

Solutions

MAT 1320 B. Fall 2013 October 2nd, 11:30 Prof. Desjardins

TEST #1

Student Number: _____

- Time: 80 min.
 - Write your Student Number on this page and your Name on the second page.
 - Only basic scientific calculators are permitted: non-programmable, non-graphing, no differentiation or integration capability. Notes or books are not permitted.
 - There are 8 Multiple Choice Questions worth 2 marks each and 1 Problem worth 4 marks for a total of 20 marks.
 - For the Multiple Choice Questions, enter the letter of the correct answer in the table on the second page. For the Problem, write your answers in the space provided.
-

Name: _____

Answers for the Multiple Choice Questions:

Question	Answer
1	B
2	A
3	C
4	A
5	C
6	B
7	D
8	A

Multiple Choice Questions:

1. [2 points] What is the domain of the function $f(x) = \sqrt{4-x^2}$?

- (A) $x \geq 2$ (B) $-2 \leq x \leq 2$ (C) $x \leq -2$ (D) $x < 2$

$$\text{need } 4 - x^2 \geq 0 \text{ or } x^2 \leq 4$$

2. [2 points] Solve for x : $e^{2x+1} = 6$.

- (A) 0.3959 (B) 1.7918 (C) 0.8959 (D) 1.3959

$$\ln(e^{2x+1}) = \ln(6)$$

$$2x+1 = \ln(6)$$

$$x = \frac{\ln(6) - 1}{2}$$

3. [2 points] Find a formula for the inverse of $f(x) = \ln(x+6)$.

- (A) e^{x+6} (B) $e^x + 6$ (C) $e^x - 6$ (D) $x + 6$

$$y = \ln(x+6)$$

$$e^y = e^{\ln(x+6)} = x+6$$

$$x = e^y - 6$$

4. [2 points] What is the average rate of change of the function $f(x) = 4 + 3x^2$ on the interval $[2, 2.1]$?

- (A) 12.3 (B) 12.03 (C) 12.003 (D) 12

$$\frac{\Delta f}{\Delta x} = \frac{(4+3(2.1)^2) - (4+3(2)^2)}{2.1-2} = \frac{13.23-12}{0.1}$$

5. [2 points] What is the equation of the tangent line to the curve $y = f(x) = 2x + 3x^2$ at the point $(1, 5)$?

- (A) $y = 32x - 27$ (B) $y = 6x - 1$ (C) $y = 8x - 3$ (D) $y = 3x + 2$

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

$$m = f'(1) = 2 + 6(1) = 8$$

$$y - 5 = 8(x - 1)$$

6. [2 points] The Quotient Rule states that $\frac{d}{dx} \left(\frac{f(x)}{g(x)} \right) =$

- (A) $\frac{f'(x)g(x) + f(x)g'(x)}{(g(x))^2}$ (B) $\frac{f'(x)g(x) - f(x)g'(x)}{(g(x))^2}$
- (C) $\frac{f'(x)g(x) - f(x)g'(x)}{g(x)}$ (D) $f'(x)g(x) - f(x)g'(x)$

7. [2 points] If $f(x) = x^2e^x$ then $f''(x) = ?$

- (A) $2e^x$ (B) $(2 + x^2)e^x$ (C) $(2 + 2x + x^2)e^x$ (D) $(2 + 4x + x^2)e^x$

$$f'(x) = 2xe^x + x^2e^x$$

$$f''(x) = 2e^x + 2xe^x + 2xe^x + x^2e^x$$

8. [2 points] Which of the following is the derivative of $\cot x$?

