

CONCORDIA UNIVERSITY**Department of Mathematics & Statistics**

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

MARKS

- [9] **1.** (a) Write the equation of the line passing through the points $(-4, 1)$ and $(2, 3)$.
(b) Write the equation of the line perpendicular to the lines in (a) and passing through the point $(1, -3)$.
(c) Find the coordinates of the center and the radius of the circle
$$x^2 + y^2 - 6x + 2y = 6$$
- [9] **2.** Consider the quadratic function $f(x) = \frac{x^2}{2} + x - 4$.
(a) Find the coordinates of the vertex and indicate whether it corresponds to the maximum or the minimum of $f(x)$.
(b) Find the x -intercepts and the y -intercept.
(c) Sketch the graph of $f(x)$ using the information above.
- [6] **3.** Find all vertical and all horizontal asymptotes (if any) of the function
$$f(x) = \frac{(2x^2 - 5)(x + 1)}{3x(x^2 - 4)}$$
- [11] **4.** Find the exact solutions of the following equations (**do not approximate**):
(a) $5^{2x} - 7 \cdot 5^x = -10$
(b) $\log_3(3x) - \log_3(2 - x) = 2$
- [8] **5.** (a) Consider $f(x) = 3 - 2\sqrt{x + 4}$. Find the inverse function $f^{-1}(x)$.
(b) Determine the domain and the range of $f(x)$ and of $f^{-1}(x)$
- [11] **6.** Find the exact solutions of the following equations (**do not approximate**):
(a) $3^{x+2} - 6^x = 0$
(b) $\ln(x + 1) + \ln(x + 7) = 2 \ln 4$

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- [6] 7. (a) The length of the arc of a circle intercepted by the central angle of $\alpha = 60^\circ$ is 15.7 cm. Find the radius of the circle.
- (b) Find the area of a sector of a circle having the radius 18.2 meters and the central angle $\pi/4$ radians.
- [10] 8. Verify the identities
- (a)
$$\frac{\cos x}{1 - \sin x} + \frac{\cos x}{1 + \sin x} = 2 \frac{1 + \tan^2 x}{\sec x}$$
- (b)
$$\cos^4(x) + \sin^4(x) = 1 - \frac{1}{2} \sin^2(2x)$$
- [15] 9. Solve the triangle ABC (i.e. find the missing sides and angles).
- (a) $\angle A = 30^\circ$, $\angle C = 65^\circ$, $b = 30$ cm.
- (b) $b = 20$ cm, $\angle B = 90^\circ$, $\angle C = 60^\circ$.
- (c) $a = 12$ cm, $b = 8$ cm, $c = 5$ cm.
- [10] 10. (a) Find the period P and the amplitude A of the function $y = 3 \sin(2x + \frac{\pi}{2})$, and graph it on the interval $[0, P]$.
- (b) Let $f(x) = \sqrt{x-1}$ and $g(x) = 2^{x^2+1}$. Find $h = g \circ f$ and determine the domain and the range of $h(x)$.
- [5] 11. Find the area of a parallelogram $ABCD$ if we know the lengths of the sides $AB = 5$ cm, $BC = 4$ cm, and the angle $\angle A = (\pi/3)$ rad.
- [5] 12. **Bonus Question:** Express $\tan(\theta)$ as an algebraic expression of parameter a given that $\theta = \operatorname{arcsec}(a)$, and $0 \leq \theta < \frac{\pi}{2}$.
- (Reminder: $\operatorname{arcsec}(x)$ is the inverse function of $\sec(x)$.)

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