

Part I: For each of the following, state the name of the conic and include:

- Circles: Center and radius
- Parabolas: Vertex, focus, directrix, "a" value, and direction it opens
- Ellipses: Center, endpoints of major and minor axes, and foci
- Hyperbolas: Center, vertices, endpoints of transverse axis, slopes of asymptotes

Part II: Graph each equation on the separate sheet of graph paper provided.

1) $x^2 + y^2 = 16$ Circle
center: $(0, 0)$
 $r = 4$

2) $x^2 = 8(y - 2)$ parabola
vertex: $(0, 2)$ opens up
 $4a = 8$ focus: $(0, 4)$
 $a = 2$ directrix: $y = 0$
F.L. = 8

3) $\frac{x^2}{25} + \frac{y^2}{16} = 1$ ellipse
center: $(0, 0)$ $a = 5$ $c^2 = 25 - 16$
 $b = 4$ $c^2 = 9$
 $c = 3$
major: $(5, 0), (-5, 0)$
minor: $(0, 4), (0, -4)$ foci: $(3, 0), (-3, 0)$

4) $\frac{x^2}{9} - \frac{y^2}{16} = 1$ Hyperbola
center: $(0, 0)$ opens horizontally $c^2 = 9 + 16$
 $a = 3$ vertices: $(3, 0), (-3, 0)$ $c^2 = 25$
 $b = 4$ $m = \pm \frac{4}{3}$ $c = 5$
foci: $(5, 0), (-5, 0)$

5) $x^2 - 6x + y^2 - 8y = 0$ Circle
 $x^2 - 6x + 9 + y^2 - 8y + 16 = 9 + 16$
 $(x - 3)^2 + (y - 4)^2 = 25$
center: $(3, 4)$ $r = 5$

6) $(y + 2)^2 = -12(x + 3)$ parabola
vertex: $(-3, -2)$ opens left
focus: $(-6, -2)$ $4a = -12$
directrix: $x = 0$ $a = -3$
F.L. = 12

7) $\frac{(x - 3)^2}{12} + \frac{(y + 2)^2}{21} = 1$ ellipse
center: $(3, -2)$ vertical $c^2 = 21 - 12$
 $a = \sqrt{21}$ major: $(3, -2 \pm \sqrt{21})$ $c^2 = 9$
 $b = 2\sqrt{3}$ minor: $(3 \pm 2\sqrt{3}, -2)$ $c = 3$
foci: $(3, 1), (3, -5)$

8) $\frac{4y^2}{36} - \frac{9x^2}{36} = \frac{36}{36}$ Hyperbola (vertical)
 $\frac{y^2}{9} - \frac{x^2}{4} = 1$ vertices: $(0, 3), (0, -3)$
center: $(0, 0)$ $m = \pm \frac{3}{2}$
 $a = 3$ $c^2 = 9 + 4$ foci: $(0, \sqrt{13}), (0, -\sqrt{13})$
 $b = 2$ $c = \sqrt{13}$

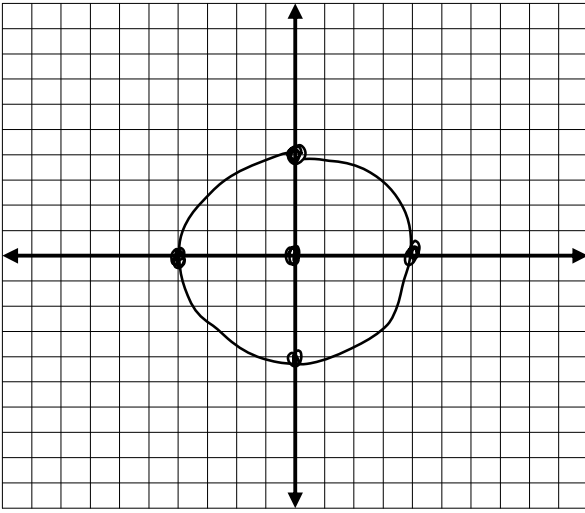
9) $(x - 3)^2 + (y + 2)^2 = 9$ circle
center: $(3, -2)$
 $r = 3$

10) $y^2 + 4y - 4x = 0$ Parabola
 $\frac{y}{2} = 2$ $y^2 + 4y + 4 = 4x + 4$ opens right
 $2^2 = 4$ $(y + 2)^2 = 4(x + 1)$ $4a = 4$
vertex: $(-1, -2)$ $a = 1$
focus: $(0, -2)$
directrix: $x = -2$