- (A) $-\csc^2 x$ (B) $-\csc x \cot x$ (C) $\sec^2 x$ (D) $\tan^2 x$

Problem:

9. [4 points] Differentiate the following functions:

(a) $f(x) = 3e^x + 4x^3 - 7x^2 + 5x - 3$

(b) $g(t) = \frac{t^2}{t+4}$

(c) $y = 2x^{5/2} - 4x^{1/3}$

(d) $f(x) = 2x^2 e^x \cos x$

a) $f'(x) = 3e^x + 12x^2 - 14x + 5$

b) $g'(t) = \frac{(2t)(t+4) - t^2(1)}{(t+4)^2} = \frac{t^2 + 8t}{(t+4)^2}$

c) $\frac{dy}{dx} = 5x^{3/2} - \frac{4}{3}x^{-2/3}$

d) $f'(x) = 4x e^x \cos x + 2x^2 e^x \cos x - 2x^2 e^x \sin x$

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Name: _____

Answers for the Multiple Choice Questions:

Question	Answer
1	C
2	D
3	A
4	B
5	C
6	A
7	B
8	C

Multiple Choice Questions:

1. [2 points] What is the domain of the function $f(x) = \sqrt{x^2 - 4}$?

- (A) $x \geq 2$ (B) $-2 \leq x \leq 2$ (C) $x \leq -2$ and $x \geq 2$ (D) $x < 2$

need $x^2 - 4 \geq 0$
 $x^2 \geq 4$

2. [2 points] Solve for x : $e^{2x+2} = 8$.

- (A) 1.0397 (B) 0.4515 (C) 2.0794 (D) 0.0397

$$2x+2 = \ln(8)$$

$$x = \frac{\ln(8) - 2}{2}$$

3. [2 points] Find a formula for the inverse of $f(x) = e^x + 6$.

- (A) $\ln(x - 6)$ (B) $\ln(x + 6)$ (C) $\ln x - 6$ (D) $x + 6$

$$y = e^x + 6$$

$$y - 6 = e^x$$

$$\ln(y - 6) = x$$

4. [2 points] What is the average rate of change of the function $f(x) = 3 + 4x^2$ on the interval $[2, 2.1]$?

- (A) 16 (B) 16.4 (C) 16.04 (D) 16.004

$$\frac{\Delta f}{\Delta x} = \frac{(3 + 4(2.1)^2) - (3 + 4(2)^2)}{2.1 - 2} = \frac{17.64 - 16}{0.1}$$

5. [2 points] What is the equation of the tangent line to the curve $y = f(x) = 3x + 2x^2$ at the point $(1, 5)$?

- (A) $y = 8x - 3$ (B) $y = 6x - 1$ (C) $y = 7x - 2$ (D) $y = 3x + 2$

$$f'(x) = 3 + 4x$$

$$m = f'(1) = 3 + 4(1) = 7$$

$$y - 5 = 7(x - 1)$$

6. [2 points] The Quotient Rule states that $\frac{d}{dx} \left(\frac{f(x)}{g(x)} \right) =$

- (A) $\frac{f'(x)g(x) - f(x)g'(x)}{(g(x))^2}$ (B) $\frac{f'(x)g(x) + f(x)g'(x)}{(g(x))^2}$
- (C) $\frac{f'(x)g(x) - f(x)g'(x)}{g(x)}$ (D) $f'(x)g(x) - f(x)g'(x)$

7. [2 points] If $f(x) = x \cos x$ then $f''(x) = ?$

- (A) $-x \cos x$ (B) $-2 \sin x - x \cos x$ (C) $2 \sin x - x \cos x$ (D) $2 \sin x$

$$f'(x) = \cos x - x \sin x$$

$$f''(x) = -\sin x - \sin x - x \cos x$$

8. [2 points] Which of the following is the derivative of $\tan x$?

- (A) $-\csc^2 x$ (B) $\sec x \tan x$ (C) $\sec^2 x$ (D) $\tan^2 x$

Problem:

9. [4 points] Differentiate the following functions:

(a) $f(x) = 4e^x + 6x^3 + 5x^2 - 6x + 2$

(b) $g(t) = \frac{t^2}{t+3}$

(c) $y = 5x^{7/2} - 2x^{2/3}$

(d) $f(x) = x^2 e^x \sin x$

a)
$$f'(x) = 4e^x + 18x^2 + 10x - 6$$

b)
$$g'(t) = \frac{2t(t+3) - (t^2)(1)}{(t+3)^2} = \frac{t^2 + 6t}{(t+3)^2}$$

c)
$$\frac{dy}{dx} = \frac{35}{2} x^{5/2} - \frac{4}{3} x^{-1/3}$$

d)
$$f'(x) = 2xe^x \sin x + x^2 e^x \sin x + x^2 e^x \cos x$$

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Name: _____

Answers for the Multiple Choice Questions:

