DO NOW

$(0, 2\pi)$

pg 209; #17 $h = \sin^2 x + \cos x$

$h' = 2\sin x \cos x - \sin x$

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

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

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

$\cos x = \frac{1}{2}$

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$x = \pi$ $\quad x = \frac{\pi}{3}, \frac{5\pi}{3}$

4.1 Extrema on an Interval - Day 2

Guidelines for Finding Extrema on a Closed Interval:

To find the extrema of a continuous function f on a closed interval $[a, b]$, use the following steps.

1. Find the critical numbers of f in (a, b).
2. Evaluate f at each critical number in (a, b).
3. Evaluate f at each endpoint of $[a, b]$.
4. The least of these values is the minimum and the greatest of these values is the maximum.

Example: Find the absolute maximum and minimum.

1. $f(x) = 2(3 - x)$ on $[-1, 2]$

$f(x) = 6 - 2x$

$f'(x) = -2$

left: $f(-1) = 2(4) = 8$

right: $f(2) = 2(1) = 2$

minimum: $(2, 2)$
maximum: $(-1, 8)$

2. $f(x) = 3x^4 - 4x^3$ on $[-1, 2]$

$f'(x) = 12x^3 - 12x^2$

$12x^3 - 12x^2 = 0$

$12x^2(x - 1) = 0$

$12x^2 = 0$ or $x - 1 = 0$

$x = 0$ $\quad x = 1$

left: $f(-1) = 3 + 4 = 7$

c.#: $f(0) = 0$

c.#: $f(1) = 3 - 4 = -1$

right: $f(2) = 48 - 32 = 16$

minimum: $(1, -1)$
maximum: $(2, 16)$

3. $f(x) = 2\sin x - \cos 2x$ on $[0, 2\pi]$

$f'(x) = 2\cos x + 2\sin 2x$

$2\cos x + 2\sin 2x = 0$

$2\cos x + 2(2\sin x \cos x) = 0$

$2\cos x + 4\sin x \cos x = 0$

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

$2\cos x = 0$ or $1 + 2\sin x = 0$

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

$x = \frac{\pi}{2}, \frac{3\pi}{2}$ $\quad x = \frac{7\pi}{6}, \frac{11\pi}{6}$ ref $\angle = \frac{\pi}{6}$

$f(x) = 2\sin x - \cos 2x$ on $[0, 2\pi]$

left: $f(0) = 2\sin(0) - \cos(2 \cdot 0) = -1$ ($0 - 1$)

c.#: $f\left(\frac{\pi}{2}\right) = 2\sin\left(\frac{\pi}{2}\right) - \cos\left(2 \cdot \frac{\pi}{2}\right) = 3$ ($2 + 1$)

c.#: $f\left(\frac{3\pi}{2}\right) = 2\sin\left(\frac{3\pi}{2}\right) - \cos\left(2 \cdot \frac{3\pi}{2}\right) = -1$

c.#: $f\left(\frac{7\pi}{6}\right) = 2\sin\left(\frac{7\pi}{6}\right) - \cos\left(2 \cdot \frac{7\pi}{6}\right) = -\frac{3}{2}$ ($-2 + \frac{1}{2}$)

c.#: $f\left(\frac{11\pi}{6}\right) = 2\sin\left(\frac{11\pi}{6}\right) - \cos\left(2 \cdot \frac{11\pi}{6}\right) = -\frac{3}{2}$ ($-1 - \frac{1}{2}$)

right: $f(2\pi) = 2\sin(2\pi) - \cos(2 \cdot 2\pi) = -1$ ($0 - 1$)

minimum: $\left(\frac{7\pi}{6}, -\frac{3}{2}\right)$, $\left(\frac{11\pi}{6}, -\frac{3}{2}\right)$
maximum: $\left(\frac{\pi}{2}, 3\right)$

HOMEWORK

pg 209 - 210; 22, 26, 29 - 35 odd, 36, 39, 41