Dr. Trevor Jones
Instructor's Name (**Print**)

Student's Name (**Print**)

Student's Signature

Student Number

THE UNIVERSITY OF NEW BRUNSWICK
SAINT JOHN CAMPUS
MATH 1853 FINAL EXAM

INSTRUCTIONS

1. **Do not unstaple the exam**.
2. **Only non-programmable calculators are permitted**.
3. **Scrap paper will be provided upon request**.
4. **Work time: 3 hours**.
5. **Total marks = 50**.

FORMULAS from Chapter 2

$I = Prt$ and $A = P + Prt = P(1 + rt)$

$A = P\left(1 + \dfrac{r}{m}\right)^{mt}$ or $A = P(1+i)^n$, where $i = r/m$ and $n = mt$

$A = Pe^{rt}$

$r_{eff} = APY = \left(1 + \dfrac{r}{m}\right)^{m} - 1$

$S = R\left(\dfrac{(1+i)^n - 1}{i}\right)$ or $FV = PMT\left(\dfrac{(1+i)^n - 1}{i}\right)$

$PMT = FV\left(\dfrac{i}{(1+i)^n - 1}\right)$

$P = R\left(\dfrac{1-(1+i)^{-n}}{i}\right)$ or $PV = PMT\left(\dfrac{1-(1+i)^{-n}}{i}\right)$

$PMT = PV\left(\dfrac{i}{1-(1+i)^{-n}}\right)$

FOR GRADING ONLY

Page	MARK
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3	____ / 14
4	____ / 12
5	____ / 12
TOTAL	

Part I (26 marks): Multiple Choice. Circle the appropriate answer (a, b, c, d, or e) for each of the 13 questions.

(1) If the line joining the points $(1, 5)$ and $(-3, 6)$ is perpendicular to the line $3y - ax = 1$, then the value of a is:

a:	12	**b:**	3/4	**c:**	-4	**d:**	There is no solution for a.	**e:**	None of these.

(2) Find $\lim_{x \to -\infty} \dfrac{1 - x + 2x^2}{3x + 2}$.

a:	2/3	**b:**	$+\infty$	**c:**	$-\infty$	**d:**	1/2	**e:**	1/3

(3) Consider the following matrices: $A = \begin{bmatrix} 1 & 3 & 8 \\ 2 & 6 & 5 \end{bmatrix}$, $B = \begin{bmatrix} 7 \\ 3 \\ 5 \end{bmatrix}$, $C = \begin{bmatrix} 3 \\ 1 \\ 5 \end{bmatrix}$ and $D = \begin{bmatrix} 3 & 6 & 5 \end{bmatrix}$.

Identify the operation that is **not** defined:

a:	$2B + C$	**b:**	AB	**c:**	CA	**d:**	DB	**e:**	$D(B + C)$

(4) A manufacturer sets up a sinking fund in order to purchase a piece of machinery. The purchase will be made in 20 years at a cost of $\$50,000$. What amount must the deposited at the end of each month in order to be able to purchase the machinery? (Assume interest to be 8% per year compounded monthly).

a:	$\$2,345.35$	**b:**	\$84.89	**c:**	\$3.81	**d:**	\$1.092.61	**e:**	\$208.33

(5) $\ln\left(\dfrac{x^2\sqrt{x^2 - 1}}{e^x}\right) =$

a:	$\ln(x^2) + \sqrt{\ln(x^2) - \ln(1)} + \ln(e^x)$	**c:**	$2\ln(x) + \frac{1}{2}\Big(\ln(x^2) - \ln(1)\Big) - x$
b:	$\ln(x^2) + \sqrt{\ln(x^2) - \ln(1)} - \ln(e^x)$	**d:**	$2\ln(x) + \frac{1}{2}\ln(x^2 - 1) - x$

(6) A corporation manufactures motor pumps. Each pump sells for \$9.00 and the variable cost for producing each unit is 40% of the selling price. The monthly fixed cost incurred by the corporation is $\$50,000$. What is the break-even quantity for the corporation?

a:	$\dfrac{50,000}{6}$	**b:**	0.4×50.000	**c:**	$\dfrac{50,000}{5.4}$	**d:**	$\dfrac{50,000}{9}$	**e:**	0.6×50.000

(7) $\$1,000$ is invested at a rate of 8% compounded continuously. What is the accumulated amount after 3 years?

a:	$\$1,271.25$	**b:**	$\$1,382.725$	**c:**	$\$1,259.71$	**d:**	$\$1,385.33$	**e:**	None of these.

