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MATH 149 HOMEWORK 11 SOLUTIONS

Section 3.1

#17. Find critical numbers of $h(x) = \sin^2 x + \cos x$ for $0 < x < 2\pi$

$h'(x) = 2\sin x \cdot \cos x - \sin x = 0$

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

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

$h'(x)$ is defined for all $x \in (0, 2\pi)$ $\qquad x = \frac{\pi}{3}, \frac{5\pi}{3}$

so only critical points in $(0, 2\pi)$ are $x = \pi, \frac{\pi}{3}, \frac{5\pi}{3}$

#28. Locate absolute extrema of $f(x) = \dfrac{2x}{x^2+1}$ on $[-2, 2]$

* critical numbers.

$$f'(x) = \frac{2(x^2+1) - 2x(x^2+1)}{((x^2+1))^2} = \frac{-2(x^3 - x^2 + x - 1)}{(x^2+1)^2} = \frac{-2(x-1)^2(x+1)}{(x^2+1)^2}$$

$f'(x) = 0 \Rightarrow x = 1, \ x = -1 \rightarrow$ critical numbers.

$f'(x)$ is defined for all x in $[-2, 2]$ so no critical numbers from there.

* Evaluate at critical numbers and end points.

$f(-1) = \frac{-2}{2} = -1 \rightarrow$ absolute minimum $\qquad f(-2) = \frac{-4}{5}$

$f(1) = \frac{2}{2} = 1 \rightarrow$ absolute maxim. $\qquad f(2) = \frac{4}{5}$

#40. $f(x) = \sqrt{4 - x^2}$ $\qquad$ Critical numbers: $f'(x) = \dfrac{-2x}{2\sqrt{4-x^2}} = \dfrac{x}{\sqrt{4-x^2}}$

$f'(x)$ does not exist when $x = 2, -2$ (in the domain)

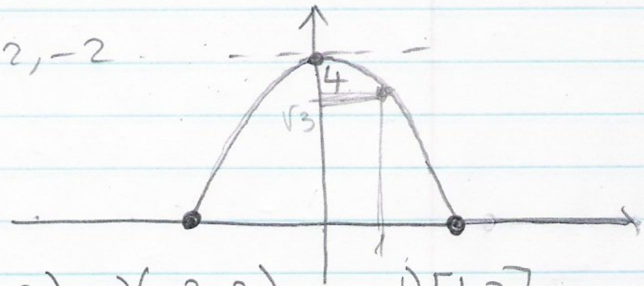
$f'(x) = 0$ when $x = 0$

Critical numbers: $x = 0, 2, -2$

$f(0) = \sqrt{4} = 2$

$f(2) = \sqrt{4-4} = 0$

$f(-2) = \sqrt{4-4} = 0$



	a) $[-2, 2]$	b) $[-2, 0)$	c) $(-2, 2)$	d) $[1, 2]$
absolute maximum	2 at $x = 0$	does not exist	2 at $x = 0$	$\sqrt{3}$ at $x = 1$
absolute minimum	0 at $x = 2$ and $x = -2$	0 at $x = -2$	does not exist	0 at $x = 2$

#60. Cost $= C(x) = 2x + \dfrac{300{,}000}{x}$ $\qquad 1 \le x \le 300$

critical numbers $\quad C'(x) = 2 - \dfrac{300{,}000}{x^2} = 0 \Rightarrow x \cong 387 \nearrow$ not in $[1, 300]$

$C(1) = 300{,}002$

$\boxed{C(300) = 1600}$ minimum

minimum cost of \$1600 at $x = 300$

If $1 \le x \le 400$, then compare

$C(1) = 300{,}002$, $\boxed{C(387) \cong 1549.19}$ minimum $\quad C(400) = 1550$