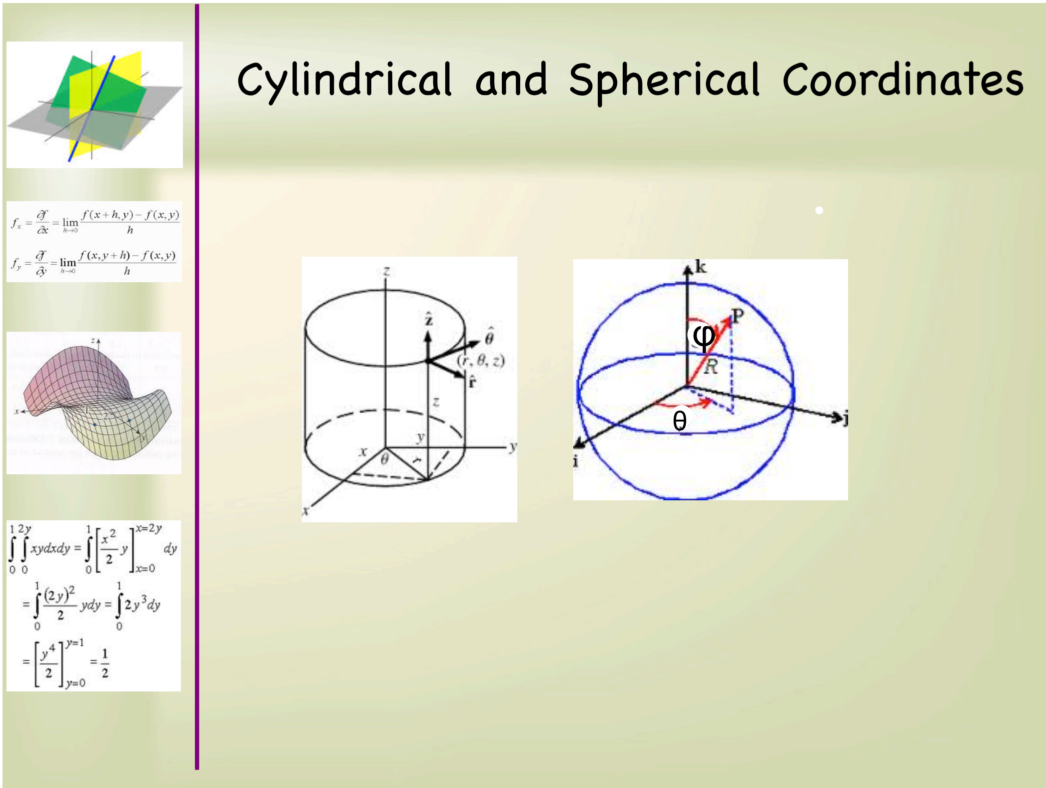
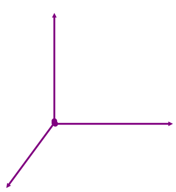
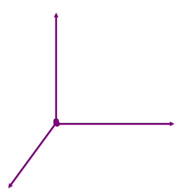
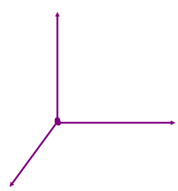


We can describe a point, P, in three different ways.

Cartesian | Cylindrical | Spherical







Cylindrical Coordinates

$x = r\cos\theta$ $\qquad$ $r = \sqrt{x^2 + y^2}$

$y = r\sin\theta$ $\qquad$ $\tan\theta = y/x$

$z = z$ $\qquad$ $z = z$

Spherical Coordinates

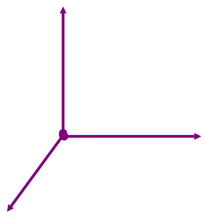
$x = \rho\sin\varphi\cos\theta$ $\qquad$ $\rho = \sqrt{x^2 + y^2 + z^2}$

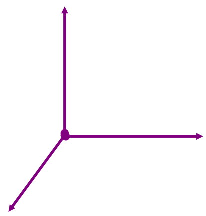
$y = \rho\sin\varphi\sin\theta$ $\qquad$ $\tan\theta = y/x$

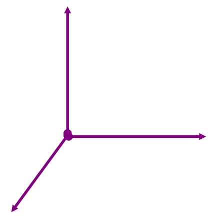
$z = \rho\cos\varphi$ $\qquad$ $\cos\varphi = \dfrac{z}{\sqrt{x^2 + y^2 + z^2}}$

Easy Surfaces in Cylindrical Coordinates

a) $r = 1$ b) $\theta = \pi/3$ c) $z = 4$

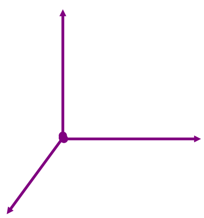


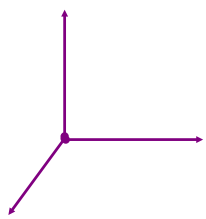


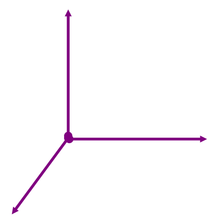


Easy Surfaces in Spherical Coordinates

a) $\rho = 1$ b) $\theta = \pi/3$ c) $\varphi = \pi/4$







EX 1 Convert the coordinates as indicated

a) $(3, \pi/3, -4)$ from cylindrical to Cartesian.

b) $(-2, 2, 3)$ from Cartesian to cylindrical.

EX 2 Convert the coordinates as indicated

a) $(8, \pi/4, \pi/6)$ from spherical to Cartesian.

b) $(2\sqrt{3}, 6, -4)$ from Cartesian to spherical.

EX 3 Convert from cylindrical to spherical coordinates.

$(1, \pi/2, 1)$

EX 4 Make the required change in the given equation.

a) $x^2 - y^2 = 25$ to cylindrical coordinates.

b) $x^2 + y^2 - z^2 = 1$ to spherical coordinates.

c) $\rho = 2\cos\varphi$ to cylindrical coordinates.

EX 4 Make the required change in the given equation (continued).

d) $x + y + z = 1$ to spherical coordinates.

e) $r = 2sin\theta$ to Cartesian coordinates.

f) $\rho sin\,\theta = 1$ to Cartesian coordiantes.