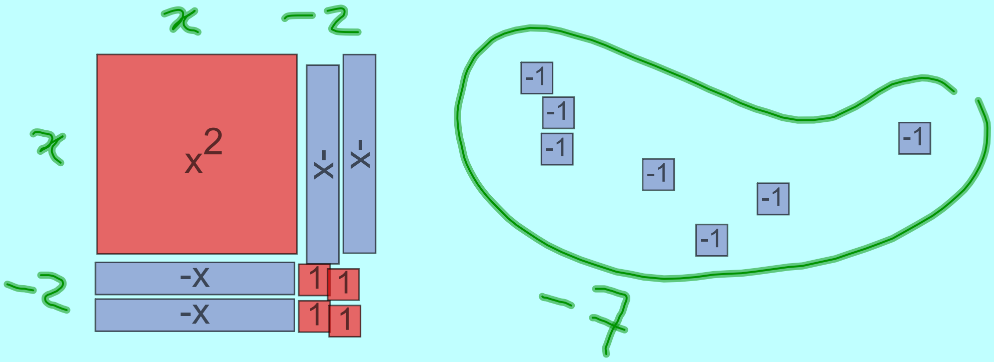


$x^2 - 4x - 3 = (x-2)^2 - 7$



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To go from standard form to vertex form, we force a perfect square into our equation.

(c) $y = x^2 + 12x - 7$

make a perfect square

$y = (x^2 + 12x + 36) - 36 - 7$

zero

perfect square

$y = (x+6)^2 - 43$

	x	$+6$
x	x^2	$6x$
$+6$	$6x$	36

$-36 - 7$ -43

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(d) $y = x^2 - 20x + 15$

$y = (x-10)^2 - 85$

	x	-10
x	x^2	$-10x$
-10	$-10x$	$+100$

$-100 + 15$

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If the value in front of x^2 is not 1 (the 'a' term), we must factor that number out of all x terms.

(e) $y = 3x^2 + 12x + 11$

$y = 3(x^2 + 4x) + 11$

$y = 3(x^2 + 4x + 4 - 4) + 11$

$(x+2)^2$

$y = 3[(x+2)^2 - 4] + 11$

$y = 3(x+2)^2 - 12 + 11$

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

(f) $y = -x^2 + 6x + 13$

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Assigned Work:

p. 390 # 1, 2, 4, 9, 10

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