MAC 2233.30 | # *Test Solutions* | *Instr: Jamieson*

2011 Summer B

Ch 4.3 – 4, 3.6 – 7, 5.1 – 3

Name: ____

There are 27 points on this test.

$f(x)$	$f'(x)$
u^n	$nu^{n-1}u'$
au	au'
a	0
e^u	$e^u u'$
a^u	$\ln(a)\cdot a^u u'$
$\ln(u)$	$\frac{1}{u}\cdot u'$
$\log_a(u)$	$\frac{1}{\ln(a)u}\cdot u'$
$a\cdot u(x)\pm b\cdot v(x)$	$a\cdot u'\pm b\cdot v'$
$a\cdot u(x)$	$a\cdot u'$
$u(x)\cdot v(x)$	$u\cdot v'+v\cdot u'$
$\frac{u}{v}$	$\frac{v\cdot u'-u\cdot v'}{v^2}$

$f(x)$	$\mathbf{F(x)=\int f(x)dx}$
$u^n\cdot u'$	$\frac{u^{n+1}}{n+1}+C, n\neq -1$
$\frac{1}{u}\cdot u'$	$\ln(\lvert u\rvert)+C$
a	$ax+C$
$e^u\cdot u'$	e^u+C
$a^u\cdot u'$	$\frac{a^u}{\ln(a)}+C$

$$A_0e^{rt}$$

$$A_0\left(1+\frac{r}{n}\right)^{nt}$$

$$\frac{-b\pm\sqrt{b^2-4ac}}{2a}$$

In #1 – 5 differentiate the given function

1. (2 pt) $f(x)=e^{7x}\ln(x-5)$

$$f'(x)=e^{7x}\cdot 7\cdot\ln(x-5)+e^{7x}\frac{1}{x-5}$$

(-1 per detail; -2 if it does not have structure of the product rule)

2. (3 pt) $f(x)=e^{9x}\ln\left((x+1)^4\right)$

(-1 per detail; -2 if it does not have correct order of operations)

$$f'(x)=e^{9x}\cdot 9\cdot\ln\left((x+1)^4\right)+e^{9x}\frac{1}{(x+1)^4}\cdot 4(x+1)^3$$

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3. (3 pt) $f(x) = \ln((x+1)^3(x+2)^5)$ (-1 per detail; -2 if it does not have correct order of operations)

$$f'(x) = \frac{1}{(x+1)^3(x+2)^5}\left[3(x+1)^2(x+2)^5 + (x+1)^3 \cdot 5(x+2)^4\right]$$

4. (2 pt) $f(x) = \dfrac{280}{1+5e^{-0.03x}}$ [Simplify your answer.]

(-1 per detail, including simplification; -2 if it does not have structure of the quotient rule)

$$f'(x) = \frac{\left(1+5e^{-0.03x}\right)\cdot 0 - 280 \cdot 5e^{-0.03x} \cdot (-0.03)}{\left(1+5e^{-0.03x}\right)^2}$$

$$= \frac{-280 \cdot 5e^{-0.03x} \cdot (-0.03)}{\left(1+5e^{-0.03x}\right)^2}$$

5. (3 pt) $f(x) = e^{3x} \cdot 2^x \cdot 1.03^x$ (-1 per detail; -2 if it does not have correct order of operations)

$$f'(x) = e^{3x} \cdot 3 \cdot 2^x \cdot 1.03^x + e^{3x} \cdot 2^x \ln(2) \cdot 1.03^x + e^{3x} \cdot 2^x \cdot 1.03^x \ln(1.03)$$

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6. (2 pt) Our company's profit is $P(x) = -0.3x^3 - 30x^2 + 100x + 1000$ dollars when we produce x pounds per month of our commodity. We are currently producing 30 pounds per month. ***Use marginal analysis*** to estimate the additional profit earned if we increase production by 0.2 pounds per month.

