1. Ellipse E is described by these parametric equations:

$x(t) = 3\cos(t) - 1$
$y(t) = 2\sin(t) + 2$

a. Write a rectangular (x-and-y) equation for ellipse E.

b. Find the coordinates of the foci (focal points) of ellipse E.

Now consider the linear transformation described by transformation equations $x' = 2x$, $y' = 3y$. Think about how the transformation acts geometrically. Let N be the image of ellipse E under this transformation.

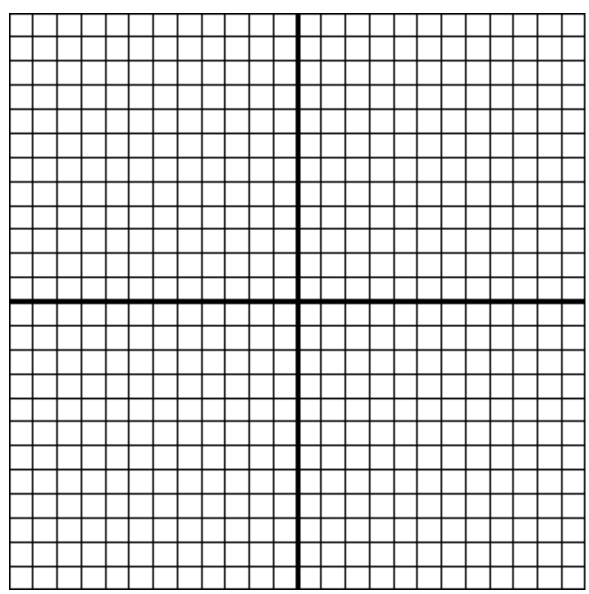
c. Write parametric equations for this new curve N.

$x(t) =$

$y(t) =$

d. Write a rectangular (x-and-y) equation for N, and say which type of curve it is.

e. On the given grid, [–12,12] by [–12,12], sketch graphs of ellipse E and the new curve N.



2. The equation $x^2 - 4y^2 + 6x + 8y + 21 = 0$ describes a non-degenerate conic section.

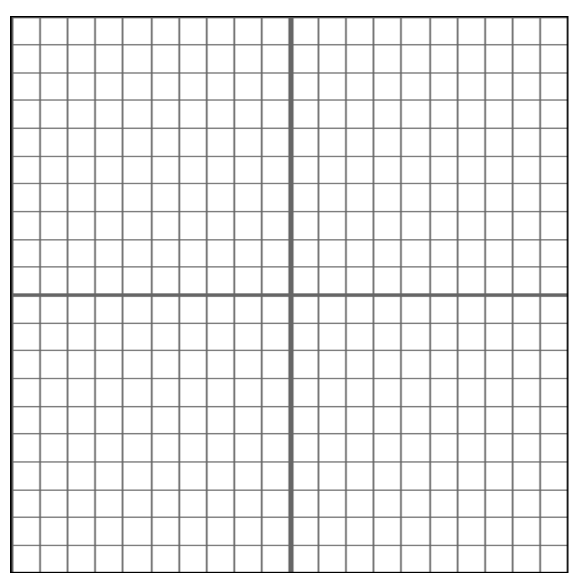
a. Which type of curve is this? Show a calculation that can be used to decide.

b. Use completing-the-square to rewrite the equation in a standard form for this type of curve.

c. Find the coordinates of the vertex or vertices.

d. Write equations for the asymptotes of the curve.

e. On the given grid, sketch a graph of the curve. Also draw the curve's asymptotes.



3. The equation $x^2 + 4xy + 4y^2 - x = 0$ describes a non-degenerate conic section.

a. Which type of curve is this? Show a calculation that can be used to decide.

b. The direction angle is an angle α between 0° and 90° satisfying $\tan(2\alpha) = \frac{B}{A-C}$.
Find the direction angle for this curve.

c. Rewrite the given equation in a form suitable for graphing on your calculator (that is, one or more equations of the form $y = \cdots$).

d. Sketch a graph of the curve obtained from your calculator. Also record the window dimensions that you've used.

