

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		
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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?