Answer: -502

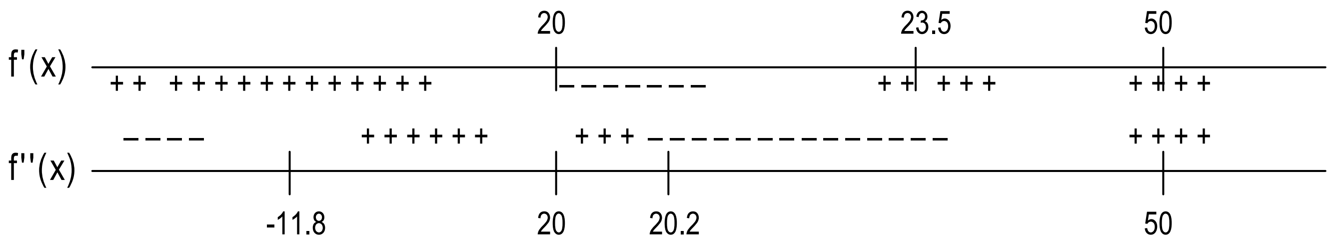
$$P'(x) = -0.9x^2 - 60x + 100$$

P(30) = -2510 (1 pt)

P(30)*0.2 = -502 (1 pt)

7. (4 pt) For $f(x) = 100(x-20)^{2/5}(x-50)^3$

$f'(x) = 340(x-20)^{-3/5}(x-50)^2[x-23.5]$ and $f'(x) = 816(x-20)^{-8/5}(x-50)(x+11.8)(x-20.2)$



The critical points and the possible inflection points are those shown with the appropriate derivative. Classify them.

(1 + 1 left column)		(1 + 1 right column)	
PDR at x =	20.2	Min at x =	23.5
Other inflection points at x =	-11.8, 50	Max at x =	20
Other possible inflection points at x =	20	Other critical points at x =	50

8. (3 pt) A company's profit $P(x) = (-500{,}000 + 7000x)e^{-0.03x}$ dollars is determined by its sales x. Find the sales level that maximizes profit. Round to the nearest unit.

x = 104.76

$$P'(x) = 7000e^{-0.03x} + (-500{,}000 + 7000x)e^{-0.03x}(-0.03) = 0 \quad \text{(1 pt)}$$

$$7000 + (-500{,}000 + 7000x)(-0.03) = 0 \quad \text{(1 pt)}$$

x = (-7000/-0.03 + 500000)/7000 = 104.76 (1 pt)

9. (3 pt) Find and classify the inflection points of $f(x) = -0.1x^4 + x^3 + 0.2x^2 + 3x + 5$. Justify the classification. Use three significant digits precision. (1 pt for classification)

$f'(x) = -0.4x^3 + 3x^2 + 0.4x + 3$

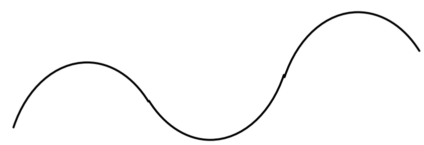
$f''(x) = -1.2x^2 + 6x + 0.4 = 0$ (1 pt)

x = (-6 ± √(6² – 4*-1.2*0.4))/-2.4 = -0.0658, 5.0658 (1 pt)

PDR at x = 5.0658

Other inflection point at x = -0.0658

Other possible inflection point at x =



10. (4 pt) Find and classify the critical points of $f(x) = 0.2x^4 + 4x^3 - 0.8x^2 + 5$. Justify the classification. Use three significant digits precision. (1 pt for classification)

$f'(x) = 0.8x^3 + 12x^2 - 1.6x = 0$

$x(0.8x^2 + 12x - 1.6) = 0$ (1 pt)

(1 pt)

x = (-12 ± √(12² – 4*0.8*-1.6))/1.6 = 0.132, -15.132

or

x = 0

(1 pt for remembering 0)

Max at x = 0

Min at x = 0.132, -15.132

Other critical points at x =