(8) If $f(x) = x\sqrt[3]{x}$, then $f'(x) =$

a:	$1 \cdot \frac{1}{3} \cdot x^{-2/3}$	**b:**	$\frac{4}{3}\sqrt[3]{x}$	**c:**	$\frac{x}{3\sqrt{x}}$	**d:**	$\frac{1}{3\sqrt[3]{x}}$	**e:**	None of these.

(9) Evaluate $\lim_{x \to 1^+} \dfrac{x^2 - 5x + 6}{x - 1}$

a:	2	**b:**	Not defined	**c:**	$-\infty$	**d:**	$+\infty$	**e:**	None of these.

(10) How many days will it take for a sum of $\$1,500$ to earn $\$25$ interest if it is deposited in a bank paying simple interest at 5% per year (use a 365 day year).

a:	121.67 days	**b:**	183 days	**c:**	220 days	**d:**	153.52 days	**e:**	None of these.

(11) The maximum value of the function $f(x) = -x^2 + 5x - 3$ is

a:	$-5/2$	**b:**	-3	**c:**	$5/2$	**d:**	$13/4$	**e:**	None of these.

(12) If $f'(2) = 1$, $f(2) = 3$, $g'(2) = -1$ and $g(2) = 1$, then the derivative of $[f(x) \cdot g(x)]$ at $x = 2$ equals:

a:	4	**b:**	-3	**c:**	-1	**d:**	-2	**e:**	None of these.

(13) Evaluate $\lim_{x \to 9} \dfrac{2x - 18}{\sqrt{x} - 3}$

a:	2	**b:**	Does not exist	**c:**	1	**d:**	12	**e:**	None of these.

Part II: Full Solution Section. Show all work in the space provided. Full marks will be awarded only for complete and justified solutions.

3 mks **1.** Find the derivative of the following functions.

(a) $f(x) = \dfrac{x}{x^2 + 2x - 5}$

(b) $g(x) = 2^{2x^2 - 1}$

3 mks **2.** Consider the following function: $f(x) = \begin{cases} x^2 + 2 \text{ if } x \leq 1 \\ x + 2 \text{ if } x > 1 \end{cases}$

Is it continuous at $x = 1$? differentiable at $x = 1$?

6 mks **3.** Find the roots of $-2x^2 + 5x - 2 = 0$, then simplify the fraction $\dfrac{-2x^2 + 5x - 2}{x^3 - 8}$, and find $\lim\limits_{x \to 2} \dfrac{-2x^2 + 5x - 2}{x^3 - 8}$

3 mks **4.** A company decided to increase their weekly production of 100 units to 105 units. The company is selling their product at a price $p(x) = 100 - \ln(100/x)$, where x is the number of items produced. What is the weekly change in revenue?

3 mks **5.** Linda has joined a *Christmas Fund Club* at her bank. At the end of every month, December through October inclusive, she will make a deposit of \$40 in her fund. If the money earns interest at the rate of 7% per year compounded monthly, how much will she have in her account on December 1st of the following year?

3 mks **6.** A group of investors purchased a condominium complex for \$2 million. They made an initial down payment of 10% and obtained financing for the balance. The loan is to be amortized over 15 years at an interest rate of 12% per year compounded quarterly. How much will the investors still have to pay after 5 years (that is, after making 20 payments) ?

3 mks **7.** Solve the system $\begin{cases} x + y = -2 \\ x + 2z = 2 \\ -y + 2z = 4 \end{cases}$