

Department of Mathematics
Brooklyn College
Final Examination — Fall 2005
Mathematics 2.9

Show all work and justify all your answers!

Calculator answers are not acceptable in starred (*) questions!

Part I: (40 points) *Do all FIVE questions in this part.*

1. (a) Find the midpoint of the line segment with endpoints $A(-1, 5)$ and $B(7, 3)$.
(b) Find an equation of the straight line through the point $(1, 7)$ parallel to the straight line passing through A and B .
2. (a) Sketch the graph of the quadratic function $y = x^2 - 14x + 46$. Where is the function increasing? decreasing? What are the coordinates of its maximum (or minimum)?
(b) Simplify $\frac{1 + 2i}{-2 + 3i}$. Express your answer in the form $a + bi$, where a and b are real numbers.
3. (a) Give the term involving y^8 in the expansion of $(2x - y^2)^{10}$.
(b) *Evaluate $\log_9 27 + \log_7 \frac{1}{49}$.
4. Solve each of the following inequalities. Use interval notation to describe your solution.
(a) $|4 - 5x| > 49$
(b) $\frac{3 - 2x}{x + 2} \leq 0$
5. (a) *Find the $\sin$, $\tan$ and $\sec$ of the angle θ in standard position if $(-12, -5)$ is a point on the terminal side.
(b) Convert the expression $\log_b \left(\frac{\sqrt[3]{X}}{YZ^3} \right)$ into an expression involving $\log_b X$, $\log_b Y$ and $\log_b Z$.
(c) *Evaluate $\cos^{-1}\left(\frac{\sqrt{3}}{2}\right) + 2 \tan^{-1}(\sqrt{3})$

Please turn over!

Part II. (60 points) *Do SIX of the following seven questions.*

6. (a) Find the center and radius of the circle having the equation

$$x^2 + y^2 + 6x - 8y = 7$$

- (b) Find the center, vertices, equations of the asymptotes and sketch the hyperbola with equation

$$\frac{(x+6)^2}{4} - \frac{(y-4)^2}{16} = 1$$

7. (a) Solve $\log_7(x) + \log_7(2x - 13) = 1$.

- (b) Solve $\sqrt{16 - x} + 4 = x$.

8. $f(x) = 2x + 3$ and $g(x) = x^2 + 4x + 3$. Find and simplify

(a) $g \circ f(x)$

(b) $f^{-1}(x)$

9. (a) Use the Rational Root theorem to list all possible rational roots of the equation $4x^3 + 4x^2 - 35x + 52 = 0$.

- (b) Show that -4 is a root of the equation of part (a), and find the remaining roots.

10. (a) *Find **exactly** the sin, sec and tan of the angle t if $\cos t = \frac{4}{9}$ and angle t is in the fourth quadrant.

- (b) Use your calculator to find a seven digit approximation to the angle t . Your answer should be in radians!

- (c) Sketch the graph of $y = \sin^{-1} x$

11. (a) Find the amplitude and period of $c(x) = 2 \cos 3x$.

- (b) Sketch the graph of $y = c(x)$ over one period of the function. Label the points at which the maximums and the minimums of $c(x)$ occur.

12. (a) Find the intercepts, asymptotes and sketch the graph of

$$r(x) = \frac{x+2}{x^2 - 6x + 5}$$

- (b) Verify the identity:

$$\cos^4 x - \sin^4 x = \cos 2x$$

Place the numbers of the question you chose to omit in Part II on the front of your booklet!