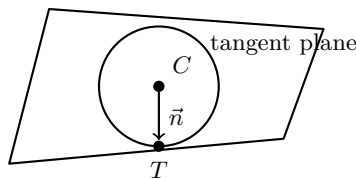


Question 5

The sphere $(x - 1)^2 + (y + 2)^2 + (z - 3)^2 = 36$ contains the point $T = (3, 2, 7)$. Find the tangent plane at T and the line normal to the sphere there.

Question 5 – Solution

Strategy The radius from the center to T is normal to the tangent plane.



Normal direction The center is $C = (1, -2, 3)$ and $T - C = \langle 2, 4, 4 \rangle = 2 \langle 1, 2, 2 \rangle$.

Tangent plane Using normal $\langle 1, 2, 2 \rangle$ through T ,

$$\boxed{(x - 3) + 2(y - 2) + 2(z - 7) = 0}, \quad \text{or} \quad \boxed{x + 2y + 2z = 21}.$$

Normal line $\boxed{\vec{r} = \langle 3, 2, 7 \rangle + t \langle 1, 2, 2 \rangle}$.

Verification $|T - C| = 6$, so T is indeed on the sphere.