

CONCORDIA UNIVERSITY
Department of Mathematics & Statistics

Course	Number	Section(s)
Mathematics	206/4	ALL
Examination	Date	Pages
Final	April 2013	2
Instructors	Time	Course Examiner
A. Bradley, M. Padamadan, R. Mearns, V. Kalvin	3 Hours	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) $2|x+1| + 3 < 7$

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

$$2x^2 + y^2 = 1$$

$$2x - y = -1$$

- [8] 9. (a) Which of the points $A(9, 3)$, $D(4, 5)$ 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) $f(x) = \frac{3}{x^2 + 9}$

(b) $g(x) = \sqrt{4 - 3x}$

(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

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

(c) $f \circ g$

(d) $g \circ f$

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

- (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?