

For each of these functions, find a) the intervals where it is increasing and decreasing and b) find the local maxima and minima

1. $y = x + 2 \sin x$ $[0, 2\pi]$
2. $y = x + 2 \cos x$ $[0, 2\pi]$
3. $y = 2 \sin x + \cos 2x$ $[0, 2\pi]$
4. $y = 2 \cos x + \cos 2x$ $[0, 2\pi]$

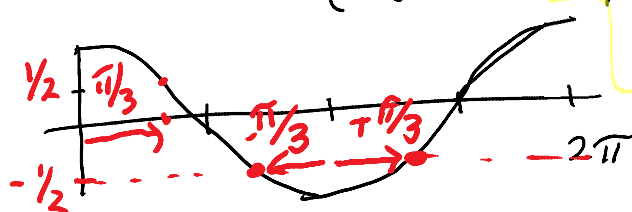
solutions to 1&3

1. $y = x + 2 \sin x$
 $y' = 1 + 2 \cos x = 0$

$$2 \cos x = -1$$

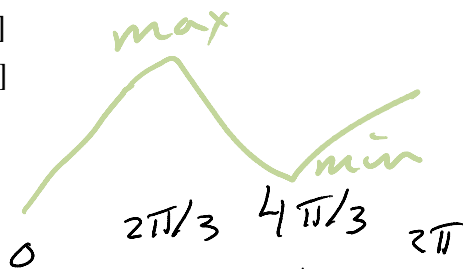
$$\cos x = -1/2$$

$$\cos(\pi/3) = 1/2$$



$$x = \pi \pm \pi/3$$

$$= 2\pi/3, 4\pi/3$$



$$(0, 2\pi/3) \quad (2\pi/3, 4\pi/3) \quad (4\pi/3, 2\pi)$$

$$y' \text{ pos} \quad \text{neg} \quad \text{pos}$$

$$y \text{ increasing } (0, 2\pi/3), (4\pi/3, 2\pi)$$

$$y \text{ decreasing } (2\pi/3, 4\pi/3)$$

$$\text{local max } (2\pi/3, 2\pi/3 + 1)$$

$$\text{local min } (4\pi/3, 4\pi/3 - 1)$$

3. $y = 2 \sin x + \cos 2x$

$$y' = 2 \cos x - 2 \sin 2x = 0$$

$$2 \cos x - 2 \cdot 2 \sin x \cos x = 0$$

$$2 \cos x (1 - 2 \sin x) = 0$$

$$\cos x = 0$$

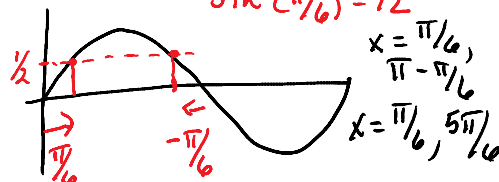
$$1 - 2 \sin x = 0$$

$$-2 \sin x = -1$$

$$\sin x = 1/2$$



$$x = \pi/2, 3\pi/2$$



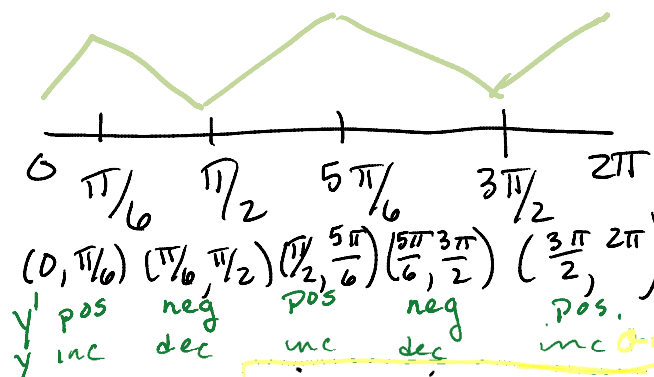
$$\sin(\pi/6) = 1/2$$

$$x = \pi/6, 5\pi/6$$

$$x = \pi/6, 5\pi/6$$

$$2 \sin x + \cos 2x$$

$$2 + -1$$



$$(0, \pi/6) \quad (\pi/6, \pi/2) \quad (\pi/2, 5\pi/6) \quad (5\pi/6, 3\pi/2) \quad (3\pi/2, 2\pi)$$

$$y' \text{ pos} \quad \text{neg} \quad \text{pos} \quad \text{neg} \quad \text{pos}$$

$$y \text{ inc} \quad \text{dec} \quad \text{inc} \quad \text{dec} \quad \text{inc}$$

$$y \text{ increasing } (0, \pi/6), (\pi/2, 5\pi/6), (3\pi/2, 2\pi)$$

$$y \text{ decreasing } (\pi/6, \pi/2), (5\pi/6, 3\pi/2)$$

$$\text{loc max: } (\pi/6, 3/2) \quad (5\pi/6, 3/2)$$

$$\text{loc min: } (\pi/2, 1) \quad (3\pi/2, -3)$$