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CONCORDIA UNIVERSITY  
Department of Mathematics & Statistics

Course	Number	Section(s)	
Mathematics	206/2	All	
Examination	Date	Time	Pages
Final	December 2013	3 Hours	2
Instructors	Course Examiner		
A. Bellahnid, D. Gernazian, D. Pearce, T. Hughes, U. Mgbemena	D. Sen		

**Special Instructions**

▷ Only approved calculators are allowed.

MARKS

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

(a)  $-\sqrt{18} + 2\sqrt{8} + \sqrt{72}$       (b)  $\frac{2}{3} \ln 8 - \ln(5^2 - 1)$

[4] 2. Rationalize the denominator:

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

[6] 3. Simplify the expressions:

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

[8] 4. Factor the polynomials completely:

(a)  $6x^2 + 5x + 1$       (b)  $8x^3 + 27$

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

$$\frac{x}{x-3} - \frac{x+1}{x^2+5x-24}$$

[9] 6. Solve the equations:

(a)  $\frac{x}{x^2-9} + \frac{4}{x+3} = \frac{3}{x^2-9}$       (b)  $\log_5(x+3) = 1 - \log_5(x-1)$

(c)  $8^{-x+14} = (16)^x$

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

(a)  $0 < \frac{3x+2}{2} < 4$       (b)  $\left| \frac{2x+3}{3} - \frac{1}{2} \right| < 1$

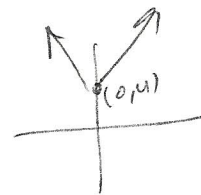
- [4] 8. Solve the system of equations:

$$x^2 + y^2 = 36$$

$$x + y = 8$$

Note:  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

- [8] 9. (a) Which of the points  $A(2, 3)$ ,  $B(6, 4)$  is closer to the point  $C(4, 3)$ ?  
 (b) Show that the equation  $2x^2 + 2y^2 + 8x + 7 = 0$  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)  $f(x) = \frac{3x}{x^2 - 4}$

(b)  $g(x) = \sqrt{-x - 2}$

(c)  $h(x) = |x| + 4$

- [5] 11. Sketch the graph of the function  $f(x) = \log(x - 4) + 2$ , starting from the graph of the function  $g(x) = \log x$  and using appropriate transformations.

$$\frac{2}{|x|}$$

- [8] 12. Let  $f(x) = \frac{x}{x-1}$  and  $g(x) = \frac{-4}{x}$ . Find:

(a)  $fg$

(b)  $\frac{f}{g}$

(c)  $f \circ g$

(d)  $g \circ f$

- [8] 13. (a) Find the inverse of the function  $f(x) = \frac{2x}{3x-1}$ .

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

- [5] 14. The diagonal of a rectangle measures 10 inches. If the length is 2 inches more than the width, find the dimensions of the rectangle.

- [5] 15. From each corner of a square piece of sheet metal, remove a square of side 9 centimeters. Turn up the edges to form an open box. If the box is to hold 144 cubic centimeters, what should be the dimensions of the piece of sheet metal?

- [8] 16. The number  $N$  of bacteria present in a culture at time  $t$  (in hours) obeys the law of uninhibited growth

$$N(t) = 1000e^{0.01t}$$

- (a) Determine the number of bacteria at  $t = 0$  hours.  
 (b) What is the population after 4 hours?  
 (c) When will the number of bacteria double?

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CONCORDIA UNIVERSITY  
Department of Mathematics & Statistics

Course	Number	Section(s)	
Mathematics	206/4	All	
Examination	Date	Time	Pages
Final	April 2013	3 Hours	2
Instructors	Course Examiner		
A. Bradley, M. Padamadan, R. Mearns, V. Kalvin	D. Sen		

**Special Instructions**

- ▷ Only approved calculators are allowed.

MARKS

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

(a)  $3\sqrt{5} + \sqrt{20} - 2\sqrt{45}$  (b)  $\log_5 10 + \log_5 (3^3 - 12) - \log_5 30$

- [4] 2. Rationalize the denominator:

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

- [6] 3. Simplify the expressions:

(a)  $6x(x^3 - x^2 - 3x) - 4x(3x^4 - 2x^3 + 3x^2 + x)$  (b)  $\frac{4x^2 - 8x}{12x - 24}$

- [8] 4. Factor the polynomials completely:

(a)  $2x^2 - x - 6$  (b)  $x^7 - x^5$

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

$$\frac{x+4}{x^2-x-2} - \frac{2x+3}{x^2+2x-8}$$

- [9] 6. Solve the equations:

(a)  $\frac{x+1}{x^2+2x} - \frac{x+4}{x^2+x} = \frac{-3}{x^2+3x+2}$  (b)  $3(169^x) = 39$

(c)  $\log_4(5 - 2x) = -2$

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

(a)  $1 \leq \frac{-2-3x}{7} < 4$  (b)  $2|x+1| - 3 \leq 7$

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

$$\begin{aligned}2x^2 + y^2 &= 1 \\2x - y &= -1\end{aligned}$$

- [8] 9. (a) Which of the points  $A(9, 3)$ ,  $B(4, 5)$  is closer to the point  $C(13, 4)$ ?  
(b) Show that the equation  $x^2 + y^2 - 8x + 20y + 107 = 0$  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):

$$(a) f(x) = \frac{3}{x^2 + 9} \quad (b) g(x) = \sqrt{4 - 3x} \quad (c) h(x) = |x - 4|$$

- [5] 11. Sketch the graph of the function  $f(x) = -2(x - 3)^2$ , starting from the graph of the function  $g(x) = x^2$  and using appropriate transformations.

- [8] 12. Let  $f(x) = \frac{x + 3}{2x - 4}$  and  $g(x) = \frac{3x - 1}{x - 2}$ . Find:

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

- [8] 13. (a) Find the inverse of the function  $f(x) = \frac{2x + 5}{x + 7}$ .

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

- [5] 14. Connie can clean her house in 2 hours. If Alvaro helps her, they can clean the house in 1 hour and 15 minutes together. How long would it take Alvaro to clean the house by himself?

- [5] 15. A total of \$18,000 is invested, some in stocks and some in bonds. If the amount invested in bonds is half that invested in stocks, how much is invested in each category?

- [8] 16. The logistic growth model

$$P(t) = \frac{1000}{1 + 32.33e^{-0.439t}}$$

represents the population (in grams) of a bacterium after  $t$  hours.

- (a) What is the population after 9 hours?  
(b) When will the population be 700 grams?  
(c) How long does it take for the population to reach one-half the carrying capacity?