

8. Find the equation of the sphere whose center is $(3, 5, 4)$ and which is tangent to the xz -plane.

The point on the xz plane where the sphere touches the xz plane is $(3, 0, 4)$.

(Think about any plane tangent to a sphere. A line from the center of the sphere to the point of tangency is $\perp$ to the tangent plane.)

So the center is $(3, 5, 4)$ and the radius is 5

$$(x-3)^2 + (y-5)^2 + (z-4)^2 = 25$$



The only line through $(3, 5, 4)$ which is $\perp$ to the xz plane has $x=3$ and $z=4$.

9. Find the work done by the force $\vec{F} = 3\vec{i} - 5\vec{j} + 6\vec{k}$ as it moves an object in a straight line from $P = (3, 1, 4)$ to $Q = (9, 4, 6)$. Force is measured in pounds. Distance is measured in feet.

$$\text{Work} = \vec{F} \cdot \overrightarrow{PQ} = (3\vec{i} - 5\vec{j} + 6\vec{k}) \cdot (6\vec{i} + 3\vec{j} + 2\vec{k}) = 18 - 15 + 12 = 15 \text{ ft-lbs.}$$

10. Find the distance from the point $(4, 5, 6)$ to the z -axis.

The point on the z -axis which is closest to $(4, 5, 6)$ is $(0, 0, 6)$; so the distance is $\sqrt{16 + 25}$

