Math 2.9   Final Examination   Spring 2009
Department of Mathematics, Brooklyn College
Show all work and justify all your answers

Part I(60 points). Answer all five (5) questions.

QUESTION 1.
a) Find an equation of the straight line passing through the point P(3, -4) and perpendicular to the line with equation $5x - 4y = 7$.
b) Find the center and radius of the circle with equation

$$x^2 + y^2 + 8x - 12y + 27 = 0$$

and sketch its graph showing at least four points on it.

QUESTION 2.
a) Find the vertex and all of the x and y intercepts of the parabola $y = -3x^2 + 12x + 15$ and sketch its graph using this information.
b) Simplify and express $(3 + 4i)/(2 - i)$ in the form $a + bi$, where a, b are real numbers.

QUESTION 3.
a) Use the rational root test to list all possible rational roots of the equation $2x^3 - 7x^2 + 6x + 5 = 0$. Find all the roots of the equation given that there is a fractional root.
b) Find the exact value of $\log_2(1/8) + (16)^{-3/2}$.

QUESTION 4.
a) Find the vertical and horizontal asymptotes and all the intercepts and sketch the graph of the function

$$f(x) = \frac{2x + 3}{x - 4} .$$

b) Find and graph the solution set of $|\frac{2x-5}{3}| \leq 1$.

QUESTION 5.
a) Find the amplitude and period of the function $f(x) = 4\sin(2x)$ and sketch its graph over the interval $0 \leq x \leq 2\pi$.
b) Find the exact value of $\csc(4\pi/3)$.

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Part II (40 points). Answer any four (4) of the six (6) questions.

QUESTION 6.

Solve each of the following equations and check your answers.

a) $\sqrt{16 - x} + 4 = x$, b) $\log_7 x + \log_7(2x - 13) = 1$.

QUESTION 7.

Given functions

$$f(x) = \frac{2x + 1}{x - 3}, \quad g(x) = 2x^2 + x + 3$$

find each of the following:

a) $(g \circ f)(2)$, b) $(f \circ g)(x)$, c) the inverse function $f^{-1}(x)$.

QUESTION 8.

a) Find and simplify $[f(x + h) - f(x)]/h$ given $f(x) = x^2 - 2x + 3$.

b) Solve the equation

$$(27)^{2x-3} = 9^x .$$

QUESTION 9.

a) Find the center, vertices and foci of the ellipse

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

and sketch its graph showing these points.

b) Find the domain of the function

$$h(x) = \frac{\sqrt{13 - 3x}}{4 - x^2} .$$

QUESTION 10.

a) Evaluate exactly $\tan(\arcsin(-(2/3))$.

b) Verify the identity

$$\frac{\cos \theta}{\sec \theta - \tan \theta} = 1 + \sin \theta .$$

QUESTION 11.

a) Find $\sin(2\theta)$ given that θ is in the third quadrant and $\tan \theta = 5/12$.

b) Find the term involving y^3 in the expansion of $(x + 2y)^9$.