The assigned homework exercises after Test 1 form the coverage for Test 2. The following items are additional practice problems.

1. Plot the point \((x, y, z) = (2\sqrt{2}, -2\sqrt{6}, 3)\) in the cartesian coordinate 3-space. Draw a rectangular box where the point is a vertex of the box. Label the coordinate axes. Then determine the cylindrical coordinates \((r, \theta, z)\) of the point.

2. Evaluate \(\int_0^1 \int_\sqrt{3y}^{\sqrt{1-y^2}} y \, dx \, dy\) by changing the variables to polar coordinates. Sketch and shade the region of integration in the \(xy\)-plane. Also, sketch and shade the region of integration in the polar coordinate plane. Label the coordinate axes.

3. Evaluate \(\int_0^1 \int_0^{\sqrt{2-x}} dy \, dx\) by changing the variables to polar coordinates. Sketch and shade the region of integration in the \(xy\)-plane. Also, sketch and shade the region of integration in the polar coordinate plane. Label the coordinate axes.

4. Let \(F(x, y) = \left(\frac{1}{y} e^{x/y}, -\left(\frac{x}{y^2} e^{x/y} + \pi \sin(\pi y)\right)\right)\) be a vector field. Let \(C\) be a line segment that is parametrized by \(r(t) = (t, -2t + 3), 0 \leq t \leq 1\). Apply the Fundamental Theorem for Line Integrals in evaluating the line integral \(\int_C F \cdot dr\).

5. \(\int \int_R (x + y) \, dA\) where \(R\) is the triangular region with vertices \((0,0), (2,1),\) and \((1,2)\). Apply the change of variables \(u = -x + 2y\) and \(v = x + y\).

6. Let \(F(x, y) = (8xy, 6x^2)\) be a vector field. Let \(C\) be a triangular path in the \(xy\)-plane from the origin to point \((1, 2)\) to point \((0, 2)\) and to the origin. Apply Green’s Theorem in evaluating the line integral \(\int_C F \cdot dr\).

7. Sketch the solid \(M\) in the first octant that is bounded by the graphs of \(x^2 + y^2 = 1, x^2 + y^2 + z^2 = 4,\) and the coordinate planes. Label the coordinate axes. Use cylindrical coordinates to set up an integral for the volume of \(M\). Then evaluate the integral.