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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	
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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:
- $$\begin{aligned}x^2 + y^2 &= 36 \\ x + y &= 8\end{aligned}$$
- [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.
- [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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