CONCORDIA UNIVERSITY
Department of Mathematics & Statistics

Course	**Number**	**Sections**
Mathematics	201	All
Examination	**Date**	**Duration**
Midterm	23 October, 2016	1 h 30 min
Special Instructions:	Only approved calculators are allowed **Show all your work for full marks**	

1. [12] **(a)** Find the midpoint M of the line segment joining $\mathrm{A}(-3,1)$ and $\mathrm{B}(3,-3)$, and then find the distance between M and the point A.

(b) Find the equation of the line that passes through the point $(8,-7)$ and is perpendicular to the line $4x = 20 + 2y$.

(c) Find the coordinates of the center and the radius of the circle whose equation is $x(4-x) = y(y+3)$

2. [9] Consider the quadratic function $f(x) = 3x^2 - 9x + 12$.

(a) Express $f(x)$ in the vertex form.

(b) Find the coordinates of the vertex and indicate whether it corresponds to the maximum or minimum of $f(x)$.

(c) Find the x- and y-intercepts of the graph $y = f(x)$.

3. [5] Consider the functions $f(x) = \sqrt{4x+3}$ and $g(x) = x^2 - 1$. Find $(f \circ g)$ and $(g \circ f)$, and determine the domain of $(f \circ g)$ and the domain of $(g \circ f)$.

4. [6] Given the rational function $f(x) = \dfrac{x^4 - 16}{3(x^2+1)(x^2-x-6)}$, find:

(a) the x- and y- intercepts,

(b) all vertical asymptotes, if any,

(c) all horizontal asymptotes, if any.

5. [12] Find the solutions of the following equations:

(a) $9^x = 3^x + 12$

(b) $\log_2 x + \log_2(x-14) = 5$

(c) $5^{\log_5(x^2)} - 4 \cdot 3^{\log_3(x+1)} = 8$

6. [6] Consider the function $f(x) = \ln(x+3) + 6$.

(a) Find the inverse function $f^{-1}(x)$.

(b) Find the domain and range of $f(x)$ and the domain and range of $f^{-1}(x)$.

Bonus. [3]: Let $f(x)$ be a function defined for all real x. **(a)** If we now that the range of f is $(-2,1)$, what is the range of $F(x) = [f(x)]^2$? And **(b)** explain why this information is sufficient to claim that $F(x)$ cannot be invertible function even if $f(x)$ is invertibe.