

For each equation:

- (a) Determine the type of conic  
 (b) Write in standard form

$$1. 9x^2 + 4y^2 - 18x + 16y - 119 = 0$$

$$9(x^2 - 2x + 1) + 4(y^2 + 4y + 4) = 119 + 9 + 16$$

$$\frac{9(x-1)^2}{144} + \frac{4(y+2)^2}{144} = \frac{144}{144}$$

$$\frac{(x-1)^2}{16} + \frac{(y+2)^2}{36} = 1 \quad \text{ellipse}$$

$$2. x^2 + y^2 - 4x - 6y - 23 = 0$$

$$x^2 - 4x + 4 + y^2 - 6y + 9 = 23 + 4 + 9$$

$$(x-2)^2 + (y-3)^2 = 36 \quad \text{circle}$$

$$3. 16x^2 - 9y^2 + 32x + 54y - 209 = 0$$

$$16(x^2 + 2x + 1) - 9(y^2 - 6y + 9) = 209 + 16 + (-9)$$

$$16(x+1)^2 - 9(y-3)^2 = 144$$

$$\frac{(x+1)^2}{9} - \frac{(y-3)^2}{16} = 1 \quad \text{hyperbola}$$

$$4. x^2 + 4x - 8y + 20 = 0$$

$$x^2 + 4x + 4 = 8y - 20 + 4$$

$$(x+2)^2 = 8y - 16$$

$$(x+2)^2 = 8(y-2) \quad \text{parabola}$$

$$5. y^2 + 12x + 4y + 28 = 0$$

$$y^2 + 4y + 4 = -12x - 28 + 4$$

$$(y+2)^2 = -12x - 24$$

$$(y+2)^2 = -12(x+2) \quad \text{parabola}$$

$$6. 4x^2 + 25y^2 + 16x + 250y + 541 = 0$$

$$4(x^2 + 4x + 4) + 25(y^2 + 10y + 25) = -541 + 16 + 625$$

$$4(x+2)^2 + 25(y+5)^2 = 100$$

$$\frac{(x+2)^2}{25} + \frac{(y+5)^2}{4} = 1 \quad \text{ellipse}$$

$$7. x^2 + y^2 + 2x - 6y = 0$$

$$x^2 + 2x + 1 + y^2 - 6y + 9 = 0 + 1 + 9$$

$$(x+1)^2 + (y-3)^2 = 10 \quad \text{circle}$$

$$8. y^2 - x^2 + 2x - 6y - 8 = 0$$

$$y^2 - 6y + 9 - (x^2 - 2x + 1) = 8 + 9 - 1$$

$$(y-3)^2 - (x-1)^2 = 16$$

$$\frac{(y-3)^2}{16} - \frac{(x-1)^2}{16} = 1 \quad \text{hyperbola}$$

$$9. 9x^2 + 4y^2 - 90x + 8y + 228 = 0$$

$$9(x^2 - 10x + 25) + 4(y^2 + 2y + 1) = -228 + 225 + 4$$

$$9(x-5)^2 + 4(y+1)^2 = 1$$

$$10. x^2 - 6x - 2y + 7 = 0$$

$$x^2 - 6x + 9 = 2y - 7 + 9$$

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

$$(x-3)^2 = 2(y+1) \quad \text{parabola}$$