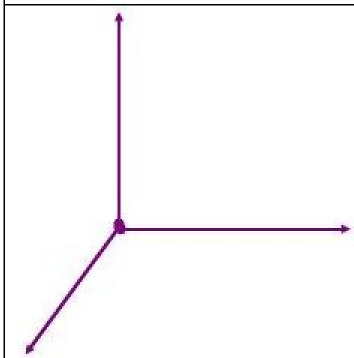
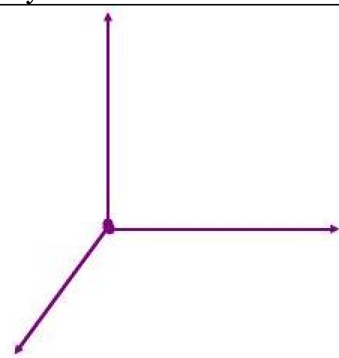
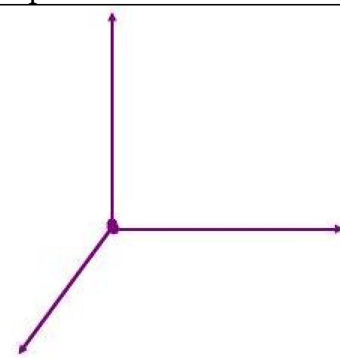
Math 2210 #9
Cylindrical and Spherical Coordinates

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

Cartesian	Cylindrical	Spherical
		

Cylindrical Coordinates

$x = r\cos\ \theta$
$y = r\sin\ \theta$
$z = z$

$$r = \sqrt{x^2 + y^2}$$
$$\tan\ \theta = y/x$$
$$z = z$$

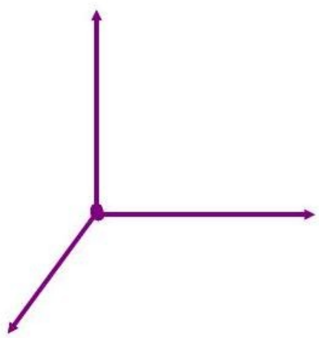
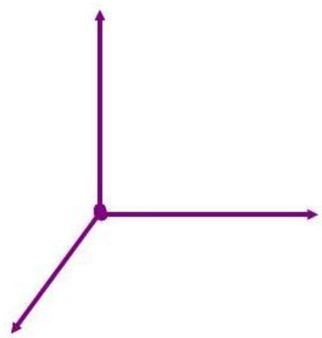
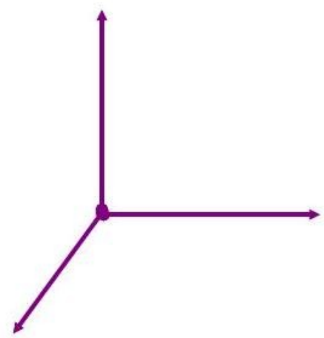
Spherical Coordinates

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

$$\rho = \sqrt{x^2 + y^2 + z^2}$$
$$\tan\ \theta = y/x$$
$$\cos\ \varphi = \frac{z}{\sqrt{x^2 + y^2 + z^2}}$$

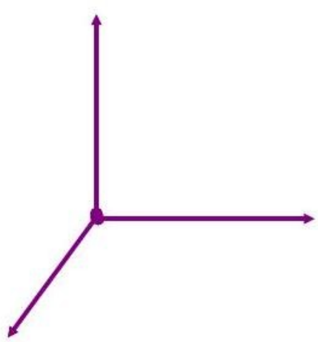
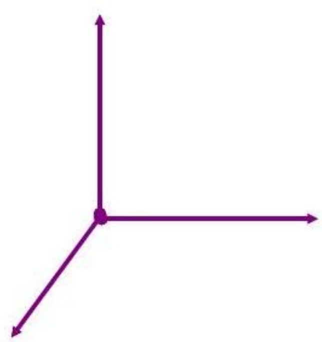
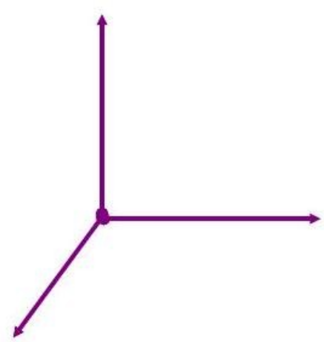
Easy Surfaces in Cylindrical Coordinates

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

Easy Surfaces in Spherical Coordinates

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

EX 1

Convert the coordinates as indicated

1a)

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

1b)

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

EX 2

Convert the coordinates as indicated

2a)

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

2b)

$(2\sqrt{3}, 6, -4)$ 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.

4a)

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

4b)

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

4c)

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

EX 4

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

4d)

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

4e)

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

4f)

$\rho\sin\ \theta = 1$ to Cartesian coordiantes.