

## Supplemental Exercises for Section 15.6

Find spherical coordinates for each of the points below given in rectangular coordinates.

1.  $(0, 0, 0)$
2.  $(0, 0, 1)$
3.  $(0, -1, 0)$
4.  $(1, 0, 0)$
5.  $(1, 1, 0)$
6.  $(1, 0, 1)$
7.  $(0, 1, 1)$
8.  $(-1, 1, 0)$
9.  $(0, -1, -1)$
10.  $(\sqrt{3}, 1, 2\sqrt{3})$
11.  $(-1, 1, -1)$
12.  $(1, 1, -1)$

Find rectangular coordinates for each of the points below given in spherical coordinates.

13.  $(\sqrt{3}, \frac{\pi}{3}, \frac{-\pi}{2})$
14.  $(2\sqrt{2}, \frac{\pi}{2}, \frac{3\pi}{2})$
15.  $(\sqrt{2}, \pi, \pi)$
16.  $(2\sqrt{2}, \frac{\pi}{6}, \frac{3\pi}{4})$

In the following translate the given equation and inequalities from the given coordinate system (rectangular or spherical) into the other.

17.  $z = \sqrt{x^2 + y^2}, z \leq 1$
18.  $x^2 + y^2 + (z - \frac{1}{2})^2 = \frac{1}{4}$
19.  $\rho = 5 \cos \phi$
20.  $\rho = \sqrt{2} \csc \phi$
21.  $x^2 + y^2 + (z - 1)^2 = 1, z \leq 1$
22.  $\rho = 3, \frac{\pi}{3} \leq \phi \leq \frac{2\pi}{3}$

23.  $\phi = \frac{3\pi}{4}, 0 \leq \rho \leq 2$

**SELECTER ANSWERS**

3.  $(1, 0, \frac{3\pi}{2})$

5.  $(\sqrt{2}, \frac{\pi}{2}, \frac{\pi}{4})$

11.  $(\sqrt{3}, \arccos -\frac{1}{\sqrt{3}}, \frac{3\pi}{4})$

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

14.  $(0, -2\sqrt{2}, 0)$

17.  $\phi - \frac{\pi}{4}, 0 \leq \rho \leq \sqrt{2}$

19.  $x^2 + y^2 + (z - \frac{5}{2})^2 = \frac{25}{4}$

23.  $z = -\sqrt{x^2 + y^2}, -1 \leq z \leq 0$