

## Maple Questions

Here are some sample Maple assessment questions for this chapter. (Includes 1 "Diff Geom" problem).

1. Create a worksheet which first allows the user to input a level surface and a point on the surface, and then graphs the surface and the gradient to the surface at the given point.
2. Find a parameterization of the parabola formed by the intersection of  $z = 4 + x$  and the right circular cone  $x^2 + y^2 = z^2$ . Where is the vertex of the parabola? What is the length of the section of the parabola below the plane  $z = 8$ ?
3. Create a worksheet which first allows a user to input a curve and a straight line. The worksheet should then construct the surface which results from revolving the curve about the straight line. It should also calculate the fundamental form of the surface, and then should calculate the length of the original curve using the fundamental form. It should match the result from calculating the length of the user's input curve directly.
4. Create a worksheet which calculates a Jacobian matrix of a 3-dimensional coordinate transformation

$$T(u, v, w) = \langle x(u, v, w), y(u, v, w), z(u, v, w) \rangle$$

and show that it maps a tangent vector to a curve in  $uvw$ -coordinates to a tangent vector to the image of the curve in  $xyz$ -coordinates.

5. DIFF GEOM: Create a worksheet that calculates the principle curvatures of the surface and draws osculating circles along the directions in which normal curvature is optimized. For negative curvature, the osculating circles should be on opposite sides of the surface.