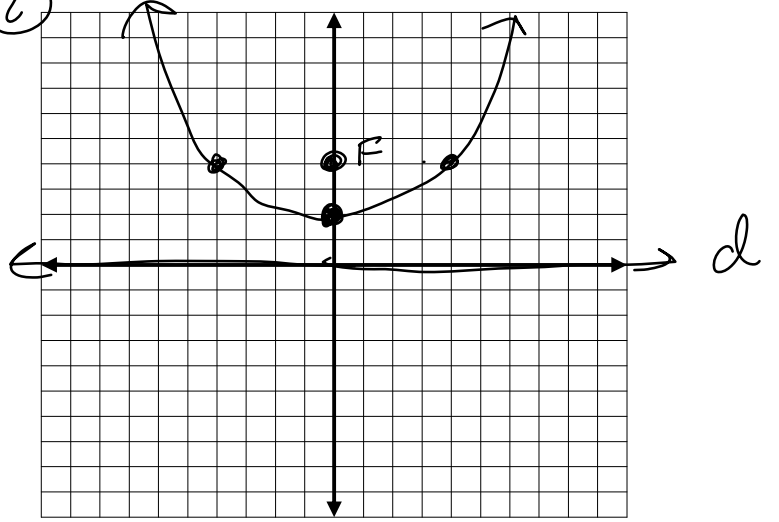
11) $\frac{x^2}{9} - \frac{y^2}{9} = \frac{9}{9}$ hyperbola
center: $(0, 0)$
 $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ vertices: $(3, 0), (-3, 0)$
 $a = 3$ $c^2 = 9 + 9$ $m = \pm 1$
 $b = 3$ $c = 3\sqrt{2}$ foci: $(3\sqrt{2}, 0), (-3\sqrt{2}, 0)$

12) $2x^2 + 4y^2 + 4x - 12y = 5$ ellipse
 $2(x^2 + 2x + 1) + 4(y^2 - 3y + 2.25) = 5 + 2 + 9$ center: $(-1, 1.5)$
 $2(x + 1)^2 + 4(y - 1.5)^2 = 16$ $a = 2\sqrt{2}$
 $\frac{(x + 1)^2}{8} + \frac{(y - 1.5)^2}{4} = 1$ $b = 2$
 $c^2 = 8 + 4$ foci: $(-1 + 2\sqrt{2}, 1.5)$
 $c^2 = 12$ $c = \sqrt{12} = 2\sqrt{3}$ $(-1 - 2\sqrt{3}, 1.5)$

