

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		
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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) $\frac{\sqrt{7}}{\sqrt{2}-1}$ (b) $\frac{5+\sqrt{3}}{5-\sqrt{3}}$
- [6] 3. Simplify the expressions:
- (a) $4x(x^3 - 2x^2 + x - 2) + 3x(3x^4 - x^3 + x^2 + x)$ (b) $\frac{x^2 + 2x}{12x + 24}$
- [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) $\frac{x}{x^2-1} - \frac{x+3}{x^2-x} = \frac{-3}{x^2+x}$ (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) $4 \leq 2x + 2 \leq 10$ (b) $|1 - 2x| - 4 < -1$

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

$$x^2 - y^2 = 21$$

$$x + y = 7$$

- [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):

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

- [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 $f(x) = \frac{2x - 1}{x - 2}$ and $g(x) = \frac{x + 4}{2x - 5}$. 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 $f(x) = \frac{2x + 3}{x + 2}$.

(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.