

DEPARTMENT OF MATHEMATICS
BROOKLYN COLLEGE

FINAL EXAMINATION - FALL 2008
MATHEMATICS 2.9

INSTRUCTIONS: Do **ALL** problems in Part I and any **FIVE** problems in Part II. Show all work.

PART I: Do all TEN problems 1-10. Each is worth 5 points.

1. Express $\frac{3-2i}{2+i}$ in the form $a + bi$, where a and b are two real numbers.
2. Find an equation for the line through the point $(4, -1)$ and parallel to the line $2x - 3y = 9$.
3. Find the term involving y^8 in the expansion ^{of} $\left(\frac{x}{3} - 3y^2\right)^7$.
4. Solve the inequality $|2x + 3| \geq 5$. Graph the answer on the number line.
5. Find the domain of the function $f(x) = \frac{\sqrt{2x+5}}{x-3}$.
6. Find the center and radius of the circle $x^2 + y^2 - 4x + 6y - 12 = 0$. Sketch the circle.
7. Evaluate $\log_4 \frac{1}{64} + (-27)^{-\frac{2}{3}}$.
8. If θ is in the third quadrant and $\tan \theta = \frac{3}{4}$, find $\sin \theta$ and $\cos 2\theta$.
9. Sketch the graph of $y = 3 \cos 2x$ from $x = 0$ to $x = 2\pi$.
10. Let $f(x) = \frac{2x-3}{x+2}$.
 - (a) Find the vertical and horizontal asymptotes.
 - (b) Find all intercepts.
 - (c) Use the above information to sketch the graph.

PART II: Do any FIVE of the problems 11-18. Each is worth 10 points.

11. Let $f(x) = 2x + 1$ and $g(x) = \frac{3x}{x-2}$. Find :
(a) $(g \circ f)(x)$ (b) $(f \circ g)(x)$ (c) $f^{-1}(x)$ (d) $g^{-1}(x)$.
12. (a) Let $f(x) = x^2 - 5$. Simplify $\frac{f(x+h)-f(x)}{h}$.
(b) Use the Rational Root Theorem to list all possible rational roots of the equation $9x^3 - 10x + 3 = 0$, and then find all roots of the equation. (Hint: One of the roots is a positive rational.)
13. (a) Solve the inequality $\frac{x+1}{2x-3} \leq 1$.
(b) Solve the equation $\log_4(x+6) - \log_4(x+1) = 2$ and check your answers.
14. (a) Find the exact value of $\tan(\arccos(-\frac{3}{7}))$.
(b) Sketch the graph for $y = -x^2 - 2x + 3$, and find its range.
15. (a) Solve the equation $\sqrt{2x+6} + x = 1$ and check your answers.
(b) Find the center, vertices and foci of the ellipse

$$\frac{(x-4)^2}{169} + \frac{(y+3)^2}{25} = 1.$$

Sketch the graph of the ellipse.

16. (a) Solve the equation $3^{x^2-1} = 9^{x+1}$.
(b) Verify the identity:
$$\frac{\tan \theta \sin^2 \theta}{\sec^2 \theta - 1} = \frac{\sin 2\theta}{2}.$$
17. (a) Find an equation for the circle taking the line segment between two points $P(-5, -3)$ and $Q(-1, 7)$ as a diameter.
(b) Find $\sin(A+B)$ if A is in the second quadrant with $\sin A = \frac{4}{5}$ and B is in the fourth quadrant with $\cos B = \frac{12}{13}$.