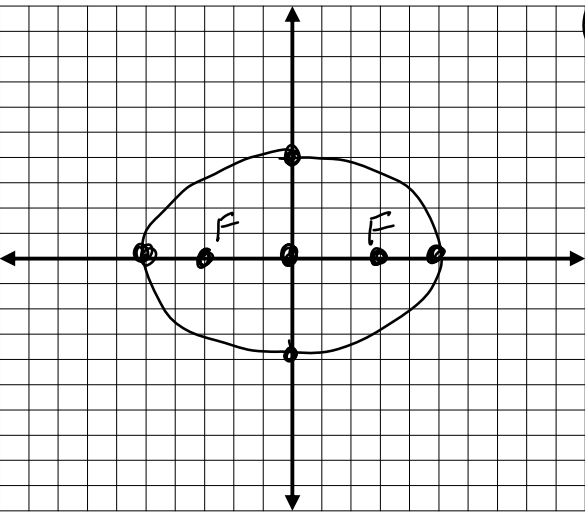
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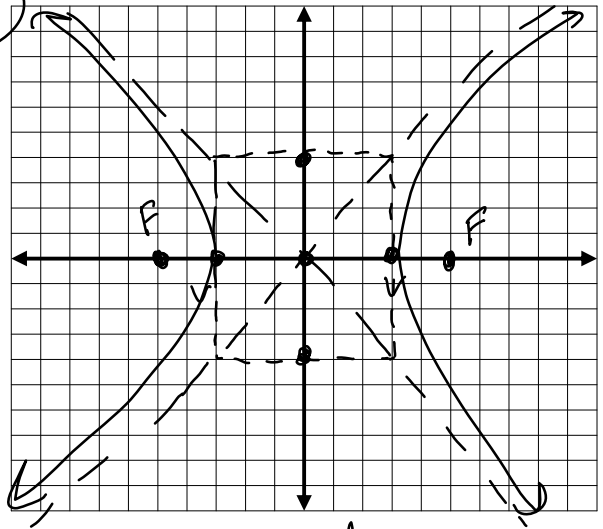
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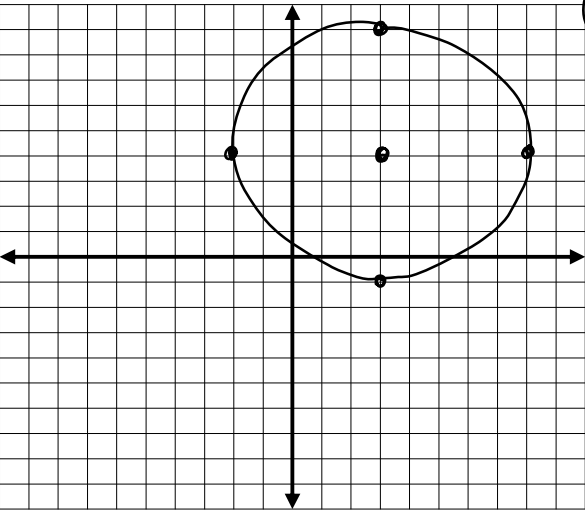
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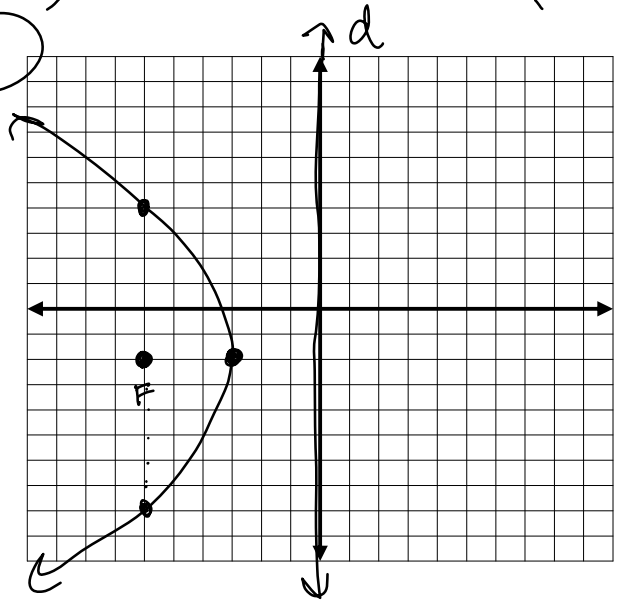
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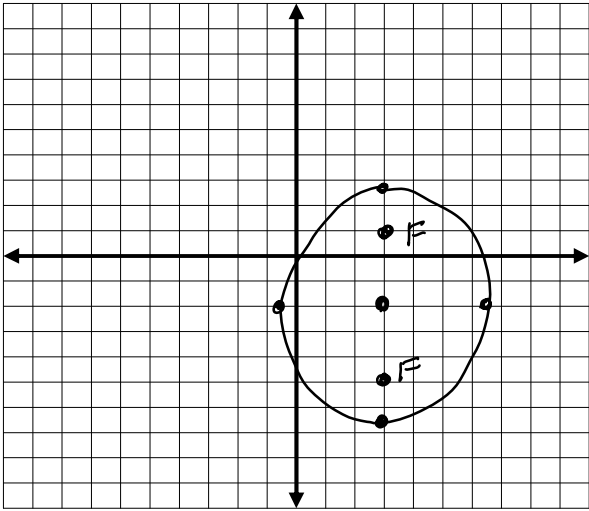
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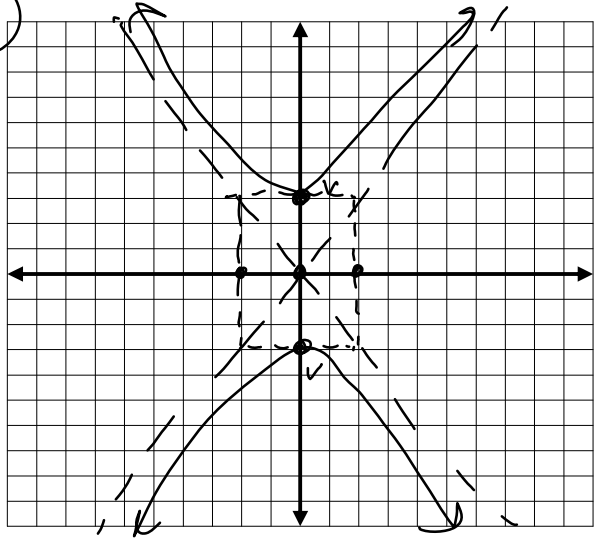
