

CONCORDIA UNIVERSITY
Department of Mathematics & Statistics

Course	Number	Section(s)	
Mathematics	206/4	All	
Examination	Date	Time	Pages
Final	April 2016	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) $3\sqrt{10} - \sqrt{40} + 2\sqrt{90}$ (b) $\log_3 5 - \log_3 (3^3 - 17) - \log_3 \frac{1}{2}$

- [4] 2. Rationalize the denominator:

(a) $\frac{\sqrt{3}}{2 - \sqrt{3}}$ (b) $\frac{\sqrt{3} - \sqrt{7}}{\sqrt{3} + \sqrt{7}}$

- [6] 3. Simplify the expressions:

(a) $9x^2(x^3 - x^2 - 4x + 5) - 4x(3x^4 - 2x^3 + 3x^2 + x)$ (b) $\frac{4x^2 + 16x}{x^2 - 16}$

- [8] 4. Factor the polynomials completely:

(a) $2x^2 + 7x + 5$ (b) $x^4 - 3x^2 - 4$

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

$$\frac{x}{x^2 - 4} + \frac{1}{x^2 + 4x + 4}$$

- [9] 6. Solve the equations:

(a) $\frac{x}{x^2 - 9} + \frac{4}{x + 3} = \frac{3}{x^2 - 9}$ (b) $4^{2x-1} = 8^{x+3}$

(c) $\log_3 (4x - 7) = 2$

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

(a) $\frac{1}{2} \leq \frac{x+1}{3} < \frac{3}{4}$ (b) $2|2x + 5| \leq 14$

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

$$\begin{aligned}2x^2 + y^2 &= 18 \\ xy &= 4\end{aligned}$$

- [8] 9. (a) Find the distance between the points $(-4, 5)$ and $(3, 2)$.
(b) Show that the equation $2x^2 + 2y^2 - 12x + 8y - 24 = 0$ 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):

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

- [5] 11. Sketch the graph of the function $f(x) = 3 \log(x-1)$, starting from the graph of the function $g(x) = \log x$ and using appropriate transformations.

- [8] 12. Let $f(x) = \frac{x^2}{x+1}$ and $g(x) = \frac{2x}{x^2-1}$. 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. Tyrick invests \$15,000, some in stocks and the rest in bonds. If he invests twice as much in stocks as he does in bonds, how much does he invest in each?

- [5] 15. Pure water is being added to 153 milliliters of a 30% solution of hydrochloric acid. How much water should be added to dilute the solution to a 13% mixture?

- [8] 16. A student sick with a flu virus returns to an isolated college campus of 2000 students. The number of students infected with the flu t days after the student's return is predicted by the logistic function

$$P(t) = \frac{2000}{1 + 1999e^{-0.8905t}}$$

- (a) How many students will be infected with the flu after 5 days?
(b) How long will it take for one-half of the student population to become infected?
(c) How many students does the model predict will become infected after a very long period of time?

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