

CONCORDIA UNIVERSITY
Department of Mathematics & Statistics

Course	Number	Section(s)
Mathematics	206/4	All

Examination	Date	Time	Pages
Final	April 2015	3 Hours	2

Instructors	Course Examiner
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Special Instructions

- ▷ **Only approved calculators are allowed.**
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MARKS

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

(a) $4\sqrt{12} + 5\sqrt{27} - \sqrt{75}$ (b) $\frac{1}{3} \log_3 27 - \log_3(3^3 - 18)$

- [4] **2.** Rationalize the denominator:

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

- [6] **3.** Simplify the expressions:

(a) $5x(x^3 - 5x^2) - x^2(x^2 - 7x - 5)$ (b) $\frac{x^3 - 8}{x^3 - 2x^2}$

- [8] **4.** Factor the polynomials completely:

(a) $4x^2 - 16x + 15$ (b) $1 - 8x^2 - 9x^4$

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

$$\frac{4x}{x^2 - 4} - \frac{2}{x^2 + x - 6}$$

- [9] **6.** Solve the equations:

(a) $\frac{2x}{x^2 - 4} = \frac{4}{x^2 - 4} - \frac{3}{x + 2}$ (b) $\log_3(3x - 1) = 2$ (c) $3^{x^3} = 9^x$

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

(a) $-1 \leq \frac{3 - 5x}{2} \leq 9$ (b) $\left| \frac{2x + 3}{3} - \frac{1}{2} \right| < 1$

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

$$4x^2 + y^2 = 13$$

$$x^2 + y^2 = 10$$

- [8] 9. (a) Which of the points $A(6, 9)$, $B(2, -3)$ is closer to the point $C(5, 0)$?

(b) Show that the equation $x^2 + y^2 + 4x + 2y - 20 = 0$ 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) $f(x) = \frac{2}{(2-x)^2}$

(b) $g(x) = -\sqrt{x-3x^2}$

(c) $h(x) = 3|x+1|-3$

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

(a) fg

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

(c) $f \circ g$

(d) $g \circ f$

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

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

- [5] 14. A bank wants to lend \$1,000,000 and wants to obtain an average return of 18% per year. If they lend at 19% or at 16%, how much can they lend at 16% and 19% to meet their requirements?

- [5] 15. A rectangle has an area that is numerically twice its perimeter. If the length is twice the width, what are its dimensions?

- [8] 16. Iodine 131 is a radioactive material that decays according to the function

$$A(t) = A_0 e^{-0.87t}$$

where A_0 is the initial amount present and A is the amount present at the time t (in days). Assume that a scientist has a sample of 100 grams of iodine 131.

(a) How much iodine 131 is left after 9 days?

(b) When will 70 grams of iodine 131 be left?

(c) What is the half-life of iodine 131?

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