2. (3 points) Determine $\int_C y^2\,dx + z\,dy + x\,dz$, where C is the line segment which connects $(2, 0, 0)$ to $(3, 4, 5)$.

   Solution.

3. (3 points) Determine $\int_C \frac{1}{x^2 + y^2 + z^2}\,ds$, where C is given by $\langle \cos t, \sin t, t \rangle$, $0 \le t \le \pi$.

   Solution.

4. (3 points) Let $\mathbf{F}(x, y) = 3x^2y^2\mathbf{i} + (2x^3y + 5)\mathbf{j}$. Find a scalar function f such that $\nabla f = \mathbf{F}$ and use this to determine $\int_C \mathbf{F} \cdot d\mathbf{r}$ where C is given by $\mathbf{r}(t) = (t^3 - 2t)\mathbf{i} + (t^3 + 2t)\mathbf{j}$ for $0 \le t \le 1$.

   Solution.

5. (2 points) Set up, but do not evaluate the "direct" integral for the previous problem. Then, use your calculator to determine a numerical approximation for the integral. Did you get the same answer?

   Solution.

6. (3 points) Find the work done by the force field $\mathbf{F} = x^2\mathbf{i} + y^3\mathbf{j}$ in moving an object from $(1, 0)$ to $(2, 2)$.

   Solution.

7. (3 points) For what value(s), if any, of a is $(3x^2y + az)\mathbf{i} + x^3j + (3x + 3z^2)\mathbf{k}$ conservative?

   Solution.

8. (3 points) Find the circulation of $\mathbf{F} = xy\mathbf{i} + x^2y^3\mathbf{j}$ along C, where C is the counter-clockwise oriented triangle with vertices $(0, 0)$, $(1, 0)$, and $(1, 2)$. Determine the value of this integral by working three separate line integrals.

   Solution.

9. (3 points) Find the flux of $\mathbf{F} = xy\mathbf{i} + x^2y^3\mathbf{j}$ over C, the same counter-clockwise oriented triangle with vertices $(0, 0)$, $(1, 0)$, and $(1, 2)$ as in the previous problem (notice that the vector field is the same as well). Determine this by working three separate line integrals.

   Solution.