

1. Find the scale functions (h 's) for the transformation from Cartesian (x, y, z) to (u, v, w) coordinates:

$$x = \frac{a \sinh(v)}{\cosh(v) - \cos(u)}$$

$$y = \frac{a \sin(u)}{\cosh(v) - \cos(u)}$$

$$z = w$$

2. Consider the function $f(x) = 2\theta(x)\theta(2-x) + (6-2x)\theta(x-2)\theta(3-x)$
- (a) Plot $f(x)$ vs. x . Label the vertical and horizontal axes numerically at interesting parts of the graph.
 - (b) List the first six non-zero terms in a Fourier decomposition of $f(x)$ that will match $f(x)$ in the interval for $0 < x < 5$.
3. <http://tutorial.math.lamar.edu/Classes/CalcIII/DivergenceTheorem.aspx>
4. Use the Lagrangian formulation of mechanics to answer this question: A wedge of mass m is placed on a frictionless horizontal surface and a block also of mass m is placed on the frictionless slope of the wedge. The block is connected to an inextensible string that passes over a massless, frictionless pulley that is attached to the wedge. The other end of the string is attached to the wall. The string is horizontal between the wall and the pulley, and the string is parallel to the slope of the wedge between the pulley and the block. The angle θ is given.
- (a) Find the acceleration of the wedge to the left in terms of g and θ .
 - (b) What angle θ maximizes the acceleration of the wedge?

