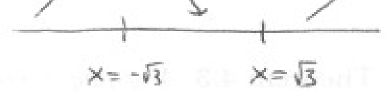
Section 4.3   Pr. 1, 3, 5, 7, 9, 11, 17, 21, 33, 39, 45, 53 (12 Problems)   12, 36

12) $h(x) = 2x^3 - 18x$

a) $h'(x) = 6x^2 - 18$

$= 6(x^2-3) = 0 \Rightarrow x = \pm\sqrt{3}$



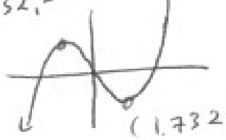
Increasing: $(-\infty, -\sqrt{3}] \cup [\sqrt{3}, \infty)$

Decreasing: $[-\sqrt{3}, \sqrt{3}]$

b) Local min: $(\sqrt{3}, \underbrace{-12\sqrt{3}}_{f(\sqrt{3})}) \approx (1.732, -20.785)$

Local max: $(-\sqrt{3}, 12\sqrt{3}) \approx (-1.732, 20.785)$

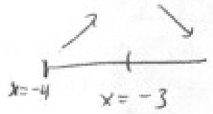
c) Neither extrema is absolute

d) 

36) $g(x) = -x^2 - 6x - 9$ $-4 \le x < \infty$

a) $g'(x) = -2x - 6 = 0$

$\Rightarrow x = -3$

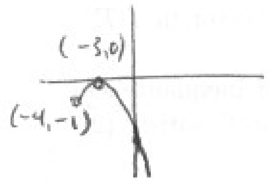


Local max: $(-3, 0)$

Local min: $(-4, -1)$ (Endpoint)

b) Absolute maximum value is 0, which occurs when $x = -3$.

There is no absolute min

c) 

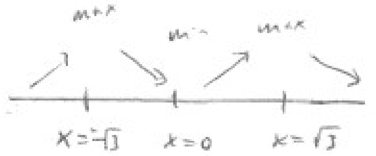
Section 4.4 : Pr. 1, 3, 5, 9, 17, 43, 45, 51, 63, 67, 69 (40 Pr.16-3) 16, 46 14 Points

16) $y = -x^4 + 6x^2 - 4 = x^2(6-x^2) - 4$

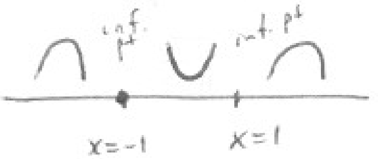
$y' = -4x^3 + 12x = -4x(x^2-3)$

$y'' = -12x^2 + 12 = -12(x^2-1)$

$= -12(x+1)(x-1)$



1



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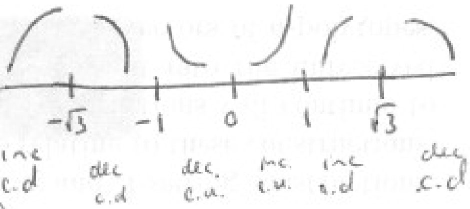
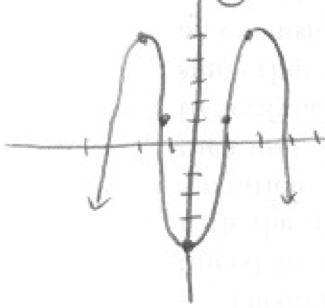


1



max: $(-\sqrt{3}, 5)$

$(\sqrt{3}, 5)$

min $(0, -4)$

inf. pt. $(-1, 1)$

$(1, 1)$

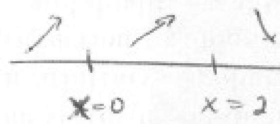
2

46) $y' = x^2(2-x)$

$= 2x^2 - x^3$

$y'' = 4x - 3x^2$

$= x(4-3x)$



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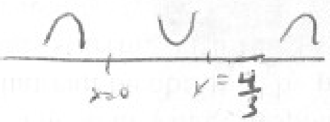

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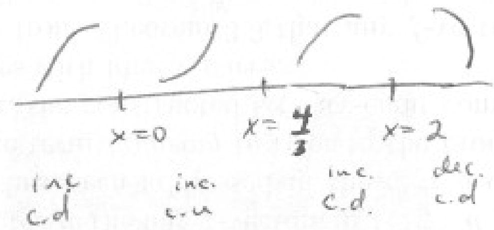


1

don't know position

local max: $(2, \_\_\_\_)$

local min: none

inflection pts: $(0, \_\_\_\_)$

$(\frac{4}{3}, \_\_\_\_)$

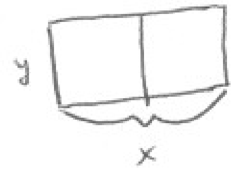
If we're only given y', we don't know the y coordinates of any points on the graph.

Section 4.5 : Pr. 1, 3, 5, 7, 11, 13, 21a, 43, 47, 48   8, 20a

10 Problems

8) $A = 216\,m^2$; Need: dimensions to minimize fence needed.

$F = 2x + 3y$ We know $xy = 216 \Rightarrow y = \frac{216}{x}$

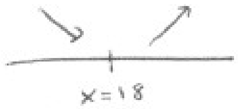


Minimize $F = 2x + 3\left(\frac{216}{x}\right)$ where $x > 0$

$= 2x + 648x^{-1}$

$F'(x) = 2 - \frac{648}{x^2} = 0$ ($F'(x)$ exists for all $x > 0$)

$\Rightarrow 2 = \frac{648}{x^2}$



local min, only critical #

$\Rightarrow$ abs min

$\Rightarrow 2x^2 = 648 \Rightarrow x^2 = 324$

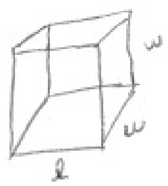
$\Rightarrow x = 18$ (Since $x > 0$)

If $x = 18$, then $y = \frac{216}{18} = 12$

Dimensions : $18\,m \times 12\,m$

Fence Needed : $F = 2(18) + 3(12) = 72\,m$

20a)



(Square end)   Girth + length of box ≤ 108 in

$\Rightarrow 4w + l \leq 108$ (To maximize, need $4w + l = 108$) $\Rightarrow l = 108 - 4w$

We wish to maximize $V = w^2 l$

$= w^2(108 - 4w)$

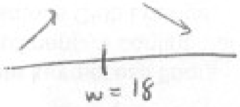
$= 108w^2 - 4w^3$ where $w > 0$

$V' = 216w - 12w^2$ Exists for all $w > 0$

$= 12w(18 - w) = 0$

$\Rightarrow w = 0$ or $w = 18$

not in domain



local max, only critical #

$\Rightarrow$ abs. max

$w = 18 \Rightarrow l = 108 - 4(18)$

$= 36$

Dimensions of box: 18 in × 18 in × 36 in.