MATH 205 – Calculus I

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Work attached on seperate Page

SQ 4.4

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Instructions: Though calculators can be used for the both questions, all problems require you to show your work. Any answer without proper justification will receive ***ZERO*** credit. Only **EXACT** answers will receive full credit unless otherwise noted. Proper Interval Notation must be used to receive credit.

1. Given $g(x) = (x^2 - 1)e^x$, on [-5, 5], determine each of the following.
   a. The local extrema values and where they occur.

   Critical Points for $g(x)$ at $x = \frac{-2 \pm \sqrt{8}}{2}$

   b. The absolute extrema values and where they occur.

   absolute max of $24e^5$ at $x = 5$
   absolute min of $\left[\left(\frac{-2+\sqrt{8}}{2}\right)^2 - 1\right]e^{\left(\frac{-2+\sqrt{8}}{2}\right)}$

   c. Intervals on which $g(x)$ is i) Increasing: $\left(-5, \frac{-2-\sqrt{8}}{2}\right) \cup \left(\frac{-2+\sqrt{8}}{2}, 5\right)$

   ii) Decreasing: $\left(\frac{-2-\sqrt{8}}{2}, \frac{-2+\sqrt{8}}{2}\right)$

   d. The location of any points of inflection:

   Points of inflection for $g(x)$ at $x = \frac{-4 \pm \sqrt{12}}{2}$

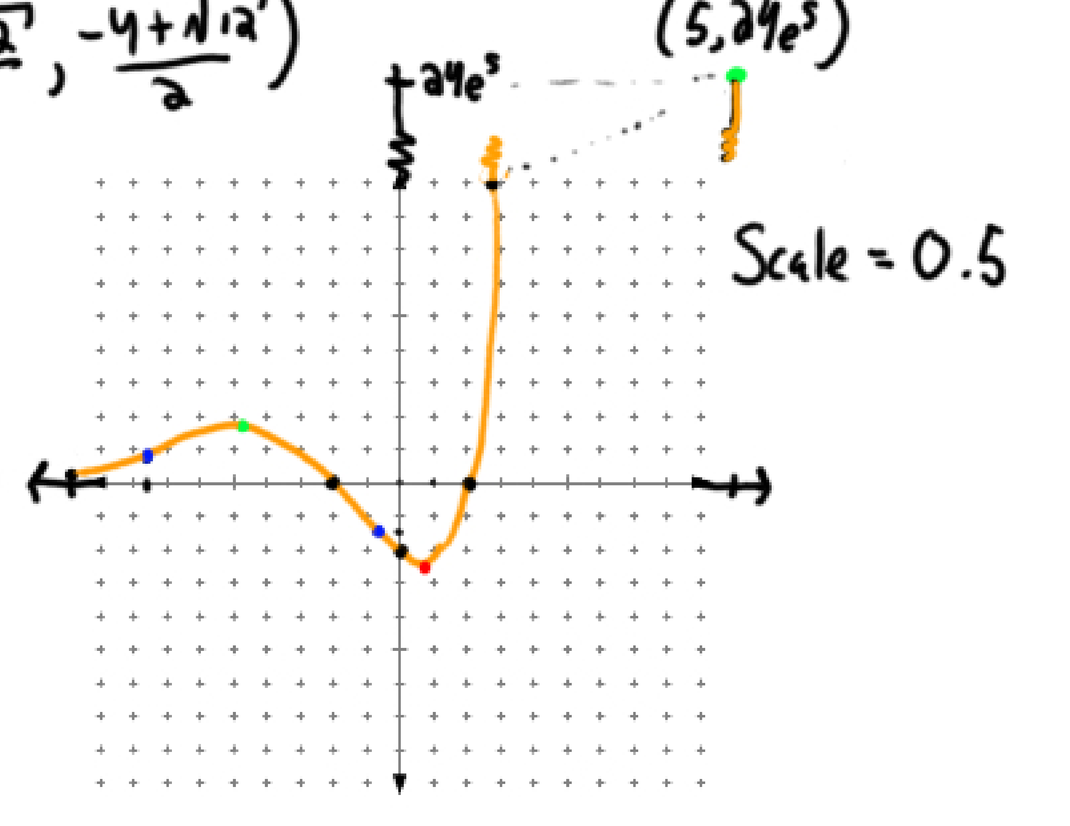
   e. Intervals on which $g(x)$ is i) Concave Up:

   $\left(-5, \frac{-4-\sqrt{12}}{2}\right) \cup \left(\frac{-4+\sqrt{12}}{2}, 5\right)$

   ii) Concave down:

   $\left(\frac{-4-\sqrt{12}}{2}, \frac{-4+\sqrt{12}}{2}\right)$

   f. Sketch the curve clearly showing
      a) the intercepts
      b) local and absolute extrema
      c) Inflection points and concavity



