Name _____ Rec. Instr. _____

Rec. Time _____

COLLEGE ALGEBRA

Final Exam
December 13, 2006

Page 1 (15 pts.)	**Page 2** (35 pts.)	**Page 3** (30 pts.)	**Page 4** (30 pts.)	**Page 5** (30 pts.)	**Page 6** (30 pts.)	**Page 7** (30 pts.)	**TOTAL** (200 pts.)

Below you will find 20 problems, with their maximum scores. Solve the problems in the space provided. When writing a solution to a problem, **show all work**. No books or notes are allowed.

Problem 1 (5 points). Factor $2x^2 - 11x - 30$.

Problem 2 (5 points). Assume $x, y > 0$. Simplify $\left(\dfrac{27x^8y^{1/5}}{x^5y^{-2/5}}\right)^{1/3}$, then convert to radical notation.

Problem 3 (5 points). Given the function $h(x) = \sqrt{2x^2+3}$, find functions $f(x)$ and $g(x)$, such that $h(x) = (f \circ g)(x)$.

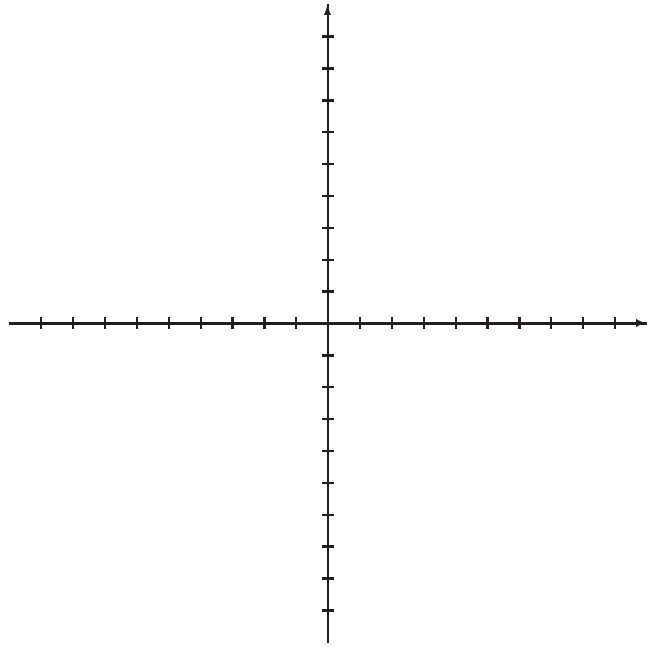
Problem 4 (5 points). Given the functions $f(x) = \sqrt[3]{x-4}$ and $g(x) = 8x^3 + 4$, find the composition $(f \circ g)(x)$ and simplify.

Problem 5 (10 points). Find the equation of the line passing through the point $(-1, 3)$, which is perpendicular to the line $x - 2y = 4$.

Problem 6 (10 points). Consider the function $f(x) = x^3 - 3x + 2$. Use your calculator to determine the relative maximum and minimum points, as well as the intervals where $f(x)$ is increasing or decreasing.

Problem 7 (10 points). Solve the equation $\sqrt{4x+1} + x = 5$.

Problem 8 (10 pts.) Consider the quadratic function $f(x) = -\frac{1}{2}x^2 + 2x + 6$. Determine the coordinates of the vertex, as well as the x- and y-intercepts. Then, using the space provided on the right, sketch the graph of $f(x)$. (Tickmarks are at distance 1 unit apart on both axes.)



Problem 9 (10 points). Find all zeros (real or complex) of $f(x) = 2x^3 + 3x^2 + 2x - 2$. (Hint: Find a rational zero first.)

Problem 10 (10 points). Solve the equation $3^{2x+7} = 27$.

Problem 11 (10 points). Determine **all** the asymptotes (vertical, horizontal, oblique) of the graph of $f(x) = \dfrac{3x^3 + 2x + 3}{x^2 - 2x}$.

Problem 12 (10 points). Solve the inequality $\dfrac{2x-5}{x-2} \leq \dfrac{x+2}{x}$.

Problem 13 (10 points). Solve the equation $\log x + \log(x+3) = 1$.

Problem 14 (10 points). Find the formula for the inverse of $f(x) = \dfrac{2x-1}{2-3x}$.

Problem 15 (20 points). Consider the expression $M = \log_a \dfrac{125\sqrt{a^3}}{x^5}$.

(a) For $a = 4$ and $x = 1$, the value of M can be calculated directly as $M = \log_4 1000$. Use your calculator to approximate this logarithm. Round to three decimal places.

(b) Assume neither a nor x is known. Write M in terms of sums and differences of logarithms with base a. Then use the expression you obtained to compute the value of M, given $\log_a 5 = 1.2$ and $\log_a x = 3.4$

Problem 16 (10 points). Suppose \$1000 is invested into an account that pays 6.5% annual interest compounded continuously. Find the doubling time, that is, after how many years the balance in the account will be twice the amount invested.

Problem 17 (10 points). Find the inverse of the matrix $A = \begin{bmatrix} 10 & 8 & 3 \\ 6 & 3 & 2 \\ 3 & 2 & 1 \end{bmatrix}$. Describe the method you use.

Problem 18 (10 points). A jar is filled with pennies and nickels. In all there are 200 coins and the total amount is \$5.76. How many pennies and how many nickels are in the jar?

Problem 19 (20 points). Solve the following systems of equations.

(a) $\begin{cases} 3x + 2y + z = 4 \\ 2x + y + z = 5 \\ 3x + 2y + 2z = -1 \end{cases}$ (HINT: Use matrices.)

(b) $\begin{cases} x^2 - 3y = 4 \\ 2x + y = 1 \end{cases}$ (HINT: Use substitution.)

Problem 20 (10 points). Find the matrix product $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} \cdot \begin{bmatrix} 1 & 2 \\ -3 & -4 \\ 5 & 6 \end{bmatrix}$.