**Math 131 (Term 133)**

**Exam 1**

4:00 – 5:40 p.m. (Duration: 100 minutes)

Student Name ___________________________________________ Student ID: ____________________

<table>
<thead>
<tr>
<th>Question</th>
<th>Score</th>
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<td>1</td>
<td>10</td>
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<td><strong>Total Score</strong></td>
<td><strong>100</strong></td>
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Exercise 1 (10 points)
Find an equation of the line passing through $(4, -5)$ and perpendicular to the line $3y = \frac{-2}{5}x + 3$.

Exercise 2 (15 points)
A manufacturer sells a product at 8.35 SR per unit, selling all produced. The fixed cost is 2,116 SR and the variable cost is 7.20 SR per unit. Find the break-even quantity.
Exercise 3 (15 points)
The demand function for an office company’s line of plastic rulers is $p = 0.81 - 0.00045q$, where $p$ is the price (in Riyals) per unit when $q$ units are demanded (per day) by consumers. Find the level of production that will maximize the revenue and find this maximum revenue.

Exercise 4 (15 points)
A chemical manufacturer wishes to fill an order for 800 litters of a 25% acid solution. Solutions of 20% and 35% are in stock. How many litters of each solution must be mixed to fill the order?
Exercise 5 (15 points)
Find the break-even quantities for a company which sells all it produces, if the variable cost per unit is 3 SR, the fixed costs are 2 SR, and the total revenue is given by \( R = 5\sqrt{q} \) where \( q \) is the number of thousands of units produced.

Exercise 6 (15 points)
A firm produces three products A, B, and C that require processing by three machines I, II, and III. The time in hours required for processing one unit of each product is given by the following table:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
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</thead>
<tbody>
<tr>
<td>Machine I</td>
<td>4</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Machine II</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Machine III</td>
<td>3</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

Machine I is available for 380 hours, Machine II is available 210 hours, and Machine III is available for 350 hours. Find how many units of each product should be produced to make use of all the available time on the machines. Use matrix reduction method only.

Let
\[
\begin{align*}
x &= \\
y &= \\
z &= 
\end{align*}
\]

System:
\[
\begin{align*}
\text{------------------------} &= \text{-------} \\
\text{------------------------} &= \text{-------} \\
\text{------------------------} &= \text{-------} \\
\text{------------------------} &= \text{-------} 
\end{align*}
\]

Augmented Matrix:

Reduced Matrix: (Show your work on the back of this page)

Solution:
\[
\begin{align*}
x &= \\
y &= \\
z &= 
\end{align*}
\]
Exercise 7 (15 points)

Use the geometric approach to maximize $Z = y - x$ subject to

$$
\begin{align*}
  x &\geq 2 \\
  x + 2y &\geq 3 \\
  x - 3y &\geq -3 \\
  y &\geq 0
\end{align*}
$$