1.) Consider the above map for the average annual rainfall in South America.
   a.) Estimate the average total amount of rain per year over South America.
      (You may make very crude estimates, but you must clearly show your methodology.)
   b.) Is your estimate an under- or an overestimate? Justify.
   c.) What does this have to do with chapter 18, i.e. with area and volume integrals?

2.a.) Sketch the graph of the equation \( r = 3 + 2 \cos(8\varnothing) \).
   b.) Compute the area of the flower-like region bounded by \( r = 3 + 2 \cos(8\varnothing) \).
   c.) Explain the presence of the \( r \) in \( r \, dr \, d\varnothing \) (in area integrals in polar coordinates).

3.) Sketch the region \( R = \{(x, y, z) : (x^2 + y^2)/3 \leq z^2 \leq 1 - x^2 - y^2, \; z \geq 0 \} \), in a coordinate system.
   (that is, the region inside the sphere \( x^2 + y^2 + z^2 = 1 \), and \textit{inside} the cone \( \sqrt{3}z = \sqrt{x^2 + y^2} \).
   b.) Find the volume of the region \( R \).

4.) Let \( R \) be the pyramid with vertices \( A(0, 0, 0), \; B(0, 0, 1), \; C(0, 1, 0) \) and \( D(1, 1, 0) \).
   a.) Draw a picture of the pyramid in a coordinate system.
   b.) Find the equations of the four planes bounding the pyramid.
   c.) If \( f(x, y, z) \) is a function defined on \( R \), the volume integral \( \iiint_R f(x, y, z) \, dV \) can be written as an iterated integral
      \( \int_a^b \int_c^d \int_e^f f(x, y, z) \, dz \, dy \, dx \). Find the limits \( a, b, c, d, e, f \) for this integral.
   d.) Evaluate the integral \( \iiint_R xy \, dV \).