Window dimensions:	*Graph:*
Xmin= Xmax= Ymin= Ymax=	

4. A parabola has its vertex at (1, –2) and its focus at (5, –2).

a. Make a rough sketch of the shape of this parabola. Include the parabola, its focus, and its directrix. Label the directrix with its equation.

b. Let (x, y) represent any point on the parabola. Write formulas for the following distances:

distance from (x, y) **to the focus** ______________________________

distance from (x, y) **to the directrix** ______________________________

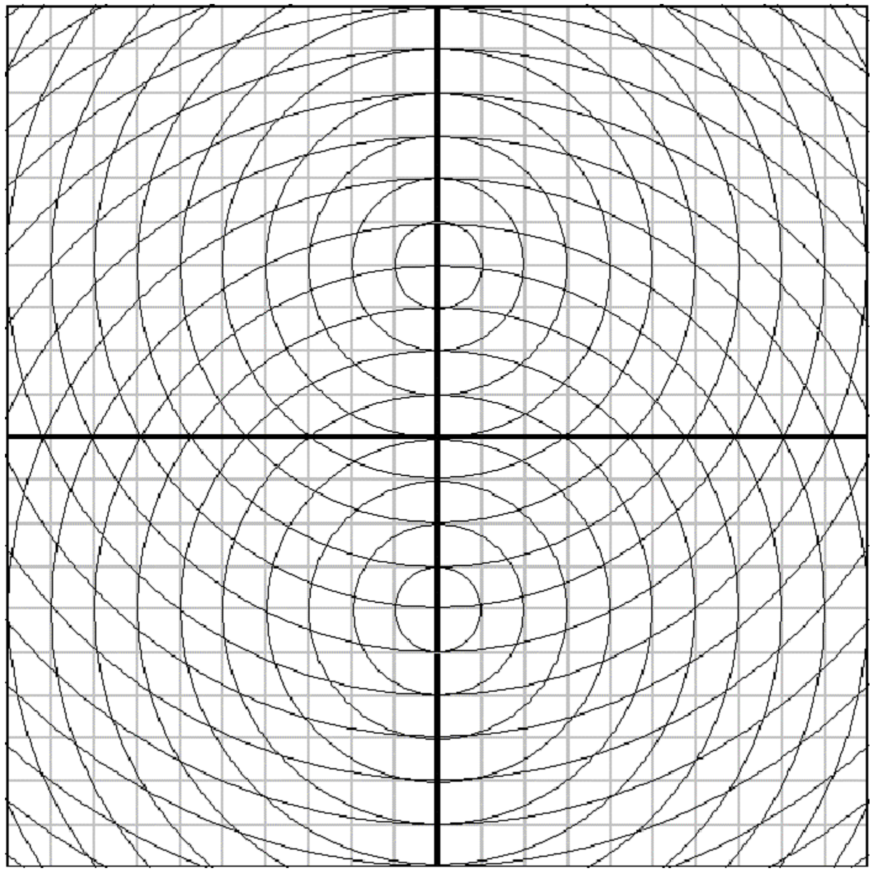
c. Write an equation for the parabola, using the two distance expressions from part **b**.

d. Algebraically transform the previous equation into vertex form (that is, into one of the standard general forms for parabolas).

e. Algebraically transform the previous equation into an equation or equations that could be used to graph the parabola on a calculator. (You do not have to do the graphing.)

5. The location of a secret treasure is mapped in the coordinate plane. Two other objects have known locations: a tree at (0, 4) and a rock at (0, –4). Here are two hints as to the location of the treasure:

- The treasure's location is 2 units further away from the tree than from the rock.
- If d_1 is the distance from the rock to the treasure and d_2 is the distance from the tree to the treasure, then the treasure is located at a point where $d_1 + d_2 = 10$.



a. On the special grid given, draw curves illustrating what each of the hints tells you about the locations of the treasure.

b. Clearly mark all possible locations of the treasure.

c. Find rectangular (x-and-y) equations for the curve you have drawn.

<u>equation from first clue</u>

<u>equation from second clue</u>

d. You should now have a system with two equations and two unknowns. Solve this system to find the coordinates of the treasure location(s).