CONCORDIA UNIVERSITY
Department of Mathematics & Statistics

Course	**Number**		**Section(s)**
Mathematics	206/2		All
Examination	**Date**	**Time**	**Pages**
Final	December 2012	3 Hours	2
Instructors			**Course Examiner**
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Special Instructions

▷ **Only approved calculators are allowed.**

MARKS

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

(a) $-4\sqrt{32}+5\sqrt{18}-3\sqrt{72}$ (b) $\log_2 20-\log_2(7^2-19)+\log_2 12$

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

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

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

(a) $8(8x^3-2x^2-2)+5x(3x^4-2x^3+x^2+x)$ (b) $\dfrac{x^2-25}{x^2-4x-5}$

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

(a) $3x^2-10x+8$ (b) $64-27x^3$

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

$$\frac{2x-3}{x^2+8x+7}-\frac{x-2}{x^2+2x+1}$$

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

(a) $\dfrac{4(x-2)}{x-3}+\dfrac{3}{x}=\dfrac{-3}{x(x-3)}$ (b) $\log_3(x+1)+\log_3(x+4)=2$

(c) $5^{x^2+8}=(125)^{2x}$

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

(a) $2<\dfrac{3-3x}{12}<6$ (b) $5+|x-1|>\dfrac{1}{2}$

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

$$\begin{aligned} x^2 + \ y^2 &= 16 \\ x^2 - 2y \ &= \ 8 \end{aligned}$$

[8] **9.** (a) Which of the points $A(1,2)$, $B(5,3)$ is closer to the point $C(2,6)$?

(b) Show that the equation $x^2 + y^2 + 4x - 4y - 1 = 0$ 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) $f(x) = \dfrac{x^3}{x^3 - 1}$ (b) $g(x) = \sqrt{x+2}$ (c) $h(x) = \dfrac{1}{2}|x|$

[5] **11.** Sketch the graph of the function $f(x) = 3\log(x-1)$, starting from the graph of the function $g(x) = \log x$ and using appropriate transformations.

[8] **12.** Let $f(x) = \dfrac{x}{x+3}$ and $g(x) = \dfrac{2}{x}$. Find:

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

[8] **13.** (a) Find the inverse of the function $f(x) = \dfrac{2x-3}{x+4}$.

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

[5] **14.** Wendy, a loan officer at a bank, has $\$1,000,000$ to lend and is required to obtain an average return of 18% per year. If she can lend at the rate of 19% or at the rate of 15%, how much can she lend at the 16% rate and still meet her requirement?

[5] **15.** An artist has 51 inches of oak trim to frame a painting. The frame is to have a border 3 inches wide surrounding the painting. If the painting is rectangular with a length twice its width, what are the dimensions of the painting?

[8] **16.** The EFISCEN wood products model classifies wood products according to their life-span. Based on data obtained from the European Forest Institute, the percentage of wood products after t years with long life-spans is given by

$$P(t) = \frac{100.3952}{1 + 0.0317e^{0.0581t}}$$

(a) What is the percentage of wood products after 10 years?

(b) How long does it take for the percentage of wood products to reach 50%?