M252

Formula Recitation
chapters 13-15

For $z = f(x,y)$ the total differential is

$dz =$

For $w = f(x,y)$, $x = g(t)$, $y = h(t)$
the chain rule becomes

$\frac{dw}{dt} =$

For $w = f(x,y)$, $x = g(s,t)$, $y = h(s,t)$
the chain rule becomes

$\frac{\partial w}{\partial s} =$ $\frac{\partial w}{\partial t} =$

For $z = f(x,y)$ the gradient of f is

The directional derivative of $f(x,y)$ in the direction of the unit vector $\vec{u}$ is

$D_u f(x,y) =$

A normal vector to the surface $f(x,y,z)=0$ at the point (x_0, y_0, z_0) is

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The equation of the tangent plane to the surface $f(x,y,z)=0$ at the point (x_0, y_0, z_0) is

The area of the surface $z = f(x, y)$ over the region R is

surface area =

Definition of Conservative Vector Field.
A vector field F is called conservative if

Test for Conservative vector field.

$\vec{F}(x,y) = \langle M, N \rangle$ is conservative if and only if

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The curl of $\vec{F}(x,y,z) = \langle M, N, P \rangle$ is defined as

Test for Conservative Vector Field.

$\vec{F}(x,y,z) = \langle M, N, P \rangle$ is conservative if and only if

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The divergence of the vector field $\vec{F}(x,y,z) = \langle M, N, P \rangle$ is

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For the smooth curve C given by $\vec{r}(t) = x(t)\vec{i} + y(t)\vec{j} + z(t)\vec{k}$ $\quad a \le t \le b$ the line integral becomes

$$\int_C f(x,y,z)\,ds =$$

For $\vec{r}(t) = x(t)\vec{i} + y(t)\vec{j} + z(t)\vec{k}$ the arc length differential becomes

$ds =$

For the smooth curve C given by $\vec{r}(t)$, $a \le t \le b$ the line integral of the vector field $\vec{F}$ in terms of $\vec{r}$, s, and t is

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The Fundamental Theorem of Line Integrals for the conservative vector field $F(x,y) = M\vec{i} + N\vec{j}$ and the piecewise smooth curve C given by $\vec{r}(t) = x(t)\vec{i} + y(t)\vec{j}$ $a \le t \le b$ states

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Let R be a simply connected region with a piecewise smooth boundary C, oriented clockwise, then Green's Theorem states