Differential Geometry Project 2: Curves Continued
You may work in a group of three and turn in one per group or you may work alone.

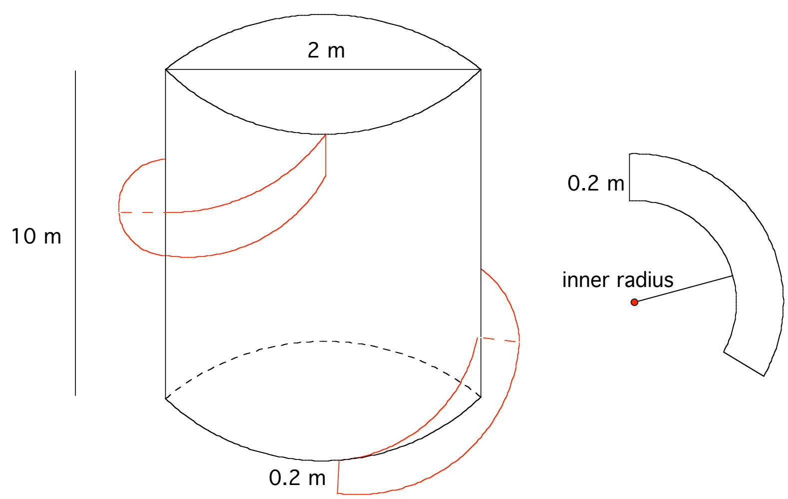
For computations, be sure to show your by-hand and/or Maple work.

Problem 1: Osculating Circle
Part A: Find the radius and equation of the circle that best fits the curve $y=x^2$ at (0,0).
Part B: Plot the curve and the circle in Maple on the same graph and print out your Maple commands and plot (you may wish to review solutions to the Calc 3 review problems).

Problem 2: Hyperbolic Helix
Part A: Do exercise 1.4.7 on page 31.
Part B: Plot the curve.
Part C: Search the web for the significance of the hyperbolic helix and report back on what you find.

Problem 3: Mystery Curve
Part A: First do part 4 of exercise 1.3.11 on page 21.
Part B: Then continue with exercise 1.5.4 on page 36 (follow the directions for the hint in the back of the book).

Problem 4: Strakes



Part A: Compute the ideal value for the inner radius of the annulus
Part B: Using your answer in Part A, build a model of the annulus and the cylinder that is to scale.
Part C: Can the flat annulus exactly fit a piece of the strake? Clearly the strake is not planar as it stands. But can the annular piece of steel be bent without stretching/stressing it in order to produce the strake? Ie is the local intrinsic geometry of the strake the same as the local geometry of the plane?
To answer these questions:
First test out your model in Part B. Consider the inner and outer edges of the strake and the annulus. (Notice that both the outer and inner edges of the strake are helixes.)

1) Compute and show work (by-hand and/or Maple work) for the curvatures and arc lengths of the inner and outer edges of the annulus and the corresponding inner and outer edges of the helical strake.
2) So you will have 8 computations (inner annulus curvature, inner annulus arc length, outer annulus curvature, outer annulus arc length, inner helix curvature, inner helix arc length, outer helix curvature, outer helix arc length). Do the inner annulus and inner helix computations agree? Do the outer annulus and outer helix computations agree? If not, how much are they off and how much stress is this on the strake?

Part D: What happens if we make the strake very wide compared to the diameter of the cylinder, such as in an auger below. Can this be made physically from an annulus? Explain why or why not.

Auger