

1. Classify each conic.

$4x^2 - 36y^2 - 40x + 216y - 80 = 0$  hyperbola

$4x^2 + 4y^2 - 40x + 216y - 80 = 0$  circle

$4x^2 + 2xy + y^2 - 40x + 216y - 80 = 0$   $2^2 - 4 \cdot 4 \cdot 1 = -12$  ellipse

2. Transform the equation or inequality by completing the square. Sketch the graph. Find and label any asymptotes, directrix, latus rectum, center, vertices, foci (x,y), radius, x-radius and y-radius, if it applies.

$x^2 - 4y^2 + 2x + 16y - 11 = 0$

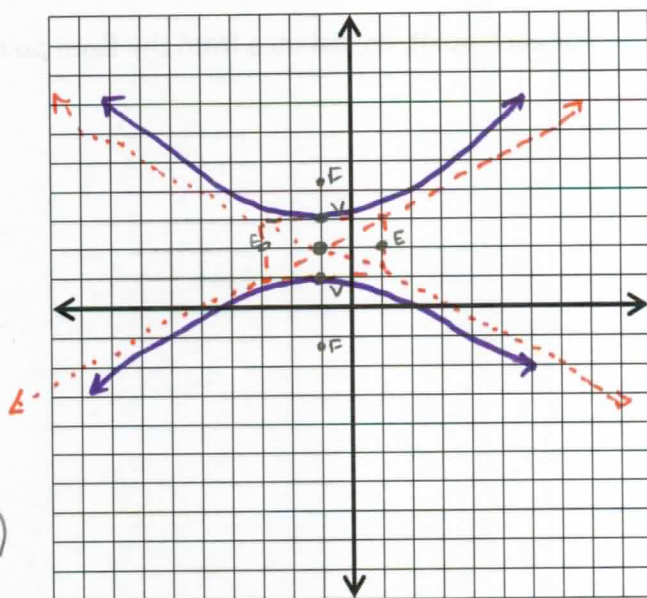
$$\begin{array}{r} x^2 + 2x - 4(y^2 - 4y) = 11 \\ +1 \qquad +4 \qquad +1 \\ \hline \end{array}$$

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

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

C: (-1, 2)  
V: (-1, 3) (-1, 1)  
E: (-3, 2) (1, 2)  
F: (-1, 2 ± √5)  
R<sub>x</sub>: 2  
R<sub>y</sub>: 1

asymptotes  $y - 2 = \pm \frac{1}{2}(x + 1)$



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

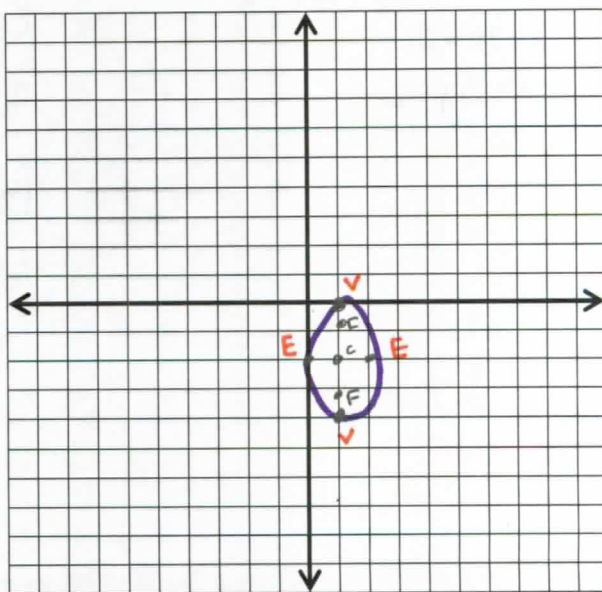
$$\begin{array}{r} 4(x^2 - 2x) + y^2 + 4y = -4 \\ +1 \qquad +4 \qquad +4 \\ \hline \end{array}$$

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

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

C (1, -2)  
V (1, 0) (1, -4)  
E (0, -2) (2, -2)  
F (1, -2 ± √3)

R<sub>x</sub> = 1  
R<sub>y</sub> = 2  
R<sub>f</sub> = √3



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

$$x^2 + 4y = 4y$$

$$+4 \quad +4$$

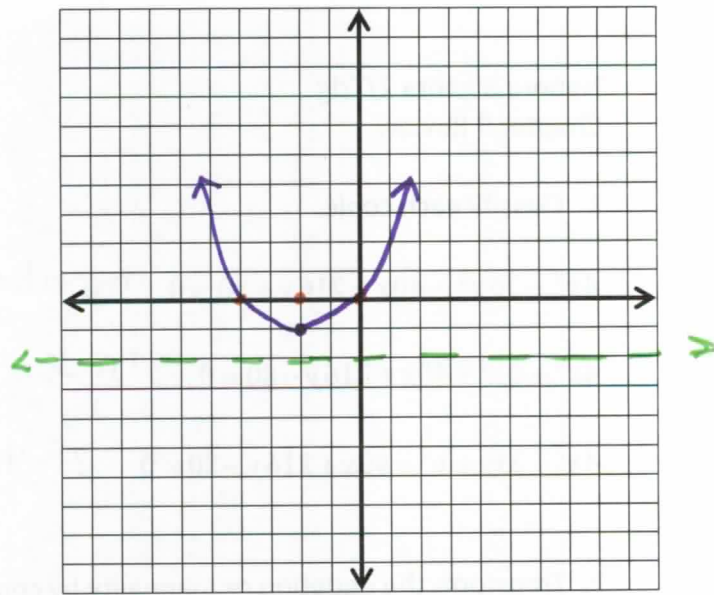
$$(x+2)^2 = 4(y+1)$$

$$V(-2, -1) \quad F(2, 0)$$

$$P = 1$$

$$LR = 4$$

$$\text{directrix } y = -2$$



3. Find a polynomial equation with integer coefficients where:

For each point, its distance from the fixed point  $(0, -5)$  is  $1/3$  its distance from the fixed point  $(0, 5)$ .



$$\sqrt{(x-0)^2 + (y+5)^2} = \frac{1}{3} \sqrt{(x-0)^2 + (y-5)^2}$$

$$3\sqrt{x^2 + y^2 + 10y + 25} = \sqrt{x^2 + y^2 - 10y + 25}$$

$$9(x^2 + y^2 + 10y + 25) = (x^2 + y^2 - 10y + 25)$$

$$9x^2 + 9y^2 + 90y + 225 = x^2 + y^2 - 10y + 25$$

$$8x^2 + 8y^2 + 100y + 200 = 0$$

$$2x^2 + 2y^2 + 25y + 50 = 0 \quad \text{circle}$$

4. Solve the system.

$$x^2 + 9y^2 - 10x + 36y = 20$$

$$x - 3y = 2$$

$$x = 3y + 2$$

$$(3y+2)^2 + 9y^2 - 10(3y+2) + 36y = 20$$

$$9y^2 + 12y + 4 + 9y^2 - 30y - 20 + 36y = 20$$

$$18y^2 + 18y - 36 = 0$$

$$18(y^2 + y - 2) = 0$$

$$(y+2)(y-1) = 0$$

$$y = -2, 1$$

$$(-4, -2) \quad (5, 1)$$

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

$$x = -4$$

$$x = 3(1) + 2$$

$$x = 5$$