

CONCORDIA UNIVERSITY
Department of Mathematics & Statistics

Course	Number	Section(s)	
Mathematics	208/1	All	
Examination	Date	Time	Pages
Final	June 2016	3 Hours	3
Instructors	Course Examiner		
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FORMULAE:

$$A = P(1+i)^n, \quad A = Pe^{rt}, \quad FV = PMT \frac{(1+i)^n - 1}{i}, \quad PV = PMT \frac{1 - (1+i)^{-n}}{i}$$

Special Instructions:

- ▷ Answer all questions.
- ▷ Only approved calculators are allowed.

MARKS

- [10] 1. The revenue of a charter bus company depends on the number of unsold seats. If 100 seats are sold, the price per seat is \$50. Each unsold seat increases the price per seat by \$1. Let x represent the number of unsold seats.

- (A) Write an expression for the price per seat.
- (B) Write an expression for the revenue.
- (C) Find the number of unsold seats that will produce the maximum revenue.
- (D) Find the maximum revenue.

- [10] 2. Solve for x in the following equations:

(A) $2^{x^2-4x} = \frac{1}{16}$

(B) $\frac{1}{2} = \left(\frac{x}{4}\right)^{\frac{1}{4}}$

(C) $\log_8(x-6) = 2 - \log_8(x+15)$

(D) $\log_{10} x + \log_{10}(x-3) = 1$

(E) $\log_{10} x = \sqrt{\log_{10} x}$

- [10] 3. For $f(x) = -32x + 75$ and $g(x) = 7(0.6)^x$ find the following by only using a proper formula:

(A) $\sum_{k=0}^{49} f(k) = f(0) + f(1) + f(2) + \cdots + f(49).$

(B) $\sum_{h=0}^{34} g(h) = g(0) + g(1) + g(2) + \cdots + g(34).$

(C) What is $\sum_{h=0}^{\infty} g(h) = g(0) + g(1) + g(2) + \cdots + g(n) + g(n+1) + \dots?$

- [10] 4. A small business owner contributes \$3,000 at the end of each quarter to a retirement account that earns 8% compounded quarterly.

(A) How long will it be until the account is worth \$150,000?

(B) Suppose that when the account reaches \$150,000, the business owner increases the contributions to \$5,000 at the end of each quarter. What will the total value of the account be after 15 more years?

- [10] 5. The Rechten family buys a house for \$140,000 with a down payment of \$30,000. The family take out a 30 year mortgage for \$110,000 at an annual interest rate of 6.6% compounded monthly.

(A) Find the amount of the monthly payment needed to amortize this loan.

(B) Find the total amount of interest paid when the loan is amortized over 30 years.

(C) Find the the part of the first payment that is interest and the part that is applied to reducing the debt.

- [10] 6. Solve by using Gauss-Jordan Elimination:

$$3x_1 - 6x_2 + 6x_3 = -5$$

$$-2x_1 + 3x_2 - 5x_3 = \frac{7}{3}$$

$$x_1 + x_2 + 10x_3 = 3$$

No other method of solving this system of equations will be accepted!

- [10] 7. An economy is based on three sectors, agriculture, energy, and manufacturing. Production of a dollar's worth of agriculture requires an input of \$0.20 from the agriculture sector and \$0.40 from the energy sector. Production of a dollar's worth of energy requires an input of \$0.10 from the energy sector and \$0.20 from the manufacturing sector. Production of a dollar's worth of manufacturing requires an input of \$0.40 from the agriculture sector, \$0.20 from the energy sector, and \$0.20 from the manufacturing sector.
- (A) Write the technology matrix M for this economy.
- (B) If a final demand of \$20 billion for agriculture, \$10 billion for energy, and \$30 billion for manufacturing is to be met, then set up the equation to be satisfied by the inputs from the respective sectors.
- (C) Solve the respective inputs satisfying these demands.
- [10] 8. Extremize $P(x, y) = 50x + 20y$ subject to
- $$3x + 2y \leq 6, \quad -2x + 4y \leq 8, \quad 5x + 5y \geq 5, \quad x \geq 0, \quad y \geq 0.$$
- [10] 9. A software development department consists of 6 women and 4 men.
- (A) How many ways can they select a chief programmer, a backup programmer, and a programming librarian?
- (B) How many ways can they select a team of 3 programmers to work on a particular project?
- (C) If the selections in part(B) are made by lottery, what is the probability that a majority of the team members will be women?
- [10] 10. Thirty animals are to be used in a medical experiment on diet deficiency: 3 male and 7 female rhesus monkeys, 6 male and 4 female chimpanzees, and 2 male and 8 female dogs. If one animal is selected at random, what is the probability of getting:
- (A) A chimpanzee or a dog?
- (B) A chimpanzee or a male?
- (C) An animal other than a female rhesus monkey?

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