Cram

pierson

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1 Polar

$$x \to r\cos(\theta)$$
$$y \to r\sin(\theta)$$
$$da \to rdrd\theta$$
$$x^2 + y^2 = r^2$$

Converting Cords

$$x = \rho\sin\varphi\cos\theta$$
$$x = \rho\sin\varphi\sin\theta$$
$$z = \rho\cos\varphi$$

$$\rho^2 = x^2 + y^2 + z^2$$

To cylindrical ...

$$r = \sqrt{x^2 + y^2}$$
$$\theta = \arctan(\frac{y}{x})$$
$$z = z$$

To spherical ...

$$r^2 = x^2 + y^2 + z^2$$
$$\theta = \arctan(\frac{y}{x})$$
$$\theta = \arccos(\frac{z}{\rho})$$

2 Vector fields and such

A curve C given by... $\quad r = \langle x(t), y(t) \rangle, \quad a \leq t \leq b$

$$\int_C \sqrt{1+9xy} ds, \qquad C = r(t) = \langle t, t^3 \rangle, \quad 0 \leq t \leq 1$$

$$\int_0^1 \sqrt{1+9t^4}\sqrt{1+9t^4} dr, \quad r(t)' = \langle 1, 3t^2 \rangle, \quad r(t)' = \sqrt{1+9t^4}$$

$$\int_1^4 1 + 9t^4$$

$$t + \frac{9t^5}{5}|_0^1$$

$$1 + \frac{9}{5}$$

2.1 Greens theorom

$$\int_c P dx + Q dy = \int \int_D \frac{\partial Q}{\partial x} \frac{\partial P}{\partial Y} \text{dxdy}$$

Example ...

$$\int_0^1 xy + y^2 dx dy \rightarrow \int_0^1 \int_0^1 \frac{\partial}{\partial x} x^2 - \frac{\partial}{\partial y} xy \text{dxdy}$$

$$\int_0^1 \int_0^1 2x - x \text{dxdy}$$

$$\int_0^1 \int_0^1 x \text{dxdy}$$

$$\int_0^1 1/2 \text{dy}$$

$$= 1/2$$