CONCORDIA UNIVERSITY
Department of Mathematics & Statistics

Course	Number		Section(s)
Mathematics	206/4		All
Examination	**Date**	**Time**	**Pages**
Final	April 2012	3 Hours	2
Instructors			**Course Examiner**
C. Ortiz, M. Najafi Ivaki, O. Quijano Xacur, V. Kalvin			D. Sen

Special Instructions

▷ **Only approved calculators are allowed.**

MARKS

[4] **1.** Simplify the expressions below. Do not use a calculator.

(a) $-2\sqrt{75}+\sqrt{27}+3\sqrt{12}$ (b) $\log_3 15+\log_3(3^2-5)-\log_3 20$

[4] **2.** Rationalize the denominator:

(a) $\dfrac{\sqrt{7}}{\sqrt{2}-1}$ (b) $\dfrac{5+\sqrt{3}}{5-\sqrt{3}}$

[6] **3.** Simplify the expressions:

(a) $4x(x^3-2x^2+x-2)+3x(3x^4-x^3+x^2+x)$ (b) $\dfrac{x^2+2x}{12x+24}$

[8] **4.** Factor the polynomials completely:

(a) $3x^2-2x-8$ (b) x^4-9x^2

[4] **5.** Perform the arithmetic operations and simplify:

$$\frac{2x+1}{x^2+7x+12}-\frac{3x+4}{x+4}$$

[9] **6.** Solve the equations:

(a) $\dfrac{x}{x^2-1}-\dfrac{x+3}{x^2-x}=\dfrac{-3}{x^2+x}$ (b) $3(3^x)=243$

(c) $\log_3(x^2-7)=2$

[8] **7.** Solve the inequalities, express your answer using set notation or interval notation:

(a) $4\le 2x+2\le 10$ (b) $|1-2x|-4<-1$

[4] **8.** Solve the system of equations:

$$\begin{aligned} x^2 - y^2 &= 21 \\ x + y &= 7 \end{aligned}$$

[8] **9.** (a) Which of the points $A(5,2)$, $B(8,3)$ is closer to the point $C(10,4)$?

(b) Show that the equation $x^2 + y^2 - x + 2y + 1 = 0$ represents a circle. Find coordinates of the center and radius of the circle.

[6] **10.** Find the domain and range of the functions (do not graph):

(a) $f(x) = \dfrac{2x}{x^2 - 4}$ (b) $g(x) = \sqrt{3x - 12}$ (c) $h(x) = |x| - 4$

[5] **11.** Sketch the graph of the function $f(x) = \frac{1}{2}\ln(x + 3)$, starting from the graph of the function $g(x) = \ln x$ and using appropriate transformations.

[8] **12.** Let $f(x) = \dfrac{2x - 1}{x - 2}$ and $g(x) = \dfrac{x + 4}{2x - 5}$. Find:

(a) fg (b) $\dfrac{f}{g}$ (c) $f \circ g$ (d) $g \circ f$

[8] **13.** (a) Find the inverse of the function $f(x) = \dfrac{2x + 3}{x + 2}$.

(b) Find the vertical and horizontal asymptotes of both f and f^{-1} above.

[5] **14.** John has \$70,000 to invest and requires an overall rate of return of 9%. He invests in a safe, government-insured certificate of deposit, but it only pays 8%. To obtain 9%, John agrees to invest some of his amount in noninsured corporate bonds paying 12%. How much should be placed in each investment to achieve his goal?

[5] **15.** A movie theater charges \$9.00 for adults and \$7.00 for senior citizens. On a day when 325 people paid an admission, the total receipts were \$2495. How many who paid were adults? How many were seniors?

[8] **16.** The mass $m(t)$ remaining after t days from a 40 gm sample of thorium-234 is given by,

$$m(t) = 40e^{-0.0277t}$$

(a) How much of the sample will remain after 60 days?

(b) After how long will only 10 gm of the sample remain?

(c) Find the half life of thorium-234.