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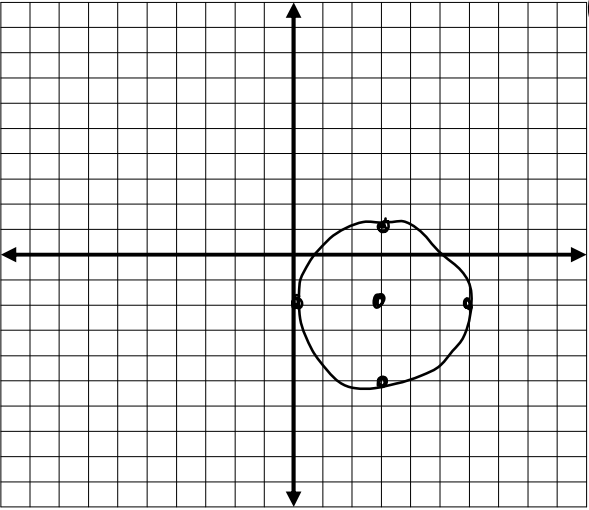
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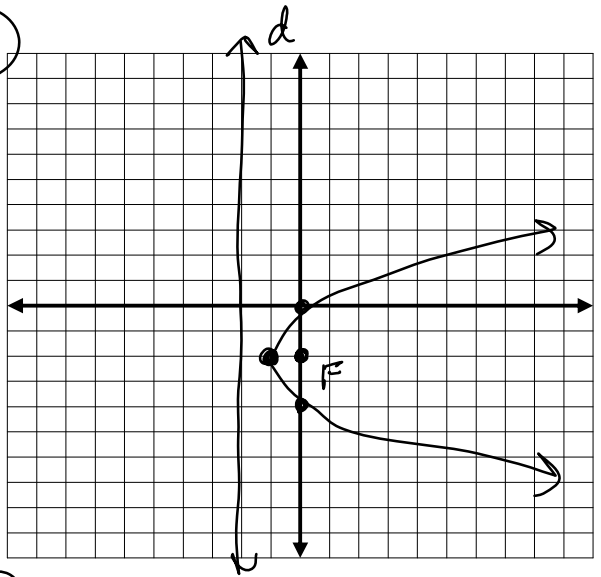
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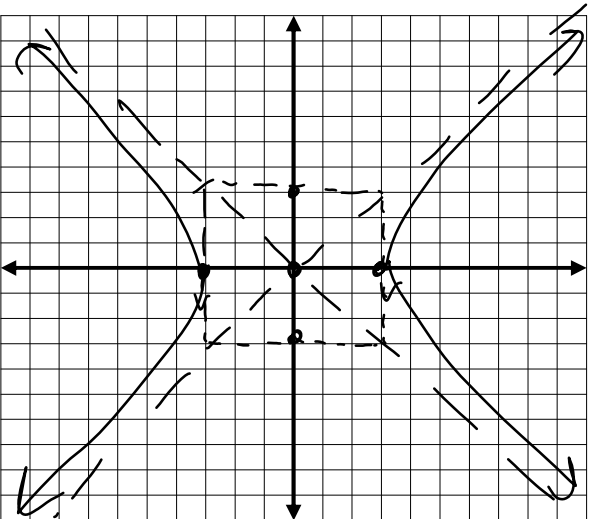
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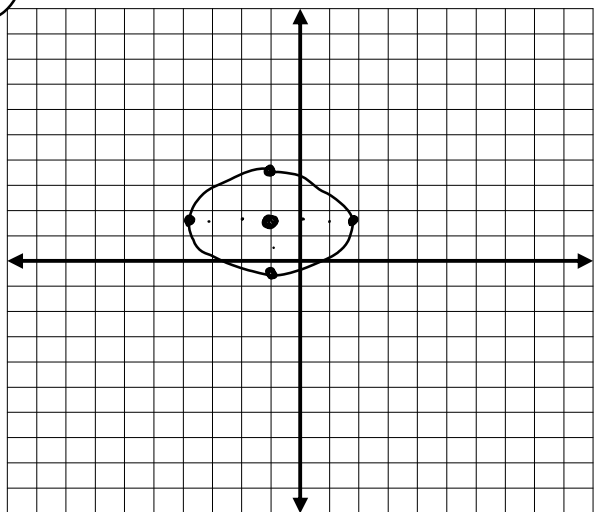
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Part III: For each of the following, write an equation in standard form.