Question	Answer
1	C
2	A
3	C
4	B
5	A
6	C
7	D
8	B

Multiple Choice Questions:

1. [2 points] What is the domain of the function $f(x) = \sqrt{9 - x^2}$?

- (A) $x \geq 3$ (B) $x \leq -3$ (C) $-3 \leq x \leq 3$ (D) $x < 3$

$$\text{need } 9 - x^2 \geq 0 \quad \text{or } x^2 \leq 9$$

2. [2 points] Solve for x : $e^{3x+1} = 10$.

- (A) 0.4342 (B) 1.3026 (C) 0 (D) 0.7675

$$3x+1 = \ln(10)$$

$$x = \frac{\ln(10) - 1}{3}$$

3. [2 points] Find a formula for the inverse of $f(x) = \ln(x - 3)$.

- (A) e^{x-3} (B) $e^x - 3$ (C) $e^x + 3$ (D) $x - 3$

$$y = \ln(x-3)$$

$$e^y = x-3$$

$$x = e^y + 3$$

4. [2 points] What is the average rate of change of the function $f(x) = 3 + 2x^2$ on the interval $[3, 3.1]$?

- (A) 12.02 (B) 12.2 (C) 12.002 (D) 12

$$\frac{\Delta f}{\Delta x} = \frac{(3+2(3.1)^2) - (3+2(3)^2)}{3.1-3} = \frac{19.22-18}{0.1}$$

5. [2 points] What is the equation of the tangent line to the curve $y = f(x) = 2x + 4x^2$ at the point $(1, 6)$?

- (A) $y = 10x - 4$ (B) $y = 8x - 2$ (C) $y = 4x + 2$ (D) $y = 12x - 6$

$$f'(x) = 2 + 8x$$

$$m = f'(1) = 2 + 8(1) = 10$$

$$y - 6 = 10(x - 1)$$

6. [2 points] The Quotient Rule states that $\frac{d}{dx} \left(\frac{f(x)}{g(x)} \right) =$

- (A) $\frac{f'(x)g(x) + f(x)g'(x)}{(g(x))^2}$ (B) $\frac{f'(x)g(x) - f(x)g'(x)}{g(x)}$
 (C) $\frac{f'(x)g(x) - f(x)g'(x)}{(g(x))^2}$ (D) $f'(x)g(x) - f(x)g'(x)$

7. [2 points] If $f(x) = x \sin x$ then $f''(x) = ?$

- (A) $2 \cos x$ (B) $-2 \cos x + x \sin x$ (C) $2 \cos x + x \sin x$ (D) $2 \cos x - x \sin x$

$$f'(x) = \sin x + x \cos x$$

$$f''(x) = \cos x + \cos x - x \sin x$$

8. [2 points] Which of the following is the derivative of $\sec x$?

- (A) $-\csc^2 x$ (B) $\sec x \tan x$ (C) $\sec^2 x$ (D) $\tan^2 x$

Problem:

9. [4 points] Differentiate the following functions:

(a) $f(x) = 5e^x - 3x^3 + 2x^2 - 7x + 6$

(b) $g(t) = \frac{t^2}{t-2}$

(c) $y = 4x^{5/2} + 2x^{4/3}$

(d) $f(x) = 2x^2e^x \sin x$

a) $f'(x) = 5e^x - 9x^2 + 4x - 7$

b) $g'(t) = \frac{(2t)(t-2) - (t^2)(1)}{(t-2)^2} = \frac{t^2 - 4t}{(t-2)^2}$

c) $\frac{dy}{dx} = 10x^{3/2} + \frac{8}{3}x^{1/3}$

d) $f'(x) = 4xe^x \sin x + 2x^2e^x \sin x + 2x^2e^x \cos x$

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Name: _____

Answers for the Multiple Choice Questions:

Question	Answer
1	A
2	C
3	B
4	D
5	B
6	D
7	A
8	B

Multiple Choice Questions:

1. [2 points] What is the domain of the function $f(x) = \sqrt{x^2 - 9}$?

