# 6.7 Rates of Change of Trigonometric Functions

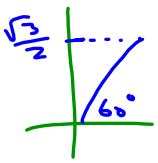
recall: AROC - $\frac{y_2 - y_1}{x_2 - x_1} = \frac{f(x_2) - f(x_1)}{x_2 - x_1}$

IROC - $DQ = \frac{f(a+h) - f(a)}{h}$

$h = 0.001$

Example: Find the AROC of $y = 3\sin(2x) - 4$ on the interval $[0, 30^\circ]$

$$AROC = \frac{f(30^\circ) - f(0^\circ)}{30^\circ - 0^\circ}$$




$$= \frac{[(3\sin(60^\circ) - 4) - (3\sin(0^\circ) - 4)]}{30^\circ}$$

$$= \frac{[3(\frac{\sqrt{3}}{2}) - 4] - (-4)}{30^\circ}$$

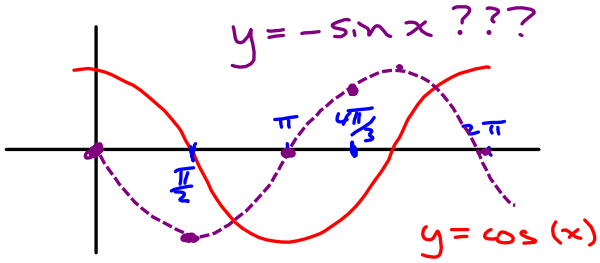
$$= \frac{\frac{3\sqrt{3}}{2}}{30^\circ}$$

$$= \frac{3\sqrt{3}}{2} \cdot \frac{1}{30} \quad 10$$

$$= \frac{\sqrt{3}}{20}$$

$$\doteq 0.0866$$

Example: Find the IROC of y = cos(x) at




(a) x = 0 → turning

IROC = 0

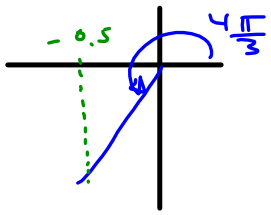
(b) x = π/2

$$DQ = \frac{\cos\left(\frac{\pi}{2} + 0.001\right) - \cos\left(\frac{\pi}{2}\right)}{0.001}$$

$$= \frac{0.00099999 - 0}{0.001}$$

$$= -0.9999 \approx -1$$

(c) x = 4π/3




$$\cos\left(\frac{4\pi}{3} + 0.001\right) = -0.4991337$$

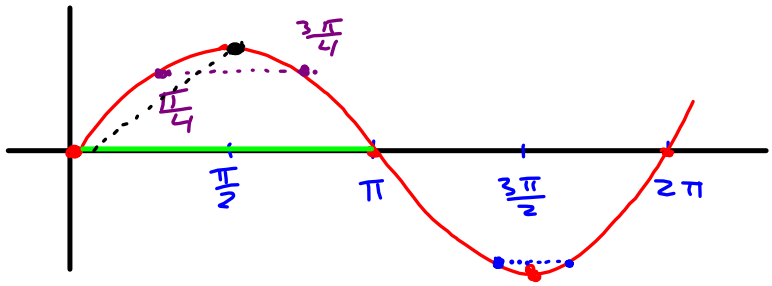
$$\cos\left(\frac{4\pi}{3}\right) = -0.5$$

$$DQ = \frac{-0.4991337 - (-0.5)}{0.001}$$

$$= 0.8663$$

hmm!! looks a lot like $\frac{\sqrt{3}}{2}$

Example 3: Make a sketch of y = sin(x). Predict




(a) an interval where the AROC is zero $[0, \pi]$, $[269°, 271°]$, $\left[\frac{\pi}{4}, \frac{3\pi}{4}\right)$

(b) an interval where the AROC is positive $[0, \pi/2]$

(c) an interval where the AROC is negative $\left[\frac{\pi}{2}, \pi\right]$

(d) a value where the IROC is zero $\frac{\pi}{2}$, $\frac{3\pi}{2}$, $\left\{\frac{\pi}{2} + \pi n, n \in I\right\}$

(e) a value where the IROC is the largest $0, 2\pi, 4\pi, \{2\pi n, n \in I\}$

min values @

$\{\pi + 2\pi n, n \in I\}$

# HOMEFUN:

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a peek at calculus: page 373 #15