Math 129 (Pre Managerial Calculus)
Practice Problems

1. If $X$ units of a product can be sold at a price of $p$ dollars per unit where $X + 2p = 200$, find the price(s), $p$, which will yield a revenue of $4,200.

2. It costs $1000 to make 100 units of a certain product and $1200 to make 150 units of a same product. Assume that the cost equation is linear.
   (a) write the cost equation.
   (b) If the product can be sold at $10 per unit, how many units must be made and sold to breakeven?

3. Use completing the square to find the vertex of $y = 3 - 2x - x^2$
   (b) Graph the curve, label the vertex and at least two other points

4. Let $f(x) = \sqrt{x-3}$ and $g(x) = \frac{1}{x+1}$
   (a) domain of $f$
   (b) $f(g(x))$
   (c) $g(f(x))$
   Do ALL four problems

5. Solve for $x$:
   (a) $2^{x^2}2^{-2x} = 8$
   (b) $\log_3 3 + \log_3 (x + 1) - \log_3 (2x - 7) = 8$
   (c) $e^{2x} - e^x - 6 = 0$

   Exact solutions, not calculator approximations.

6. What monthly payment is required to pay off a loan of $240,000 over 30 years at the nominal annual rate of 9% on the unpaid balance, with compounding at the end of each month?

7. Solve for $x$:
   (a) $x = \log_3 8$ (Get a number for your answer)
   (b) $\log_2 (x + 1)$

8. How long would it take for $5000$ to grow to $7000$ if it is invested at a nominal annual rate of 6% compounded quarterly?
9. The demand equation for a certain product is \( p = 200e^{-0.01x} \)
   (a) At what price will \( p \) will 150 units be sold?
   (b) How many units (round off to the nearest unit) will be sold if the price per unit is $10?

10. Solve: \( x^2 + 4x - 21 \geq 0. \)

11. Given that \( A = \begin{bmatrix} 5 & -8 \\ -4 & 7 \end{bmatrix}, B = \begin{bmatrix} 2 & -1 \\ -4 & 0 \end{bmatrix}, \) and \( C = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 3 & 1 \\ 2 & -1 & 0 \end{bmatrix} \)
   Find:
   (a) \( 3A \)
   (b) \( A + B \)
   (c) \( AB \)
   (d) \( A^{-1} \)
   (e) \( C^{-1} \)

12. Solve using matrices and row-reduction. If there is no solution, indicate why. If there are an infinite number of solutions, give the general form of the solution.
   \[
   \begin{align*}
   x + 2y - z &= 8 \\
   2x + 6y + z &= 12 \\
   x + 3y + 4z &= -1
   \end{align*}
   \]

13. Solve by using the inverse of the coefficient matrix:
   \[
   \begin{align*}
   2x - 3y &= 4 \\
   x + 5y &= 2
   \end{align*}
   \]

14. The table below gives the interaction between sectors in a hypothetical economy.

<table>
<thead>
<tr>
<th></th>
<th>Industry P</th>
<th>Industry Q</th>
<th>Final Demand</th>
<th>Total Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry P</td>
<td>300</td>
<td>120</td>
<td>30</td>
<td>500</td>
</tr>
<tr>
<td>Industry Q</td>
<td>100</td>
<td>120</td>
<td>80</td>
<td>300</td>
</tr>
<tr>
<td>Labor</td>
<td>50</td>
<td>60</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   Suppose that it is predicted that in 5 years the final demand for P will be 30 units, and that for Q will decrease to 70 units.
   (a) Write the system of equations, which must be satisfied by the new total outputs for industries P and Q.
   (b) Find the new total outputs for each industry.
   (c) What will be the new labor requirements for each industry?
15. Solve this linear programming problem by the method of corners: Maximize
\[ P = 200x + 160y \] subject to:
\[
\begin{align*}
2x + 4y & \leq 70 \\
5x + 3y & \leq 105 \\
x & \geq 0 \\
y & \geq 0
\end{align*}
\]

16. Write a matrix equation that is equivalent to the given system of linear equations
(b) Solve the system by use of the inverse of the coefficient matrix
(NO CREDIT if solved by any other method)
\[
\begin{align*}
x - y + 3z &= 2 \\
2x + y + 2z &= 2 \\
-2x - 2y + z &= 3
\end{align*}
\]
Answers:

1. $30 or $70
2. (a) $C = 4x + 600$  
   (b) 100
3. $V(-1, 4)$, concave down, points (-3, 0), (-2, 3), (0, 3), (1, 0)
4. (a) $[3, \infty)$  
   (b) $\sqrt{\frac{(-3x-2)}{x+1}}$
   (c) $\frac{1}{\sqrt{x-3+1}}$
5. (a) -1, 3  
   (b) $\frac{190}{53}$
   (c) $x = \ln 3$
6. $1,931.09$
7. (a) $\frac{\ln 8}{\ln 3}$ or 1.8928
   (b) 15
8. $\sim 5.6498$ years
9. (a) $\sim 44.63$  
   (b) $\sim 300$
10. $x \leq -7$ OR $x \geq 3$
11. $\begin{bmatrix} 15 & -24 \\ -12 & 21 \end{bmatrix}$, $\begin{bmatrix} 7 & -9 \\ -8 & 7 \end{bmatrix}$, $\begin{bmatrix} 42 & -5 \\ -36 & 4 \end{bmatrix}$, $\begin{bmatrix} 1/3 & 7/4 \\ 5 & 8 \end{bmatrix}$, $\begin{bmatrix} -1 & 2 \\ 1/11 & 6 \end{bmatrix}$
12. $x = 4, y = 1, z = -2$
13. $x = 2, y = 0$
14. $x_1 = 0.7x_1 + 0.4x_2 + 30$, $x_1 + 0.2x_1 + 0.4x_2 + 70$
   Outputs: 460 for P, 270 for Q  
   Labor: 46 for P, 54 for Q
15. $x = 15, y = 10$ $P_{max} = 4600$
16. $A = \begin{bmatrix} 1 & -1 & 3 \\ 2 & 1 & 2 \\ 2 & -2 & 1 \end{bmatrix}$, $X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$, $B = \begin{bmatrix} 2 \\ 2 \\ 3 \end{bmatrix}$
16b. $X = A^{-1}B = \begin{bmatrix} 1/6 & -1 & -1 \\ -2/5 & 7/5 & 4/5 \\ -2 & 4/5 & 3/5 \end{bmatrix}$, $\begin{bmatrix} 2 \\ 2 \\ 3 \end{bmatrix}$, $\begin{bmatrix} -3/14 \\ 5/13 \\ 5/5 \end{bmatrix}$