

CNC Machining - Trigonometry Practice Problems (Answers and Worked Solutions)

Problem 1:

A CNC milling cutter moves diagonally at an angle of 35° relative to the X-axis. If the cutter travels a horizontal distance (X-axis) of 8 inches, what is the total distance traveled along its path?

Solution:

Use cosine (cos):

$$\cos(35^\circ) = \frac{8}{\text{Hypotenuse}}$$

$$\text{Hypotenuse} = \frac{8}{\cos(35^\circ)} \approx 9.76 \text{ inches}$$

Problem 2:

A drill bit needs to enter a workpiece at a 20° angle. If the drill needs to reach a depth of 2 inches vertically, how far horizontally must the drill start from the target point?

Solution:

Use tangent (tan):

$$\tan(20^\circ) = \frac{2}{\text{Horizontal}}$$

$$\text{Horizontal} = \frac{2}{\tan(20^\circ)} \approx 5.49 \text{ inches}$$

Problem 3:

A chamfer operation on a CNC lathe cuts at a 45° angle. If the chamfer must be 0.250 inches along both axes equally, what is the total length of the chamfer surface?

Solution:

Use Pythagoras theorem (45° triangle):

$$\text{Hypotenuse} = \sqrt{0.250^2 + 0.250^2} \approx 0.354 \text{ inches}$$

Problem 4:

A cutting tool moves from a known position horizontally 10 inches and vertically 4 inches on a CNC mill. What angle does this toolpath form relative to the X-axis?

Solution:

Use tangent (tan):

$$\tan^{-1}\left(\frac{\text{Vertical}}{\text{Horizontal}}\right) = \tan^{-1}\left(\frac{4}{10}\right) \approx 21.8^\circ$$

Problem 5:

During a taper turning operation on a CNC lathe, the tool moves along a path forming an angle of 12° with the workpiece axis. If the tool moves 5 inches along the axis (Z-axis), how much does the tool move inward towards the center (X-axis)?

Solution:

Use tangent (tan):

$$\tan(12^\circ) = \frac{\text{X-axis}}{5}$$

$$\text{X-axis} = 5 \times \tan(12^\circ) \approx 1.06 \text{ inches}$$
