Math 1041 **Test 3 Review – Even Answer Key** **Summer 2009**

Section 2.4

6. On $(-\infty,1)$, $(1,2)$ and $(2,\infty)$, f is defined by polynomials and so f is continuous for $x \neq 1, 2$.

At $x = 1$, $f(x)$ has a jump discontinuity because the one-sided limits exist but are not equal:

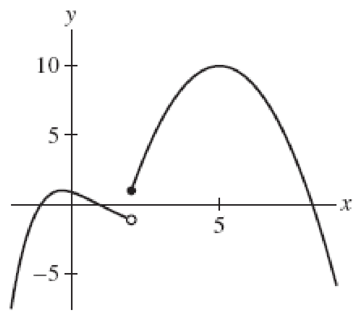
$$\lim_{x\to 1-} f(x) = \lim_{x\to 1-} (x^2+3) = 4, \qquad \lim_{x\to 1+} f(x) = \lim_{x\to 1+} (10-x) = 9.$$

Furthermore, the right-hand limit equals the function value $f(1) = 9$, so $f(x)$ is right-continuous at $x = 1$. At $x = 2$,

$$\lim_{x\to 2-} f(x) = \lim_{x\to 2-} (10-x) = 8, \qquad \lim_{x\to 2+} f(x) = \lim_{x\to 2+} (6x-x^2) = 8.$$

The left- and right-hand limits exist and are equal to $f(2)$, so $f(x)$ is continuous at $x = 2$.

82. Right-continuous at $x = 2$.



Section 2.5

8. 8 **20.** $1/4$

Section 3.2

76. The function is discontinuous at $x = 1$. The function is nondifferentiable at $x = 1$ because it is discontinuous there and it is nondifferentiable at $x = 2$ and $x = 3$ because the one-sided derivatives at each of these points are not equal to each other.

Section 3.3

12. $f'(x) = \dfrac{(x^2+1)e^x - e^x(2x)}{(x^2+1)^2} = \dfrac{e^x(x-1)^2}{(x^2+1)^2}$

Section 3.4

20. a) 4 cm/sec b) $t = \dfrac{5}{2}$ sec

Section 3.5

14.

$$y' = x^4e^x + 4x^3e^x = (x^4+4x^3)e^x$$

$$y'' = (x^4+4x^3)e^x + (4x^3+12x^2)e^x = (x^4+8x^3+12x^2)e^x$$

$$y''' = (x^4+8x^3+12x^2)e^x + (4x^3+24x^2+24x)e^x = (x^4+12x^3+36x^2+24x)e^x$$

Section 3.7

32. $y' = \frac{3}{2}\left((x+1)^{1/2} - 1\right)^{1/2} \cdot \left(\frac{1}{2}(x+1)^{-1/2} \cdot 1\right)$

38. $y' = 2x\cos\left(2x^2\right)$ **44.** $2x^2 \sec^2(2x) + 2x\tan(2x)$

56. $\frac{dy}{dx} = \frac{t\sec\left(\sqrt{t^2-9}\right)\tan\left(\sqrt{t^2-9}\right)}{\sqrt{t^2-9}}$

Section 3.8

30. $y = \frac{8}{7} - \frac{1}{14}x$

Section 3.9

26. $y' = \frac{x}{1+x^2} + \tan^{-1} x$ **28.** $\frac{e^x}{\sqrt{1-e^{2x}}}$

Chapter 3 Review Problems

40.

$$\frac{dy}{dx} = 2x - \frac{3}{2}x^{-5/2}$$

Section 4.2

18. CP: $x = \pi/4$; maximum is $f(\pi/4) = \sqrt{2}$; minimum is $f(0) = f(\pi/2) = 1$.

40. CP: $x = \frac{1}{\sqrt{3}}, x = -\frac{1}{\sqrt{3}}$; minimum of *f* is $f\left(\frac{1}{\sqrt{3}}\right) = \sqrt{3}$ and the maximum of *f* is $f(2) = 2\sqrt{5} - 2$

52. CP: $x = 1$; maximum is $f(1) = e^{-1}$; minimum is $f(0) = 0$.

Section 4.3

48.

x	$(-\infty, -2)$	-2	$(-2, 0)$	0	$(0, \infty)$
f'	+	0	−	0	+
f	↗	M	↘	m	↗

Section 4.4

8. *f* is concave up on $(1, \infty)$ and concave down on $(-\infty, 1)$; point of inflection at $t = 1$.

16. *f* is concave up on $\left(e^{5/6}, \infty\right)$ and concave down on $\left(0, e^{5/6}\right)$; point of inflection at $x = e^{5/6}$.

22.

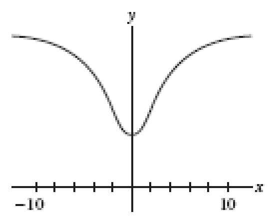
(a) f is increasing when f' is positive. Hence, f is increasing on $(0, 0.4)$.

(b) f is decreasing when f' is negative. Hence, f is decreasing on $(0.4, 1) \cup (1, 1.2)$.

(c) Now f is concave up where f' is increasing. This occurs on $(0, .17) \cup (.64, 1)$.

(d) Moreover, f is concave down where f' is decreasing. This occurs on $(.17, .64) \cup (1, 1.2)$

58. One potential graph is



Section 4.5

52. 3/4 **68.** ∞

Section 4.6

8. a) $x = 12^{1/3};\ y = 12^{1/3}$ b) $x = \frac{\sqrt{30}}{3};\ y = \frac{\sqrt{30}}{3}$ **10.** $x = \frac{3}{2};\ y = 2;\ A\left(\frac{3}{2}\right) = 3$

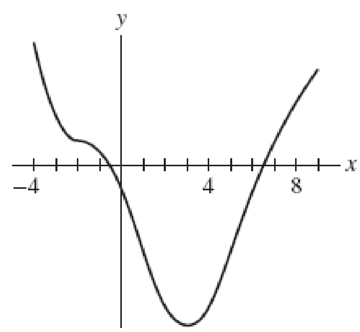
24. a) height of 1500 feet and width of 3000 feet; b) 1, 5000, 000 square feet

Section 4.7

44. e

Chapter 4 Review Problems

44.



94. $y(t) = t^3 + \sin t + 12$

Section 5.2

14. $\frac{3}{2};\ 0$

Section 5.3

2. $\frac{4}{3}$