

Writing Conics in Standard Form

1. Classify
2. Group your x's and y's together. Move constant to other side.
3. Complete the square for x and y.

Circle

~~$x^2 + y^2 + 6x + 3 = 0$~~

$$x^2 + y^2 - 6x + 4y + 9 = 0$$

$$x^2 - 6x + \frac{9}{4} + y^2 + 4y + \frac{4}{4} = -9 + \frac{9}{4} + \frac{4}{4}$$

$$\boxed{(x-3)^2 + (y+2)^2 = 4}$$

$$\frac{6}{2} = 3$$

$$3^2 = 9$$

$$\frac{4}{2} = 2$$

$$2^2 = 4$$

↓ whatever is neg goes 2nd

$$-4x^2 + y^2 + 16x - 2y - 31 = 0 \quad \text{Hyperbola}$$

$$y^2 - 2y + \frac{1}{4} - 4x^2 + 16x + \frac{4}{4} = 31 + \frac{1}{4} + \frac{4}{4}$$

$$y^2 - 2y + \frac{1}{4} - 4(x^2 - 4x + \frac{4}{4}) = 31 + \frac{1}{4} + \frac{4}{4}$$

$$\frac{(y-1)^2}{16} - \frac{4(x-2)^2}{16} = \frac{16}{16}$$

$$\frac{(y-1)^2}{16} - \frac{(x-2)^2}{4} = 1$$

Ellipses $4x^2 + 9y^2 + 24x + 18y + 9 = 0$

$$4x^2 + 24x + \frac{9}{4} + 9y^2 + 18y + \frac{9}{4} = -9 + \frac{9}{4} + \frac{9}{4}$$

$$4(x^2 + 6x + \frac{9}{4}) + 9(y^2 + 2y + \frac{1}{4}) = -9 + 4(\frac{9}{4}) + 9(\frac{1}{4})$$

$$\frac{4(x+3)^2}{36} + \frac{9(y+1)^2}{36} = \frac{36}{36}$$

$$\frac{(x+3)^2}{9} + \frac{(y+1)^2}{4} = 1$$

Parabola

$$x^2 + 8x + 2y + 14 = 0$$

$$x^2 + 8x = -2y - 14$$

$$x^2 + 8x + 16 = -2y - 14 + 16$$

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

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

$$\boxed{(x+4)^2 = 4\left(-\frac{1}{2}\right)(y-1)}$$

$$4p = -2$$

$$p = \frac{-2}{4} = -\frac{1}{2}$$