Name: _____

1090-4 EXAM #1
January 31, 2002

There are seven questions on the exam. Calculators not allowed.
You must show your work to receive any credit.

1. (10 points — 2 points each) True or false:
   (a) $(a^m)^n = a^{(m^n)}$.
   (b) $\frac{a^m}{a^n} = a^{\frac{m}{n}}$.
   (c) The y-intercept of a cost function is the variable cost of production.
   (d) The quadratic equation $3x^2 + 6x + 3 = 0$ has exactly one solution.
   (e) The quadratic equation $6x^2 + x + 2 = 0$ has two real solutions.

2. (15 points) Let

$$f(x) = 2x^2 + 2x - 3$$
$$g(x) = x + 3.$$

Compute

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

   (b) $(g \circ g)(x)$

   (c) $(f \cdot g)(x)$

3. (20 points)

(a) Find the equation of the line through $(3, 1)$ that is perpendicular to $5x - 6y = 4$.

(b) Find the equation of the line through $(6, -4)$ that is parallel to $4x - 2y = 6$.

4. (20 points) Solve the following systems of equations.
   (a)

$$\begin{aligned} 2x + y &= -3 \\ 4x + y &= -1. \end{aligned}$$

   (b)

$$\begin{aligned} x - \ y - 8z &= 0 \\ y + 4z &= 8 \\ 3y + 14z &= 22 \end{aligned}$$

5. (10 points) Suppose that a company has cost and revenue functions given respectively by

$$C(x) = 16 + 15x + \frac{2}{5}x^2$$
$$R(x) = 25x - \frac{3}{5}x^2,$$

where x is the number of units produced. How many units must be produced in order to break even?

6. (10 points) Let

$$f(x) = x^2 - 4x - 5.$$

(a) Find all solutions to the equation $f(x) = 0$.

(b) Sketch the graph of $y = f(x)$.

7. (15 points) Eddie Vedder is once again trying to outsmart Ticketmaster. While planning Pearl Jam's next tour, he is considering whether they should stop at the E Center. From past experience playing venues this size, Eddie knows that he may model his profit function as a quadratic equation of the form

$$P(x) = -x^2 + bx + c,$$

where x is the ticket price, and the profit is in hundreds of dollars. From past experience, he also knows that selling tickets at \$30 will result in zero profit (since that price is too low to recover his costs) and that profits will also be zero when charging \$100 a ticket (since few of his fans can afford that ticket price).

(a) Find the constants b and c in the profit function.

(b) How much should Eddie charge to maximize his profits?

(Even if you don't answer (a), you can still get full credit for (b) by explaining how you would proceed if you had the answer in (a).)