Section 7.5

Math Learning Target:

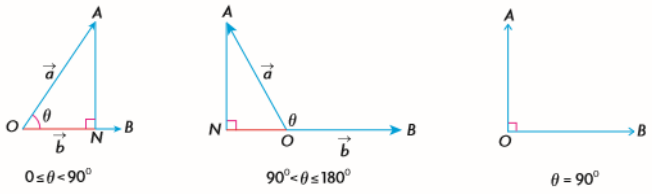
"I can calculate scalar and vector projections. I can also calculate direction angles and cosines. I can apply what I have learned in familiar and unfamiliar settings."

Recall: Unit vector in the direction of $\vec{a}$

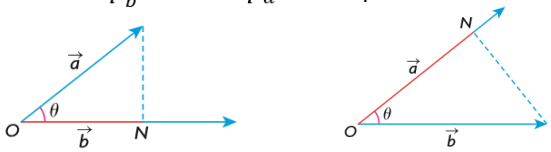
Definition

Scalar Projection of $\vec{a}$ on $\vec{b}$

The scalar projection of vector $\vec{a}$ onto $\vec{b}$ is ON, where $ON = |\vec{a}|\cos\theta$.

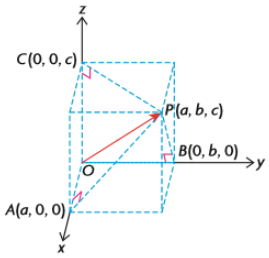


Example 1 Does $comp_{\vec{b}}\,\vec{a} = comp_{\vec{a}}\,\vec{b}$? Explain.



Definition A **direction angle** is the angle a vector makes with each of the positive coordinate axes. A **direction cosine** is the cosine ratio of a direction angle.

Example 2 Determine the direction cosine, and direction angle (to the nearest degree) of $\overrightarrow{OP} = (6,5,4)$ with only the *y*-axis.



Direction Cosine & Angle Calculation

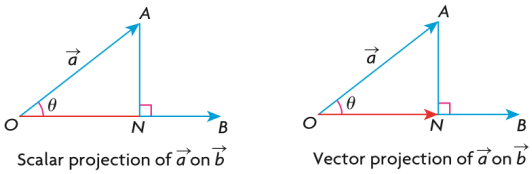
Direction Cosines for $\overrightarrow{OP} = (a, b, c)$

If α, β, and γ are the angles that $\overrightarrow{OP}$ makes with the positive x-axis, y-axis, and z-axis, respectively, then

$$\cos\alpha = \frac{(a, b, c)\cdot(1, 0, 0)}{|\overrightarrow{OP}|} = \frac{a}{\sqrt{a^2 + b^2 + c^2}}$$

$$\cos\beta = \frac{b}{\sqrt{a^2 + b^2 + c^2}} \text{ and } \cos\gamma = \frac{c}{\sqrt{a^2 + b^2 + c^2}}$$

Vector Projection



Example 3 Find the vector projection, in component form, of $\overrightarrow{OA} = (1,2,3)$ on $\overrightarrow{OB} = (4,-5,-6)$

This will provide you with "direction"...Page 398…#1, 2, 3, 6, 7b, 8, 9, 11, 12, 13, 14, 15ab, 17