

CONCORDIA UNIVERSITY
Department of Mathematics & Statistics

Course	Number	Section(s)	
Mathematics	206/2	All	
Examination	Date	Time	Pages
Final	December 2015	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) $5\sqrt{108} - 3\sqrt{27} - 4\sqrt{75}$ (b) $\frac{1}{2}\log_2 64 + \log_2 (6^2 - 4)$

- [4] 2. Rationalize the denominator:

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

- [6] 3. Simplify the expressions:

(a) $9x(x^3 - 5x^2 - 3x) - 4x(x^2 - 7x - 5)$ (b) $\frac{x^3 - 125}{x^2 - 4x - 5}$

- [8] 4. Factor the polynomials completely:

(a) $5 + 11x - 16x^2$ (b) $x^6 - 2x^3 + 1$

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

$$\frac{2x - 3}{x^2 + 8x + 7} - \frac{x - 2}{(x + 1)^2}$$

- [9] 6. Solve the equations:

(a) $\frac{x}{x^2 - 1} - \frac{x + 3}{x^2 - x} = \frac{-3}{x^2 + x}$ (b) $\log x + \log(x - 21) = 2$ (c) $4 \cdot 4^{x-2} = 256$

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

(a) $\frac{1}{2}(x - 4) \geq (2x + 6)$ (b) $|1 - 4x| - 7 < -2$

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

$$\begin{aligned}4x^2 + y^2 &= 13 \\ x^2 + y^2 &= 10\end{aligned}$$

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

(b) Show that the equation $x^2 + y^2 + 6x - 5y + \frac{1}{4} = 0$ 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):

$$(a) f(x) = \frac{x+1}{x^4-16} \quad (b) g(x) = \sqrt{x-2}+3 \quad (c) h(x) = |2x-3|+1$$

- [5] 11. Sketch the graph of the function $f(x) = -2\ln(x+1)$, starting from the graph of the function $g(x) = \ln x$ and using appropriate transformations.

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

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

- [5] 14. Shelly drove 40 miles to work at 20 miles per hour. She then drove back home at a higher rate of speed so that she averaged 30 miles per hour for the whole trip. What was her speed on the return trip?

- [5] 15. An artist has 51 inches of oak trim to frame a painting. The frame is to have a border 3 inches wide surrounding the painting. If the painting is rectangular with a length twice its width, what are the dimensions of the painting?

- [8] 16. A colony of bacteria that grows according to the law of uninhibited growth is modeled by the function

$$N(t) = 100e^{0.045t}$$

where N is measured in grams and t is measured in days.

- (a) Determine the initial amount bacteria.
(b) How long will it take for the population to reach 140 grams?
(c) What is the doubling time for the population?

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