ENGR 1990 Engineering Mathematics
Lab/Recitation #4 – Trigonometry

1. The lengths and angles of a two link planar robot are \( \ell_1 = 4 \) (ft), \( \ell_2 = 3 \) (ft), \( \theta_1 = 30 \) (deg), and \( \theta_2 = 45 \) (deg). Find the Cartesian coordinates \( x \) and \( y \) of \( B \) using: a) a calculator to evaluate the trigonometric functions, and b) the values given for commonly used angles.

2. The lengths and angles of a two link planar robot are \( \ell_1 = 4 \) (ft), \( \ell_2 = 3 \) (ft), \( \theta_1 = -45 \) (deg), and \( \theta_2 = 60 \) (deg). Find the Cartesian coordinates \( x \) and \( y \) of \( B \) using: a) a calculator to evaluate the trigonometric functions, and b) the values given for commonly used angles.

3. The \( XY \) coordinates of the end point \( B \) and the lengths of the links \( OA \) and \( AB \) are \( x = 5.5 \) (ft), \( y = -2 \) (ft), \( \ell_1 = 4 \) (ft), and \( \ell_2 = 3 \) (ft). Find: (a) the angles \( \alpha \) and \( \beta \), and (b) the link angles \( \theta_1 \) and \( \theta_2 \) for the elbow-down position. Express all angles in both degrees and radians.