Name: ____________________________

Math 1121 Exam #2

No calculators! Show all your work for everything.

Question 1. (15 points) I'm investing in some stocks today, and my investment's value changes throughout the day. Let's say the value of my investment at various times is given by this function:

$$f(t) = 3t^2 - 24t + 10,$$

where t is the time in hours past 9AM, and $f(t)$ is the value of the investment in dollars.

Please say: at which times during the day is my investment increasing in value, and at which times is it decreasing in value?

$f'(t) = 6t - 24$

$f' = 0: \quad 6t = 24$

$t = 4$

$f'(0) = 6 \cdot 0 - 24 = -24$

$f'(5) = 6 \cdot 5 - 24 = 6$

4

$-$ 0 $+$

decreasing when $t < 4$ (before 1PM)

increasing when $t > 4$ (after 1PM)

Question 2. (7 points) Please solve for x in:

$$4^{2x-1} = 5$$

$\ln 4^{2x-1} = \ln 5$

$(2x-1)\ln 4 = \ln 5$

$2x - 1 = \frac{\ln 5}{\ln 4}$

$2x = \frac{\ln 5}{\ln 4} + 1$

$x = \frac{1}{2}\left(\frac{\ln 5}{\ln 4} + 1\right)$

Question 3. (8 points each) In each part, please find the derivative:

a) $\log_2(xe^x)$

$$\frac{1}{xe^x \ln 2}\left(xe^x + e^x \cdot 1\right)$$

b) $x^4 - 2x^3 + 10^x + \sqrt{x}$

$$4x^3 - 6x^2 + 10^x \ln 10 + \frac{1}{2}x^{-1/2}$$

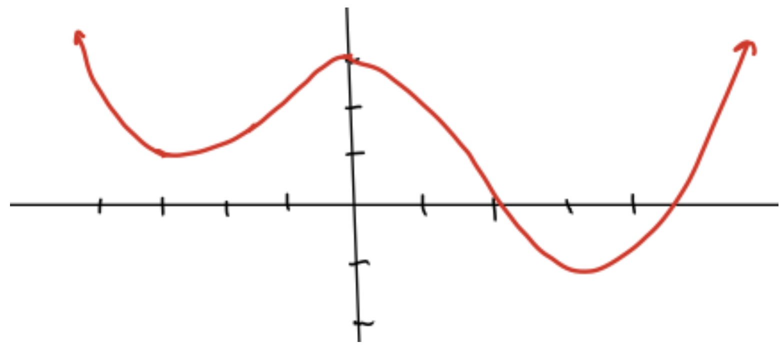
c) $\dfrac{x^2 - 5x^4}{e^x}$

$$\frac{e^x(2x - 20x^3) - (x^2 - 5x^4)e^x}{(e^x)^2}$$

d) $(4x+5)(x^2+x)^4$

$$(4x+5) \cdot 4(x^2+x)^3 \cdot (2x+1) + (x^2+x)^4 \cdot 4$$

Question 4. (10 points)



For this question, $f(x)$ is the picture above.

a) Please give the x-values for any relative extrema, and say for each one if it is a maximum or minimum.

$x=-3$ & $x=3$ are rel. min

$x=0$ is rel. max

b) Please give intervals where $f(x)$ is increasing and decreasing.

increasing on $(-3,0)$ & $(3,\infty)$

decreasing on $(-\infty,-3)$ & $(0,3)$

Question 5. (12 points) Please find the x-values for any relative extrema, and say for each one if it is a maximum or minimum for this function:

$$f(x) = x^3 + 3x^2 + 5$$

$f'(x) = 3x^2+6x$

$= 3x(x+2)$

$\underline{f'=0}$: $3x(x+2)=0$

$3x=0$ $\quad x+2=0$

$x=0$ $\quad x=-2$

$$\begin{array}{cccccc} & & -2 & & 0 & \\ f' & + & 0 & - & 0 & + \end{array}$$

$f'(-3) = 3(-3)(-3+2)$
$+ \; - \; -$

$f'(-1) = 3(-1)(-1+2)$
$+ \; - \; +$

$f'(1) = 3(1)(1+2)$
$+ \; + \; +$

$x=-2$ is a rel max
$x=0$ is a rel min

Question 6. (3 points each) In each part, give the value of the logarithm. One of these parts is impossible to do by hand— for that one, just say that it's impossible. For the ones you can answer, give some very brief explanation for why your answer is correct.

a) $\log_2 8$ $= 3$ since $2^3 = 8$

b) $\log 1000$ $= 3$ since $10^3 = 1000$

c) $\log_5 10$ impossible by hand, since nothing fits in $5^? = 10$ nicely

d) $\log_3 \frac{1}{9}$ $= -2$ since $3^{-2} = \frac{1}{9}$

Question 7. (12 points) Please give intervals where this function is increasing and decreasing:

$$f(x) = xe^{2x}$$

$f'(x) = x \cdot e^{2x} \cdot 2 + e^{2x} \cdot 1$

$= e^{2x}(x \cdot 2 + 1)$

$f'(x) = e^{2x}(2x+1)$

$f' = 0$: $e^{2x} = 0$ $\quad 2x+1 = 0$

$x = -1/2$

$-1/2$

f': $-$ $\quad 0 \quad$ $+$

$f'(-1) = e^{2\cdot -1}(2 \cdot -1 + 1)$

$+ \quad -$

$f'(0) = e^{2 \cdot 0}(2 \cdot 0 + 1)$

$+ \quad +$

increasing on $(-1/2, \infty)$

decreasing on $(-\infty, 1/2)$