- (A) $x \leq -3$ and $x \geq 3$ (B) $x \geq 3$ (C) $x \leq -3$ (D) $x > 3$

$$\text{need } x^2 - 9 \geq 0 \text{ or } x^2 \geq 9$$

2. [2 points] Solve for x : $e^{3x+2} = 12$.

- (A) 0.4849 (B) 0.8283 (C) 0.1616 (D) -0.3069

$$3x + 2 = \ln(12)$$

$$x = \frac{\ln(12) - 2}{3}$$

3. [2 points] Find a formula for the inverse of $f(x) = e^x - 5$.

- (A) $\ln(x - 5)$ (B) $\ln(x + 5)$ (C) $x - 5$ (D) $\ln x + 5$

$$y = e^x - 5$$

$$y + 5 = e^x$$

$$\ln(y + 5) = x$$

4. [2 points] What is the average rate of change of the function $f(x) = 3 + 2x^2$ on the interval $[2, 2.1]$?

- (A) 8 (B) 8.002 (C) 8.02 (D) 8.2

$$\frac{\Delta f}{\Delta x} = \frac{(3 + 2(2.1)^2) - (3 + 2(2)^2)}{2.1 - 2} = \frac{8.82 - 8}{0.1}$$

5. [2 points] What is the equation of the tangent line to the curve $y = f(x) = 3x + 4x^2$ at the point $(1, 7)$?

- (A) $y = 8x + 3$ (B) $y = 11x - 4$ (C) $y = 3x + 4$ (D) $y = 9x - 2$

$$f'(x) = 3 + 8x$$

$$m = f'(1) = 3 + 8(1) = 11$$

$$y - 7 = 11(x - 1)$$

6. [2 points] The Quotient Rule states that $\frac{d}{dx} \left(\frac{f(x)}{g(x)} \right) =$

- (A) $\frac{f'(x)g(x) + f(x)g'(x)}{(g(x))^2}$ (B) $f'(x)g(x) - f(x)g'(x)$
 (C) $\frac{f'(x)g(x) - f(x)g'(x)}{g(x)}$ (D) $\frac{f'(x)g(x) - f(x)g'(x)}{(g(x))^2}$

7. [2 points] If $f(x) = x^2e^x$ then $f''(x) = ?$

- (A) $(2 + 4x + x^2)e^x$ (B) $(2 + 2x + x^2)e^x$ (C) $(2 + x^2)e^x$ (D) $2e^x$

$$f'(x) = 2xe^x + x^2e^x$$

$$f''(x) = 2e^x + 2xe^x + 2xe^x + x^2e^x$$

8. [2 points] Which of the following is the derivative of $\csc x$?

- (A) $-\csc^2 x$ (B) $-\csc x \cot x$ (C) $\sec^2 x$ (D) $\tan^2 x$

Problem:

9. [4 points] Differentiate the following functions:

(a) $f(x) = 2e^x + 5x^3 - 10x^2 + 2x - 1$

(b) $g(t) = \frac{t^2}{t-6}$

(c) $y = 3x^{3/2} + 2x^{5/3}$

(d) $f(x) = x^2 e^x \cos x$

a) $f'(x) = 2e^x + 15x^2 - 20x + 2$

b) $g'(t) = \frac{(2t)(t-6) - (t^2)(1)}{(t-6)^2} = \frac{t^2 - 12t}{(t-6)^2}$

c) $\frac{dy}{dx} = \frac{9}{2} x^{1/2} + \frac{10}{3} x^{2/3}$

d) $f'(x) = 2xe^x \cos x + x^2 e^x \cos x - x^2 e^x \sin x$