CONCORDIA UNIVERSITY

Department of Mathematics & Statistics

Course	**Number**	**Sections**
Mathematics	201	All
Examination	**Date**	**Pages**
Final	December 2016	2
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Special Instructions:	Only approved calculators are allowed. **Show all your work for full marks.**	

MARKS

[12] **1.** (a) Write the equation of the line that contains the segment with the endpoints $(2, -1)$ and $(0, 3)$.

(b) Write the equation of the line perpendicular to the line $2y + x = 1$ and passing through the midpoint of the segment described in (a) .

(c) Find the $x-$ and $y-$ intercepts of the line $5y - 12x = 60$, and calculate the distance between these two points.

(d) Find the coordinates of the center and the radius (the **exact** value) of the circle $x(x + 4) = y(6 - y) - 8$.

[9] **2.** Consider the quadratic function $f(x) = -5 - 3x + 2x^2$.

(a) Express $f(x)$ in the vertex form, find the coordinates of the vertex, and indicate whether it corresponds to the maximum or the minimum of f.

(b) Find the $x-$ and $y-$ intercepts.

(c) Sketch the graph of $f(x)$ using the information found above.

[6] **3.** Find all vertical and horizontal asymptotes, if any, of the function

$$f(x) = \frac{(2x + 3)(x^2 + 3x - 10)}{3x^3 - 12x}$$

[15] **4.** Find the exact solutions of the following equations:

(a) $6 \log_2(x) + \log_2(x^4) = 40$

(b) $3^{2x} + 4 \cdot 3^x = 2^3$

(c) $\log_{10}(5x) + \log_{10}(x + 1) = 2$

[9] **5.** (a) Let $f(x) = \sqrt{x + 3} - 4$. Find the inverse function $f^{-1}(x)$, and determine the range of $f(x)$ and the range of $f^{-1}(x)$.

(b) Given $f(x) = \sqrt{x - 2}$ and $g(x) = x^2 - 2$, find $f \circ g$ and $g \circ f$, and determine the domain of each of these composite functions.

[12] **6.** (a) Find the terminal point P(x,y) on the unit circle determined by the angle $\theta = \frac{4\pi}{3}$ rad .

(b) Find the radius of a circle where the length l of the arc of the circle intercepted by a central angle $\theta = \frac{4\pi}{5}$ rad is $l = 40\,\text{cm}$.

(c) Find the area of a sector of a circle having the diameter 32 m and the central angle 45°.

(d) Find the amplitude, period, and phase shift of $y = 3\,\sin(\pi x - \frac{\pi}{5})$.

[15] **7.** Solve the triangle ABC (i.e. find the missing sides and angles)

(a) $\angle A = 120°, \quad b = 18\,\text{cm}, \quad c = 12\,\text{cm}$.

(b) $\angle A = 53°, \quad \angle B = 30°, \quad a = 24\,\text{cm}.$

(c) $a = 16\,\text{cm}, \quad \angle C = 90°, \quad \angle B = 37°$.

[6] **8.** Use a sketch to find the exact value of $y = \cos(\arctan 3)$ (**do not approximate**).

[10] **9.** Verify the identities

(a) $\sin x\,\tan x = \sec x - \cos x$

(b) $\tan^2 x - \sin^2 x = \tan^2 x\,\sin^2 x$

(c) $\dfrac{\cos x}{1 - \sin x} = \sec x + \tan x$

[6] **10.** An isosceles triangle has an area of $9\,\text{cm}^2$, the angle between the two equal sides is 30° . Make a plot and find the length of each side of the triangle.

[5] **11. Bonus Question**

The radius of a circle inscribed in an equilateral triangle is R. Express the area A of the triangle in terms of R.