1. $1 - e^{-\frac{1}{2}}$.
2. a). $\Phi : D \to \mathbb{R}^3$ given by $\Phi(u, v) = (u, v, \frac{1}{3}u^3 + v\sqrt{2} + 3)$.
   b). $\frac{2}{3}(8 - 3\sqrt{3})$.
3. a). positive
   b). negative
   c). 0
   d). positive
   e). 0
4. a). $\iint_S \nabla \times \overline{F}.d\overline{S} = \int_{\partial S} \overline{F}.d\overline{s}$
   b). $\frac{3\pi}{2}$.
5. a). $\frac{4\pi}{15}$
   b). Using the divergence theorem $\iint_{\partial W} \overline{F}.d\overline{S} = \iiint_W \text{div}\overline{F}dV$. It is then easy to see (using part a) the answer is $\frac{-4\pi}{5}$.
6. π.
7. $\frac{1}{6}(5\sqrt{5} - 1)$.

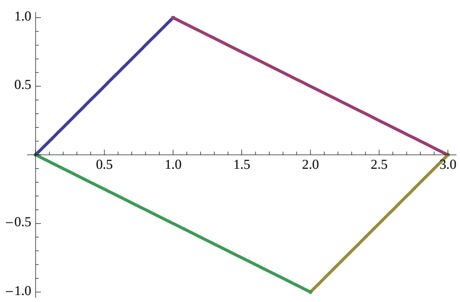

Figure 1: Parallelogram from problem 8.

8. a). See the parallelogram above.
   b.) $\frac{33}{4}$.
9. a). $\frac{1}{12}$.
   b). $(\frac{3}{5}, \frac{1}{2})$.
10. 4 units^3.
11. a). $\frac{-2\pi}{3}$.
    b). If there was such a function, then

$$\int_C \overline{F}.d\overline{s} = \int_C \nabla f.d\overline{s} = f(1, 0, 0) - f(1, 0, 0) = 0.$$

Therefore, this cannot happen.