

## TRANSFORMATIONS OF SPHERES - ANSWERS

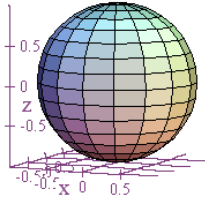
For each item below, find the vector-valued function  $\vec{r}(s,t) = x(s,t)\hat{i} + y(s,t)\hat{j} + z(s,t)\hat{k}$ , with  $0 \leq s \leq \pi$  and  $0 \leq t \leq 2\pi$ , that gives the specified graph. Specify the ranges for your parameters.

1. the sphere of radius 1 with center at the origin

$$\vec{r}(s,t) = \sin(s)\cos(t)\hat{i} + \sin(s)\sin(t)\hat{j} + \cos(s)\hat{k}$$

$$0 \leq s \leq \pi$$

$$0 \leq t \leq 2\pi$$

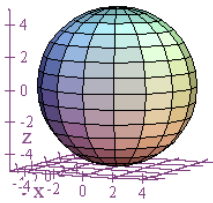


2. the sphere of radius 5 with center at the origin

$$\vec{r}(s,t) = 5\sin(s)\cos(t)\hat{i} + 5\sin(s)\sin(t)\hat{j} + 5\cos(s)\hat{k}$$

$$0 \leq s \leq \pi$$

$$0 \leq t \leq 2\pi$$

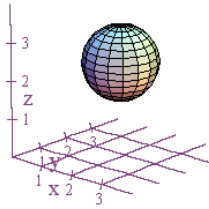


3. the sphere of radius 1 with center at  $(1,3,2)$

$$\vec{r}(s,t) = [1 + \sin(s)\cos(t)]\hat{i} + [3 + \sin(s)\sin(t)]\hat{j} + [2 + \cos(s)]\hat{k}$$

$$0 \leq s \leq \pi$$

$$0 \leq t \leq 2\pi$$

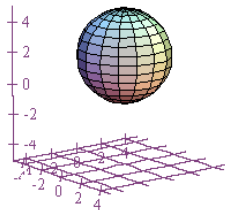


4. the sphere of radius 3 with center at  $(0,0,2)$

$$\vec{r}(s,t) = 3\sin(s)\cos(t)\hat{i} + 3\sin(s)\sin(t)\hat{j} + [2 + 3\cos(s)]\hat{k}$$

$$0 \leq s \leq \pi$$

$$0 \leq t \leq 2\pi$$



5. the sphere of radius 3 with center at  $(-1,0,1)$

$$\vec{r}(s,t) = [-1 + 3\sin(s)\cos(t)]\hat{i} + 3\sin(s)\sin(t)\hat{j} + [1 + 3\cos(s)]\hat{k}$$

$$0 \leq s \leq \pi$$

$$0 \leq t \leq 2\pi$$