Max's
Min's
POI's
Intercepts

Nathan Hallam - PG1 Worksheet

1)

$g'(x) = (x^2-1)e^x + e^x(2x)$

$g'(x) = e^x(x^2+2x-1)$

$0 = e^x(x^2+2x-1)$

$0 = x^2+2x-1$

$0 = \frac{-2 \pm \sqrt{4-4(1)(-1)}}{2}$

$x = \frac{-2 \pm \sqrt{8}}{2}$ Crt #'s

$g''(x) = e^x(2x+2) + e^x(x^2+2x-1)$

$g''(x) = e^x(2x+2+x^2+2x-1)$

$g''(x) = e^x(x^2+4x+1)$

$0 = e^x(x^2+4x+1)$

$0 = x^2+4x+1$

$x = \frac{-4 \pm \sqrt{16-4}}{2}$

$x = \frac{-4 \pm \sqrt{12}}{2}$ POI

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

$0 = x^2-1$

$1 = x^2$

$\pm 1 = x$ ints

$y = (0-1)e^0$

y int $= -1$

a)

$-3 \quad 0 \quad 1$

$+ \quad \frac{-2-\sqrt{8}}{2} \quad - \quad \frac{-2+\sqrt{8}}{2} \quad +$

$g'(-3) = 0.09$

$g'(0) = -1$

$g'(1) = 5.4$

b)

$-\infty \quad \infty$

$+ \quad -5 \quad + \quad \frac{-2-\sqrt{8}}{2} \quad \frac{-2+\sqrt{8}}{2} \quad + \quad 5 \quad +$

$(5^2-1)e^5$

$(25-1)e^5 \rightarrow 24e^5$

c)

$-\infty \quad -4 \quad -1 \quad 4 \quad \infty$

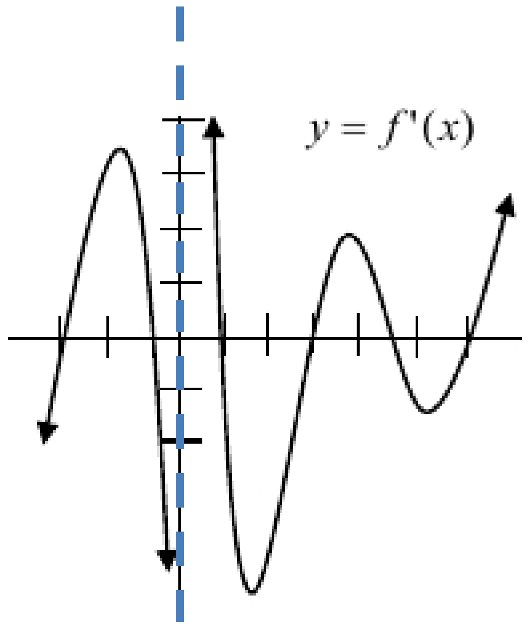
$+ \quad -5 \quad + \quad \frac{-4-\sqrt{12}}{2} \quad - \quad \frac{-4+\sqrt{12}}{2} \quad + \quad 5 \quad +$

$g''(-4) = 0.018$

$g''(0) = 1$

$g''(4) = 1801.74$

2. For the following questions, refer to the graph of $y = f'(x)$, the ***DERIVATIVE*** of $f(x)$, show below. The domain of $f(x)$ is all real numbers. Once again, this is the graph of the **DERIVATIVE!**



a. Find all critical points of the **original function** $f(x)$.

Critical Points for $f(x)$ at $x = -3, -1, 1, 3, 5$

b. Estimate the intervals over which the **original function** $f(x)$ is increasing.

$f(x)$ is increasing on the interval $(-3,-1) \cup (0,1) \cup (3,4.5) \cup (5,\infty)$

c. Estimate the intervals over which the **original function** $f(x)$ is decreasing.

$f(x)$ is decreasing on the interval $(-1,0) \cup (1,3) \cup (4.5,5)$

d. Estimate the intervals over which the **original function** $f(x)$ is concave up.

$f(x)$ is concave up on the interval $(-\infty,-2) \cup (2,4) \cup (5,\infty)$

e. Estimate the intervals over which the **original function** $f(x)$ is concave down.

$f(x)$ is concave down on the interval $(-2,0) \cup (0,2) \cup (4,5)$

f. Estimate the x-coord. of all local maximum points of the **original function** $f(x)$.

Local maximums for $f(x)$ at $x = -3, 3, 5$

g. Estimate the x-coord. of all the local minimum points of the **original function** $f(x)$.

Local minimums for $f(x)$ at $x = -1, 1, 4.5$

h. Estimate the x-coordinates of all inflection points of the **original function** $f(x)$.

Inflection Points for $f(x)$ at $x = -2, 2, 4, 5$