

CONCORDIA UNIVERSITY
Department of Mathematics & Statistics

Course	Number	Section(s)	
Mathematics	206/2	All	
Examination	Date	Time	Pages
Final	December 2010	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) $\sqrt{48} - \sqrt{147} + \sqrt{27}$ (b) $\log_3 15 + \log_3 4 - \log_3 20$

[4] 2. Rationalize the denominator:

(a) $\frac{5}{4\sqrt{2}}$ (b) $\frac{-5}{\sqrt{5}+2}$

[6] 3. Simplify the expressions:

(a) $(x-1)^3 + x(x-2)(x+2)$ (b) $\frac{3x-15}{x^2-8x+15}$

[8] 4. Factor the polynomials completely:

(a) $x^4 + 2x^3 - 8x^2$ (b) $x^5 - 81x$

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

$$\frac{5}{x^2+x-6} + \frac{1}{x+3}$$

[9] 6. Solve the equations:

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

(c) $4^{x+1} = 64$

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

(a) $-5 \leq \frac{x+1}{2} \leq 10$ (b) $|2x-1| \leq 1$

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

$$\begin{aligned}x^2 + y^2 &= 5 \\x^2 - 2y^2 &= 2\end{aligned}$$

- [8] 9. (a) Which of the points $A(1, -2)$, $B(-2, 5)$ is closer to the point $C(0, 2)$?

- (b) Show that the equation $x^2 + y^2 + 4x - 4y - 1 = 0$ 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):

$$(a) f(x) = \frac{1}{(x-4)^2} \quad (b) g(x) = \sqrt{36-x^2} \quad (c) h(x) = 1 - |x+4|$$

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

- [5] 15. The area of a rectangular window is to be 306 square centimeters. If the length exceeds the width by 1 centimeter, what are the dimensions?

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

$$A(t) = A_0 e^{-0.087t}$$

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

- (a) What is the decay rate of iodine 131?
 (b) How much iodine 131 is left after 9 days?
 (c) When will 70 grams of iodine 131 be left?