# Sec.3.1

p.166: Definition of Extrema; Theorem 3.1; Figure 3.1

p.167: Definition of Relative Extrema; Figure 3.2

p.168 – 170: Definition of Critical Number; Theorem 3.2

$f'(c)=0$ or $f'(c)=DNE$

Guidelines for Finding Extrema on a Closed Interval 1-4; Examples 2 – 3

p.171: In Exercises 17–22, find the critical numbers of the function.

**18.** $g(x) = x - \sqrt{x} = x - x^{1/2}$

$g'(x) = 1 - \frac{1}{2}x^{-1/2}$

$= 1 - \frac{1}{2\sqrt{x}} = \frac{2\sqrt{x}-1}{2\sqrt{x}}$

$g'(x)=0: 2\sqrt{x}-1=0$

$2\sqrt{x}=1 \rightarrow \sqrt{x}=\frac{1}{2}$

$x=\frac{1}{4}$

$g'(x)=DNE: 2\sqrt{x}=0$

$\sqrt{x}=0 \rightarrow x=0$

C.#s: 0 & $\frac{1}{4}$

p.171: In Exercises 23–40, find the absolute extrema of the function on the closed interval.

**28.** $f(x) = 2x^3 - 6x, [0, 3]$

$f'(x)=6x^2-6$

$f'(x)=0: 6x^2-6=0$

$x^2=1 \rightarrow x=\pm 1$

C.#: $x=1$

| $x$ | $f(x)=2x^3-6x$ | |
|---|---|---|
| 0 | 0 | |
| 1 | −4 | A.min @ (1, −4) |
| 3 | 36 | A.max @ (3, 36) |

**30.** $g(x) = \sqrt[3]{x}, [-8, 8]$

$= x^{1/3}$

$g'(x) = \frac{1}{3}x^{-2/3} = \frac{1}{3\sqrt[3]{x^2}}$

$g'(x)=DNE: x=0$

C.#: $x=0$

| $x$ | $g(x)=\sqrt[3]{x}$ | |
|---|---|---|
| −8 | −2 | A.min @ (−8, −2) |
| 0 | 0 | |
| 8 | 2 | A.max @ (8, 2) |

p.170: Example 4: Find the extrema of $f(x) = 2sinx - cos2x$ on the interval $[0, 2\pi]$.

$f(x) = 2\sin x - \cos 2x$ Write original function.

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

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

$\sin 2x = 2\sin x \cos x$

$AB=0 \rightarrow A=0$ or $B=0$

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

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

$= 2(\cos x)(1 + 2\sin x)$ Factor.

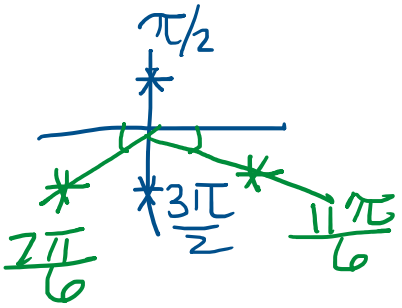
$AB=0 \rightarrow A=0$ OR $B=0$

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

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

$x = \frac{\pi}{2}, \frac{3\pi}{2}$ OR $\sin x = -\frac{1}{2}$

$x = \frac{7\pi}{6}, \frac{11\pi}{6}$




C.#'s: $\frac{\pi}{2}, \frac{7\pi}{6}, \frac{3\pi}{2}, \frac{11\pi}{6}$

| Left Endpoint | Critical Number | Critical Number | Critical Number | Critical Number | Right Endpoint |
|---|---|---|---|---|---|
| $f(0) = -1$ | $f\left(\frac{\pi}{2}\right) = 3$ Maximum | $f\left(\frac{7\pi}{6}\right) = -\frac{3}{2}$ Minimum | $f\left(\frac{3\pi}{2}\right) = -1$ | $f\left(\frac{11\pi}{6}\right) = -\frac{3}{2}$ Minimum | $f(2\pi) = -1$ |

A.max @ $\left(\frac{\pi}{2}, 3\right)$; Amin @ $\left(\frac{7\pi}{6}, -\frac{3}{2}\right)$ & $\left(\frac{11\pi}{6}, -\frac{3}{2}\right)$