Precalculus BC
Extra Problems on Conics and Other Stuff

Instructions: Do NOT work on this sheet. Show work, especially for #1 and #2, and do not use your NSpire to trivialize Algebra problems.

1. Consider the equation $\frac{(x-4)^2}{25}+\frac{y^2}{34}=1$. The largest possible x-coordinate of a point on the graph of this equation is…

(A) 4 (B) 5 (C) $\sqrt{34}$ (D) 9 (E) 29

2. The function whose graph is a reflection in the y-axis of the graph of $f(x) = 1 - 3^x$ is

(A) $g(x)=1-\frac{1}{3^x}$ (B) $g(x) = 1 + 3^x$ (C) $g(x) = 3^x - 1$ (D) $g(x) = \log_3 (x - 1)$ (E) $g(x) = \log_3(1 - x)$

3. Find the vertices and foci of the ellipse $x^2 + 4y^2 + 10x - 24y + 45 = 0$

4. If the foci of an ellipse are located at (4,0) and (-2,0), and the ellipse passes through (6,0), find its equation.

5. Find the coordinates of the focus of the parabola $x = \frac{1}{2}y^2 - \frac{1}{4}y + 2$. Write your answer as an ordered pair (x,y).

6. An ellipse has its minor (smaller) axis from (0,-4) to (0,4), and has foci $(\pm 6,0)$. Find its equation.

7. The *eccentricity* of an ellipse is defined as the ratio c/a. Compute the eccentricity of the ellipse $x^2 + 4x + 9y^2 - 18y = 122$

8. The moon orbits the earth in an ellipse; the apogee (farthest distance from the earth) is 252,710 miles, and the perigee (closest distance to earth) is 221,463 miles. Assuming that the Earth is at one focus of the ellipse, determine the major and minor axes of the ellipse and its eccentricity.

9. For what value(s) of k does the line with equation $y = kx + k$ pass through the vertex of the parabola with equation $y = 3x^2 + 24x + k$?

10. Simplify the expression $(1 + \cos x)(\csc^2 x - \cot x \csc x)$.

11. The parametric equations for the line through (2, -3, 2) and (-4, -3 4) can be written in the form

$x = a + bt$ $y = c + dt$ $z = 2 + t$.

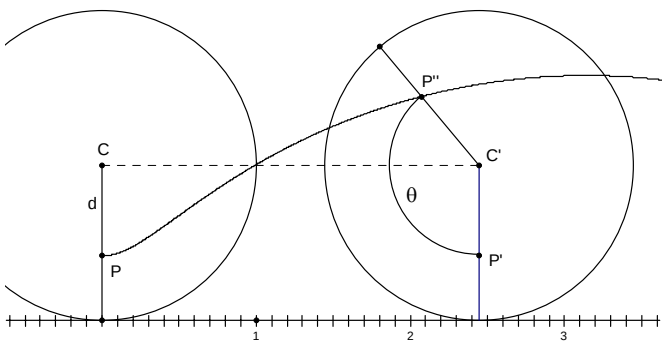
Find the ordered quadruple (a,b,c,d). [Notice that z is probably not exactly what you thought it would be—cope!]

12. To get more distance, the orange cannon brigade increases the muzzle velocity of the cannon to 500 m/s and puts the cannon on Payton's roof, 20m above ground. Find how far the cannon can shoot an orange if the launch angle is 51°.

13. The *cissoid of Diocles* is a curve whose equation is given by $y^2 (1 - x) = x^3$.

a. Solve for y and graph on your calculator.
b. You'll notice that the point (0,0) is on the graph (right?). Use the intersection method to find parametric equations for the curve: let t be the slope of the line through (0,0) intersecting the curve at $P(x,y)$, and solve for x and y in terms of t.
c. Now graph the cissoid on your calculator using the parametric form to verify that your graph is correct.
d. Last questions: Right away from the equation, you knew the graph had to be symmetric about which axis, and why? What value of x is impossible?

14. Suppose a projectile is launched from ground level at an angle of θ° with an initial velocity of 10 m/s. Let t_h be the amount of time it takes the projectile to hit ground. Find a formula for t_h in terms of θ. Then find the maximum distance the projectile travels (that is, its "range") in terms of θ.



15. A **trochoid** is the path traced by a point d units away from the center of a rolling disk of radius r. Derive parametric equations for the trochoid by expressing the vector $\overrightarrow{CC'}$ in terms of r and θ, and the vector $\overrightarrow{CP'}$ in terms of d and θ. (Of course, C is simply the point $(0,r)$).