8. $y = \sin x + \frac{1}{4}\sin 2x$

DOMAIN: $(-\infty, \infty)$

X-INT: $0 = \sin x + \frac{1}{4}\sin 2x$

$0 = \sin x + \frac{1}{4}\cdot 2\sin x\cos x$

$0 = \sin x + \frac{1}{2}\sin x\cos x$

$0 = \sin x\left(1 + \frac{1}{2}\cos x\right)$

$\sin x = 0 \qquad 1 + \frac{1}{2}\cos x = 0$

$x = 0, \pi, 2\pi \qquad \frac{1}{2}\cos x = -1$

$\cos x = -2$

Y-INT: $y = \sin 0 + \frac{1}{4}\sin(2\cdot 0)$

$y = 0 + \frac{1}{4}(0)$

$y = 0$

ASYMPTOTES: NONE

$y' = \cos x + \frac{1}{4}\cos(2x)\cdot\frac{d}{dx}(2x)$

$= \cos x + \frac{1}{4}\cdot 2\cos(2x)$

$= \cos x + \frac{1}{2}\cos(2x)$

$\cos x + \frac{1}{2}\cos(2x) = 0$

$\cos x + \frac{1}{2}(2\cos^2 x - 1) = 0$

$\cos x + \cos^2 x - \frac{1}{2} = 0$

$\cos^2 x + \cos x - \frac{1}{2} = 0$

$\rightarrow 2\cos^2 x + 2\cos x - 1 = 0$

$a = 2 \quad b = 2 \quad c = -1$

$\cos x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$\cos x = \frac{-2 \pm \sqrt{2^2 - 4(2)(-1)}}{2(2)}$

$\cos x = \frac{-2 \pm \sqrt{4+8}}{4}$

$\cos x = \frac{-2 \pm \sqrt{12}}{4}$

$\cos x = \frac{-2 \pm 2\sqrt{3}}{4}$

$\cos x = \frac{-1 \pm \sqrt{3}}{2}$

$x = \arccos\left(\frac{-1 \pm \sqrt{3}}{2}\right)$

$= \cos^{-1}\left(\frac{-1 \pm \sqrt{3}}{2}\right)$

0 $\quad x = 1.2 \quad x = 5.1$ $\quad 2\pi$

$x = 1$	MAX	$x = 3$	MIN	$x = 5.5$

INC $(0, 1.2)$

DEC $(1.2, 5.1)$

INC $(5.1, 2\pi)$

MAX: $(1.2, 1.1)$

MIN: $(5.1, -1.1)$