

Conics : Parabolas 10

Completing the square.

Example: Completing the square means filling in the blanks.

$x^2 + 6x + \underline{\quad} = (x + 3)^2$ We divide 6 by 2 = 3 and square, so 9 belongs in the blank.

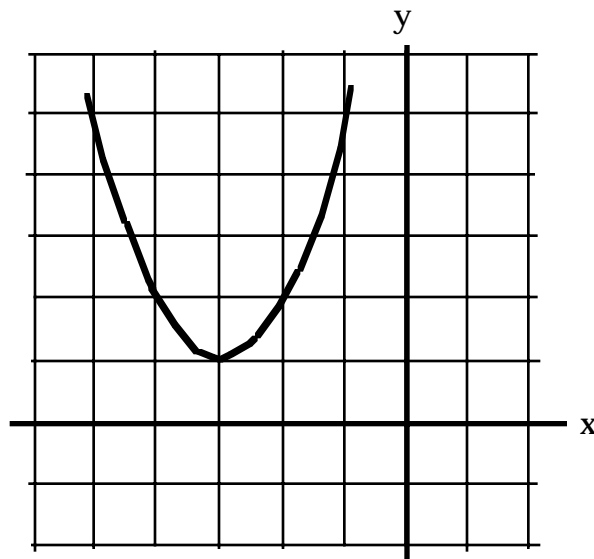
$2x^2 - 20x + \underline{\quad} = 2(x^2 - 10x + \underline{\quad}) = 2(x^2 - 10x + 25) = 2(x - 5)^2$, so 50 belongs in the first blank.

Example: The general form for an equation can be changed to the more useful standard form.

$$y = x^2 + 6x + 10 \quad \rightarrow \quad y = (x^2 + 6x + \underline{\quad}) + 10$$

$$\rightarrow y = (x^2 + 6x + 9) - 9 + 10 \quad \rightarrow \quad y = (x + 3)^2 + 1$$

When we do this, the coordinates of the vertex can easily be found. In this case, the vertex is (-3, 1). The graph of the equation is shown below.



1) Complete the square. Find the number that belongs in the blank.

a) $x^2 + 4x + \underline{\quad} = (x + \underline{\quad})^2$ b) $x^2 + 8x + \underline{\quad} = (x + \underline{\quad})^2$

c) $x^2 - 6x + \underline{\quad} = (x + \underline{\quad})^2$ d) $2x^2 + 8x + \underline{\quad} = 2(x + \underline{\quad})^2$

e) $3x^2 + 6x + \underline{\quad} = 3(x + \underline{\quad})^2$ f) $5x^2 - 30x + \underline{\quad} = 5(x + \underline{\quad})^2$

2) Change to general form.

a) $y = (x - 2)(x + 4)$ b) $y + 5 = 2(x - 1)^2$ c) $y = -3(x - 2)^2 + 4$

3) Find the coordinates of the vertex.

a) $y = -3x^2$ b) $y + 2 = (x - 5)^2$ c) $y = -3(x - 3)^2$

4) Change to standard form.

a) $y = x^2 + 8x + 16$

b) $y = x^2 - 4x + 7$

c) $y = 2x^2 + 12x + 18$

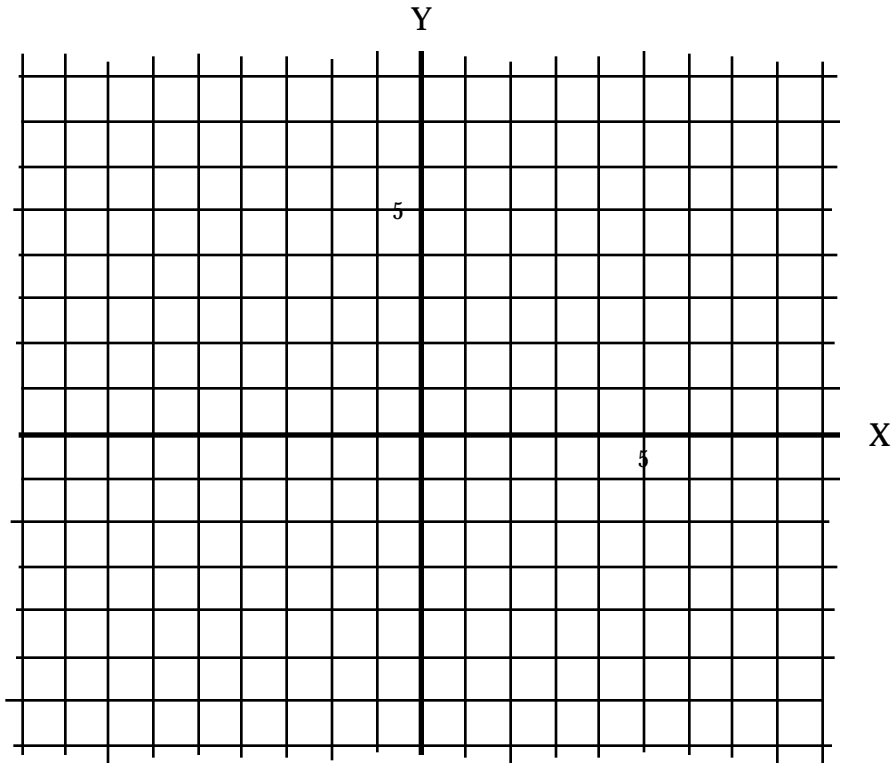
d) $y = -5x^2 + 40x - 50$

5) Graph the equations.

a) $y = (1/2)x^2$

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

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



Answers: 1)a) 4, $(x + 2)^2$, b) 16, $(x + 4)^2$, c) 9, $(x - 3)^2$,
d) 8, $2(x + 2)^2$, e) 3, $3(x + 1)^2$, f) 45, $5(x - 3)^2$, 2)a) $y = x^2 + 2x - 8$, b)
 $y = 2x^2 - 4x - 3$, c) $y = -3x^2 + 12x - 8$, 3)a) (0, 0), b) (5, -2), c) (3, 0),
4)a) $y = (x + 4)^2$, b) $y - 3 = (x - 2)^2$, c) $y = 2(x + 3)^2$,
d) $y = -5(x - 4)^2 + 30$, 5)

