

## Worksheet for Sections 15.1-15.2

1. Let  $\mathbf{F} = y \sin z \mathbf{i} + (x \sin z + z) \mathbf{j} + (xy \cos z + y + 2z) \mathbf{k}$ . Determine whether  $\mathbf{F}$  is the gradient of some function  $f$ . If it is, find  $f$ .

2. Let  $f(x, y, z) = (x^2 + y^2 + z^2)^{-1/2}$ . Show that

$$\Delta f = \nabla \cdot \nabla f = 0$$

3. Let a force  $\mathbf{F}$  be given by

$$\mathbf{F}(x, y, z) = y \mathbf{i} + x \mathbf{j} + z^3 \mathbf{k}.$$

Find the work  $W$  done by the force  $\mathbf{F}$  on an object that moves from  $(1, 0, 0)$  to  $(0, 1, \pi)$

(a) along a straight line.

(b) along a helix parameterized by  $\mathbf{r}(t) = \cos t \mathbf{i} + \sin t \mathbf{j} + 2t \mathbf{k}$  for  $0 \leq t \leq \pi/2$ .