MATH 120A - Spring 2003
Exam 2, Version 1 - Hints and Answers

1. (a) ANSWERS:
   - zero: 1
   - y-intercept: $-\frac{1}{7}$
   - vertical asymptote: $x = -\frac{7}{4}$ (Remember that the vertical asymptote is a *line*. Your answer should be the equation of a line.)
   - horizontal asymptote: $y = \frac{1}{4}$ (Remember that the horizontal asymptote is a *line*. Your answer should be the equation of a line.)

   (b) ANSWER: $f^{-1}(x) = \dfrac{-7x-1}{4x-1}$

2. (a) HINT: Use the identity $\sin^2\theta + \cos^2\theta = 1$.
   ANSWER: $\cos\theta = \pm\frac{\sqrt{273}}{17} = \pm 0.9719$

   (b) ANSWER: 7.14 inches

3. (a) ANSWER: $\frac{\pi}{3}$ radians per second

   (b) HINT: Let θ_0 be the angle from the horizontal to your initial location. It takes you 4 seconds to reach the bottom of the ride and you're travelling with an angular speed of $\frac{\pi}{3}$ radians per second. So, you go through an angle of $\frac{4\pi}{3}$ radians to reach the bottom of the ride. There are $\frac{3\pi}{2}$ radians from the positve horizontal to the bottom of the ride. So, $\theta_0 = \frac{3\pi}{2} - \frac{4\pi}{3} = \frac{\pi}{6}$. (There are other ways to express this angle. Any angle equal to $\frac{\pi}{6}\pm$ an integer multiple of 2π will also work.)
   ANSWER: Answers will vary depending on choice of origin. With the origin set on the ground at the base of the ride, the coordinates are:

   $$x(t) = 30\cos\left(\frac{\pi}{3}t + \frac{\pi}{6}\right) \text{ and } y(t) = 30\sin\left(\frac{\pi}{3}t + \frac{\pi}{6}\right) + 35.$$

   With the origin set at the center of the wheel, the coordinates are:

   $$x(t) = 30\cos\left(\frac{\pi}{3}t + \frac{\pi}{6}\right) \text{ and } y(t) = 30\sin\left(\frac{\pi}{3}t + \frac{\pi}{6}\right).$$

   (c) HINT: Origin on the ground: set $y(t) = 65$. Origin at the center: set $y(t) = 30$.
   ANSWER: $t = 1$ and $t = 7$ seconds

4. (a) ANSWER: $P(t) = 21\sin\left[\frac{2\pi}{8}(t-6)\right] + 45$

   (b) ANSWER: $P(0) = 66$ mole rats

   (c) HINT: Solve $21\sin\left[\frac{2\pi}{8}(t-6)\right]+45 = 50$ for t ($t = 6.306$). Then the symmetry solution is $t = 1.694$. The other solutions in the first 15 years are $t = 9.694$ and 14.306.
   ANSWER: 5.776 years.