Assignment 2

Due in class on Monday, 4/4/11

Problem 1

(a) Find the temperature $T$ at $(x, y, z) = (1, 2, 3)$ if $T = x + 2y + 3z$.

(b) Find the work done by the force field $\mathbf{F}(x, y, z) = (x^2, y^2, z^2)$ along the curve $\mathbf{r}(t) = (t^2, t^3, t)$ from $t = 0$ to $t = 2$.

Problem 2

(a) Find the flux of the vector field $\mathbf{F}(x, y, z) = (x^2, y^2, z^2)$ through the surface $S$ bounded by the planes $x = 0$, $y = 0$, $z = 0$, and $x + y + z = 1$.

(b) Find the divergence of the vector field $\mathbf{F}(x, y, z) = (x^2, y^2, z^2)$.

Problem 3

(a) Find the gradient of the scalar field $f(x, y, z) = x^2y^3z^4$.

(b) Find the directional derivative of $f(x, y, z) = x^2y^3z^4$ in the direction of the vector $\mathbf{v} = (1, 2, -1)$ at the point $(1, 2, 3)$.

Problem 4

(a) Find the line integral of the vector field $\mathbf{F}(x, y, z) = (x^2, y^2, z^2)$ along the curve $C$ parameterized by $\mathbf{r}(t) = (t^2, t^3, t)$ from $t = 0$ to $t = 2$.

(b) Find the curl of the vector field $\mathbf{F}(x, y, z) = (x^2, y^2, z^2)$.

Problem 5

(a) Find the divergence of the vector field $\mathbf{F}(x, y, z) = (x^2, y^2, z^2)$.

(b) Find the line integral of the vector field $\mathbf{F}(x, y, z) = (x^2, y^2, z^2)$ along the curve $C$ parameterized by $\mathbf{r}(t) = (t^2, t^3, t)$ from $t = 0$ to $t = 2$.

Problem 6

(a) Find the gradient of the scalar field $f(x, y, z) = x^2y^3z^4$.

(b) Find the directional derivative of $f(x, y, z) = x^2y^3z^4$ in the direction of the vector $\mathbf{v} = (1, 2, -1)$ at the point $(1, 2, 3)$.

Problem 7

(a) Find the line integral of the vector field $\mathbf{F}(x, y, z) = (x^2, y^2, z^2)$ along the curve $C$ parameterized by $\mathbf{r}(t) = (t^2, t^3, t)$ from $t = 0$ to $t = 2$.

(b) Find the curl of the vector field $\mathbf{F}(x, y, z) = (x^2, y^2, z^2)$.

Problem 8

(a) Find the divergence of the vector field $\mathbf{F}(x, y, z) = (x^2, y^2, z^2)$.

(b) Find the line integral of the vector field $\mathbf{F}(x, y, z) = (x^2, y^2, z^2)$ along the curve $C$ parameterized by $\mathbf{r}(t) = (t^2, t^3, t)$ from $t = 0$ to $t = 2$.