Math 148-AN Quiz #5

Name:

Read all directions and problems carefully! Show all appropriate work for credit.

1. For the function, $g(x) = -x^3 - 3x^2 + 9x + 15$;

a) Determine the critical numbers and then write the critical points of the function, $g(x)$.

b) Write the intervals, using interval notation, on which $g(x)$ is increasing and decreasing.

c) Use the First Derivative test to locate the local maximum and minimum values. Describe explicitly how this test was used to determine a max or a min.

d) Determine the inflection numbers and then write the inflection points of the function, $g(x)$.

e) Write the intervals, using interval notation, on which $g(x)$ is concave up and concave down.

$g(x) = -x^3 - 3x^2 + 9x + 15$

$g'(x) = -3x^2 - 6x + 9$

$= -3(x^2 + 2x - 3) = 0$ ← Finding CN's

$= -3(x+3)(x-1)$

$x = -3$ or $x = 1$

$g''(x) = -6x - 6$

$= -6(x+1) = 0$

$x = -1$

a) CN $x = -3 + 1$

$g(3) = -(3)^3 - 3(3)^2 + 9(3) + 15$

$= +27 - 27 - 27 + 15$

$= -12$

→ CP: $(-3, -12)$

$g(1) = -(1)^3 - 3(1)^2 + 9(1) + 15$

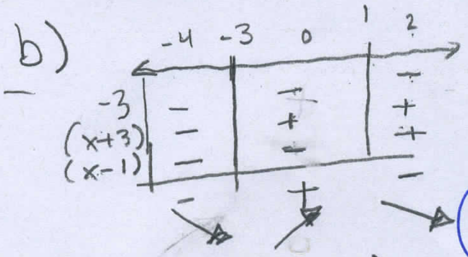
$= -1 - 3 + 9 + 15$

$= 20$

→ CP: $(1, 20)$

+4

b)



+3

Increasing: $(-3, 1)$

Decreasing: $(-\infty, -3) \cup (1, \infty)$

c) Relative min of $y = -12$ @ $x = -3$

Relative max of $y = 20$ @ $x = 1$

When the sign of the derivative switches it indicates a min or max. From "−" to "+" is a min and from "+" to "−" is a max.

+4

d) IN: $x = -1$

$g(-1) = -(-1)^3 - 3(-1)^2 + 9(-1) + 15$

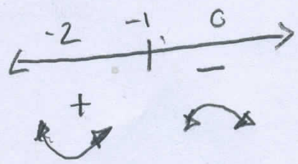
$= 1 - 3 - 9 + 15$

$= 4$

IP: $(-1, 4)$

+2

e)



CCU: $(-\infty, -1)$

CCD: $(-1, \infty)$

+2

15

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$g(x) = -x^3 - 3x^2 + 9x + 15$ $\quad +27-27-27+15=-12$

$g'(x) = -3x^2 - 6x + 9$ $\quad -1-3+9+15=20$

$g'(x) = -3(x^2 + 2x - 3) = 0$ $\quad -3((-4)^2 + 2(-4) - 3)$

a) C# $= (x+3)(x-1) =$ $x = -3$, $x = 1$
CP $= (-3, -12)$ & $(1, 20)$ +4

a) C# $= x = -3$, $x = 1$
CP $= (-3, -12)$ & $(1, 20)$

b) inc $(-3, 1)$
Dec $(-\infty, -3) \cup (1, \infty)$

-4 -3 0 1 2

− | + | −

↘ | ↗ | ↘

b) inc $(-3, 1)$
Dec $(-\infty, -3) \cup (1, \infty)$ +8

c) Relative min at $(-3, -12)$ -3. where sign of test goes from − to + you have negative slope changing to positive so
Relative max at $(1, 20)$
Relative because end behavior is ↖ & ↘ $-\infty$ ∞ +4
↘ to ↗ and + to − means change from increasing ↗ to ↘ decreasing

d) $g'(x) = -3x^2 - 6x + 9$
$g''(x) = -6x - 6$
IP $= -6(x+1)$ $x = -1$
IP $= y = 4$ at $x = -1$ +2
$-(-1)^3 - 3(-1)^2 + 9(-1) + 15 = 4$

e) -1 0 -2 + | −
$g(x)$ is:
concave up at $(-\infty, -1)$
concave down at $(-1, \infty)$ +2

15

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$g(x) = -x^3 - 3x^2 + 9x + 15$

$g'(x) = -3x^2 - 6x + 9$

$= -3(x^2 + 2x - 3)$

$= -3(x-1)(x+3)$

$x = 1$ + $x = -3$

A) Critical numbers: $x = -3$ + $x = 1$

Critical points: $(1, 20)$, $(-3, -12)$

+4

$g(1) = -(1)^3 - 3(1^2) + 9(1) + 15$

$= -1 - 3 + 9 + 15$

$g(1) = 20$

$g(-3) = -(-3)^3 - 3(-3^2) + 9(-3) + 15$

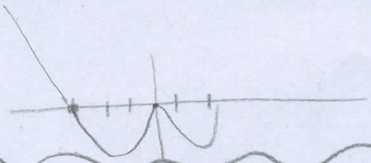
$= 27 - 27 - 27 + 15$

$g(-3) = -12$

B) $(-\infty, -3) \cup (1, \infty)$: Decreasing

$(-3, 1)$: Increasing

+3



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C) -4, -3, 0, 2

$-$ | $+$ | $-$

$0 = -3(-1)(3) = 9+$

$2 = -3(1)(5) = -15$

$-4 = -3(-5)(-1)$

Decreasing: $(-\infty, -3), (1, \infty)$

Increasing: $(-3, 1)$

REL. Maximum: ~~(1~~, 20) @ $x = 1$. $y =$

REL. Minimum: ~~(-3~~, 12) @ -3.

This test would be used to determine a max or a min by when ~~x~~ $g(x)$ ~~point~~ goes from decreasing to increasing you have a min + from increasing to decreasing you have a max

+4

D) $g'(x) = -3x^2 - 6x + 9$

$g''(x) = -6x - 6$

$= -6(x+1) = 0$

$= x = -1$

Inflection Numbers: $x = -1$

$-(-1)^3 - 3(-1^2) + 9(-1) + 15$

$1 - 3 - 9 + 15 = 4$

$\rightarrow$