1) Circle; center at (-4,1); radius = 7

$$1) \underline{(x+4)^2 + (y-1)^2 = 49}$$

2) Circle; center at (2,5); contains (5,9)

$$r = \sqrt{(5-2)^2 + (9-5)^2} = \sqrt{3^2 + 4^2} = \sqrt{25} = 5$$

$$2) \underline{(x-2)^2 + (y-5)^2 = 25}$$

3) Parabola; vertex at (0,2); Directrix x = -2



$$3) \underline{(y-2)^2 = 8x}$$

4) Parabola; vertex at (3,2); opens down, contains (1, -1)

$$a=2, 4a=8$$

Don't do

5) Ellipse; foci at (6,0) and (-6,0); minor axis length = 16

center: (0,0)

$$c=6, b=8$$



$$36 = a^2 - 64, 100 = a^2$$

$$5) \underline{\frac{x^2}{100} + \frac{y^2}{64} = 1}$$

6) Ellipse; foci at (0,3) and (0,-3); endpoints of major axis (0,5) and (0,-5)

center: (0,0)

$$c=3, a=5, b=?$$

$$9 = 25 - b^2, 16 = b^2, b=4$$

$$6) \underline{\frac{x^2}{16} + \frac{y^2}{25} = 1}$$

7) Hyperbola; foci at (13,0) and (-13,0); transverse axis length = 24

center: (0,0)

$$c=13, a=12, b=?$$

$$169 = 144 + b^2, 25 = b^2, b=5$$

$$7) \underline{\frac{x^2}{144} - \frac{y^2}{25} = 1}$$

8) Hyperbola; vertices (4,1) and (-4,1); ends of transverse axis at (0,4) and (0,-2)



center: (0,1), a=4, b=3

$$8) \underline{\frac{y^2}{16} - \frac{(x-1)^2}{9} = 1}$$

Part IV: Write parametric equations for each of the following.

1) An ellipse with major axis endpoints of (6,3), (-2,3) and minor axis endpoints of (2,6), (2,0).

center: (2,3)

$$a=4, b=3$$

$$X = 2 + 4 \cos t, Y = 3 + 3 \sin t$$

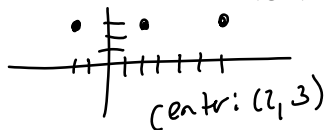
2) An ellipse with standard equation $\frac{(x+3)^2}{5} + \frac{(y-2)^2}{12} = 1$

$$X = -3 + \sqrt{5} \cos t, Y = 2 + 2\sqrt{3} \sin t$$

3) A hyperbola with vertices at (6,3), (-2,3) and foci at (7,3), (-3,3).

$$25 = 16 + b^2, a=b^2, b=3, c=5$$

$$a=4, c=5$$



$$X = 2 + 4 \sec t, Y = 3 + 3 \tan t$$

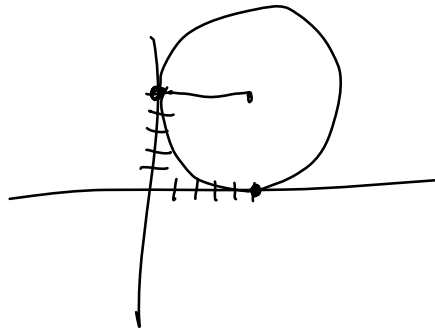
4) A hyperbola with standard equation $\frac{(x-3)^2}{16} - \frac{(y+2)^2}{9} = 1$

$$\frac{(y+2)^2}{9} - \frac{(x-3)^2}{16} = 1, a=3$$

$$X = 3 + 4 \tan t, Y = -2 + 3 \sec t$$

5) A circle that is tangent to the x-axis at (5,0) and the y-axis at (0,5).

$$X = 5 + 5 \cos t \quad Y = 5 + 5 \sin t$$



$$r = 5$$
$$\text{centr: } (5, 5)$$