Q). Find cosθ and sinθ for θ = 27

→ Scaling factor = $\frac{1}{K_n} = \frac{1}{1.6476} = 0.6073$

→ $(0.6073)_{10}$ = 0.100110 11 0111100

→ for cos() & sin() computations
- 1). x[0] = 0.6073
- 2). y[0] = 0
- 3). z[0] = Angle given by user.

→ Set of equations used
- $x_{i+1} = x_i - \mu d_i 2^{-i} y_i$
- $y_{i+1} = y_i + d_i 2^{-i} x_i$
- $z_{i+1} = z_i - d_i e^i$

→ In Rotation mode
- $d_i = sgn(z_i)$

→ For Circular Rotations
- $\mu = 1$, $e^i = \tan^{-1}(2^{-i})$

⇒ Above set of operating equations are re-written as:
- $x_{i+1} = x_i - d_i 2^{-i} y_i$
- $y_{i+1} = y_i + d_i 2^{-i} x_i$
- $z_{i+1} = z_i - d_i [\tan^{-1}(2^{-i})]$
- $d_{i+1} = sgn(z_{i+1})$

→ This is what we need to compute sin() and cos()

Look up table

i	0	1	2	3	4	5	6	7	8
2^{-i}	1	0.5	0.25	0.125	0.0625	0.03125	0.015625	0.0078125	0.00390625
$\tan^{-1}(2^{-i})$	45	26.565	14.036	7.125	3.576	1.7899	0.89517	0.44761	0.22381

i	9
2^{-i}	0.001953125
$\tan^{-1}(2^{-i})$	0.11190567

Step 0

- $x[0] = 1/k = 0.6073$
- $y[0] = 0$
- $z[0] =$ Angle given by user $= 27$ (in this example)
- $d[0] = sgn(z[0]) = sgn(27) = 1$

Step 1

- $x_1 = x_0 - (d_0 2^{-0} y_0) = 0.6073 - 0 = 0.6073$
- $y_1 = y_0 + (d_0 2^{-0} x_0) = 0 + 0.6073 = 0.6073$
- $z_1 = z_0 - d_0 \tan^{-1}(0) = 27 - 45 = -18$
- $d_1 = sgn(z_1) = -1$ (This -1 is stored as '0' in code)

Step 2 :

↳ $x_2 = x_1 - (d_1 2^{-1} y_1) = 0.6073 - \left(\frac{-y_1}{2}\right) = 0.6073 + 0.\frac{6073}{2} = 0.91095$

↳ $y_2 = y_1 + (d_1 2^{-1} x_1) = 0.6073 + \left(\frac{-x_1}{2}\right) = 0.6073 - \frac{0.6073}{2} = 0.30365$

↳ $z_2 = z_1 - d_1 \tan^{-1}(1) = -18 - (-1 \times 26.565) = 8.565$

↳ $d_2 = \text{sgn}(z_2) = 1$

⋮

Problem of unintentional o/p change

↳ Occurs when we go from one quadrant to another.

→ while moving from one quadrant, don't update the result unless and until you have the new angle.

↳ Problem fixed by using loading target_angle_conv instead of target_angle_clk

↳ target_angle_clk has been removed from the code as it was un-necessary.