A word about tangents, arc tangents and MATLAB

WATCH IT IN QUADRANTS OTHER THAN THE FIRST

% Take a 45 degree angle on circle r=1

>> help tan

tan Tangent of argument in radians.

  tan(X) is the tangent of the elements of X.

>> s1=1/sqrt(2) % s1 = 0.7071

>> c1=1/sqrt(2) % c1 = 0.7071

>> tan1=s1/c1 % tan1 = 1

>> angle_rad=atan(tan1) % angle_rad = 0.7854 (pi/4)

>> angle_deg=atan(tan1)*180/pi % angle_deg = 45

% Second quadrant Sine, Cosine on circle of radius sqrt(2)

>> s2 = 1

>> c2 = -1

>> tan2=s2/c2 % tan2 = -1

>> atan(-1)*180/pi

ans = -45 **>> % Wrong! USE ATAN2(Y,X) OR correct** **angle_rad = pi + atan(sine/cosine)**

>> help atan2

 atan2 Four quadrant inverse tangent.

  atan2(Y,X) is the four quadrant arctangent of the elements of X and Y

  such that -pi <= atan2(Y,X) <= pi. X and Y must have compatible sizes.

  In the simplest cases, they can be the same size or one can be a

  scalar. See also atan, atan2d.

>> tan2_rad=atan2(1,-1) % tan2_rad = 2.3562 radians

>> tan2_deg =atan2(1,-1)*180/pi % tan2_deg = 135 degrees **CORRECT**

$$\operatorname{atan2}(y,x) = \begin{cases} \arctan\left(\frac{y}{x}\right) & \text{if } x > 0, \\ \arctan\left(\frac{y}{x}\right) + \pi & \text{if } x < 0 \text{ and } y \geq 0, \\ \arctan\left(\frac{y}{x}\right) - \pi & \text{if } x < 0 \text{ and } y < 0, \\ +\frac{\pi}{2} & \text{if } x = 0 \text{ and } y > 0, \\ -\frac{\pi}{2} & \text{if } x = 0 \text{ and } y < 0, \\ \text{undefined} & \text{if } x = 0 \text{ and } y = 0. \end{cases}$$

% THIRD QUADRANT

>> s3 = -1 % s3 = -1

>> c3=-1 % c3 = -1

>> tan3=s3/c3 % tan3 = 1 **Wrong**

IN THIRD QUADRANT ANSWER IS

>> atan3_rad = atan2(s3,c3) % atan3 = -2.3562

>> atan3_deg= atan2(s3,c3)*180/pi % atan3 = -135

NOTE: >> 360-135 ans = 225 degrees

WATCH IT!!!!!!!!!!!!!!