MATH 175 – Section 004 – Quiz 8

You may work with other class members on this quiz, but you may not receive assistance from people not in MATH 175 (Section 004). You must show all of your work to receive full credit. Do all your work on other sheets of paper and be sure to staple all the pieces of paper together or YOU WILL GET A ‘ZERO’ ON THE QUIZ. Do not use decimal approximations unless asked to do so. You may use Maple only when explicit permission is given. Your work on this quiz must be handed in by Monday, 27 October 2003 at 1:40 p.m. GOOD LUCK!

1) Consider the curve given by the parametric equations

\[
\begin{align*}
  x &= \cos t \\
  y &= \sin^2 t 
\end{align*}
\]

(1)

a) Eliminate the parameter \( t \) to obtain an equation relating only \( x \) and \( y \).

b) Sketch the curve described by (1). Indicate how a point travels along your graph as \( t \) increases.

2) Consider the curve described by the parametric equations

\[
\begin{align*}
  x &= \cos^3 \theta \\
  y &= \sin^3 \theta 
\end{align*}
\]

a) Find \( \frac{dy}{dx} \) for this curve. Use this information to determine for which values of \( \theta \) the curve

i) has a horizontal tangent line.

ii) has a vertical tangent line.

iii) is increasing.

iv) is decreasing.

b) Find \( \frac{d^2y}{dx^2} \) for this curve. Use this information to determine for which values of \( \theta \) the curve

i) is concave up.

ii) is concave down.

c) Use the information obtained above to sketch the graph of this curve. Indicate with an arrow the direction of increasing \( \theta \).

d) Set up an integral to find the area bounded by the curve. Then use Maple to evaluate this integral.
e) Find the arc length of the curve.

f) Rotate the curve around the $x$-axis. Find the surface area of the resulting solid.

Do not use Maple to evaluate the integrals in parts e) and f). They are easily done by hand.