**Question 1. (6-Points)**
A person invested $2500 at an interest rate of 5.5% annually. How much additional money must be invested at an interest rate of 8% annually so that the total interest is 7% of the total amount invested?

Let \( x \) be the total amount invested.

We have $2500 invested at 5.5%, then

\[(x - 2500) \text{ invested at } 8\% \]

\[
\therefore (0.055)(2500) + (0.08)(x - 2500) = 0.07x \tag{2}\]

\[
137.5 + 0.08x - 200 = 0.07x \tag{1}\]

\[
0.08x - 0.07x = 200 - 137.5 = 62.5
\]

\[
\therefore 0.01x = 62.5 \Rightarrow x = \frac{62.5}{0.01} \tag{2}
\]

\[
\therefore x = 6250
\]

\[
\therefore \text{The additional money invested at } 8\% \text{ is: } 6250 - 2500 = \$3750 \tag{1}
\]

**Question 2. (6-Points)**
A T-shirt manufacturer produces \( q \) shirts at a total labor cost of 1.3\( q \) (in dollars) and at a total material cost of 0.4\( q \) (in dollars). If a fixed cost of $6500 and each shirt sells for $3.50, how many must be sold to have a profit more than $11500.

\[
\text{Profit} = \text{T.R.} - \text{T.C.} > 11500
\]

\[
\text{T.R.} = 3.50q \tag{1}
\]

\[
\text{T.C.} = \text{F.C.} + \text{V.C.} = 6500 + (1.3q + 0.4q) \tag{1}
\]

\[
= 6500 + 1.7q
\]

\[
\Rightarrow \text{Profit} = 3.50q - (6500 + 1.7q) > 11500
\]

\[
1.8q - 6500 > 11500
\]

\[
\Rightarrow 1.8q > 18000
\]

\[
\Rightarrow q > \frac{18000}{1.8} = 10000
\]

\[
\therefore \text{At least } 10001 \text{ must be sold to have a profit more than } \$11500 \tag{1}
\]
Question 3. \((4+4+2 = 10\text{-Points})\)

a. Find an equation of the line that passes through \((1,9)\) and perpendicular to the line \(7y + x = 1\) (write it in slope-intercept form)

\[ 7y = -x + 1 \Rightarrow y = -\frac{1}{7}x + \frac{1}{7} \] \(\square\)

The line is perpendicular to \(y = -\frac{1}{7}x + \frac{1}{7}\)

\[ m = \frac{-1}{-\frac{1}{7}} = 7 \] \(\square\)

\((1,9)\)

\[ \text{The equation: } y - y_1 = m(x - x_1) \]

\[ y - 9 = 7(x - 1) \] \(\square\)

\[ y = 7x - 7 + 9 \]

\[ y = 7x + 2 \] \(\square\)

b. The demand function for a publisher’s line of cookbooks is \(P = 6 - 0.003q\) where \(P\) is the price per unit when \(q\) units are demanded, then:

I. Find the level of production that will maximize the manufacturer’s total revenue.

\[ TR = pq = (6 - 0.003q)q \] \(\square\)

\[ = 6q - 0.003q^2 \]

\[ a = -0.003 < 0 \Rightarrow \text{it has a maximum value } \] \(\square\)

\[ h = \frac{-b}{2a} = \frac{-6}{2(-0.003)} = \frac{6}{0.006} = 1000 \]

\[ \text{The level of production that maximizes the total revenue } q = 1000 \text{ units.}\] \(\square\)

II. Determine the maximum revenue.

\[ \text{The maximum revenue} = f(1000) \]

\[ = 6(1000) - 0.003(1000)^2 \] \(\square\)

\[ = \$ 3000 \]
Question 4. (8-Points)
A coffee blend worth $1.60 per pound is to be mixed with a second coffee blend worth $3.00 per pound to obtain a mixture worth $2.40 per pound. How many pounds of each blend should be used in order to obtain 105 pounds of the $2.40 mixture?

Let $x$ be the amount in pounds of the $1.60/pound blend,
y = \ldots = \ldots = \ldots = \ldots = \ldots = 3.00/pound blend.

\[
x + y = 105 \quad \ldots \quad (1)
\]

\[
1.6x + 3y = (2.40)(105) = 252 \quad \ldots \quad (2)
\]

From (1), $y = 105 - x$ and substitute it in (2),

\[
1.6x + 3(105 - x) = 252
\]

\[
1.6x + 315 - 3x = 252
\]

\[
-1.4x = 252 - 315 = -63
\]

\[
x = \frac{-63}{-1.4} = 45 \text{ pounds}
\]

\[
y = 105 - 45 = 60 \text{ pounds}
\]
Question 5. \((2 + 4 + 6 = 12\text{-Points})\)

a. A manufacture of a product sells all that is produced. The total revenue is given by:
\[ T.R. = 7q \text{ and the total cost } T.C. = 6q + 800 \]  
where \(q\) represents the number of units produced and sold.

I. Find the level of production at the break-even point.

\[
\begin{align*}
\text{At the break-even point,} & \quad T.R. = T.C. \quad \{1\} \\
7q & = 6q + 800 \quad \{1\} \\
7q - 6q & = 800 \quad \{1\} \\
q & = 800 \text{ units} \quad \{1\}
\end{align*}
\]

II. Find the level of production at the break-even point if the total cost increases by 5%.

\[
\begin{align*}
The \text{ new } T.C. & = \text{ Old T.C. } + 0.05(\text{Old T.C.}) \\
& = (6q + 800) + 0.05(6q + 800) \quad \{2\} \\
& = 6.3q + 840
\end{align*}
\]

\[
\begin{align*}
\text{At break-even point,} & \quad T.R. = T.C. \\
7q & = 6.3q + 840 \quad \{1\} \\
7q - 6.3q & = 840 \quad \{1\} \\
0.7q & = 840 \quad \{1\} \\
q & = \frac{840}{0.7} \quad = 1200 \text{ units} \quad \{1\}
\end{align*}
\]

b. Solve the non linear system of equations

\[
\begin{align*}
x + y & = 4 \ldots \ldots \ldots (1) \\
3y & = 2x + 2 \ldots \ldots \ldots (2)
\end{align*}
\]

From (1) \(y = \frac{u}{x}\) and substitute it in (2) \n
\[
\begin{align*}
3\left(\frac{u}{x}\right) & = 2x + 2 \Rightarrow \frac{12}{x} = 2x + 2 \quad \{2\} \\
2x^2 + 2x & = 12 \quad \{2\} \\
x^2 + x & = 6 \Rightarrow x^2 + x - 6 = 0 \quad \{2\} \\
(x + 3)(x - 2) & = 0 \\
\Rightarrow x & = -3, x = 2 \\
\text{I. when} & \quad x = -3 \Rightarrow y = \frac{u}{-3} \Rightarrow (-3, -\frac{u}{3}) \quad \{1\} \\
\text{II. when} & \quad x = 2 \Rightarrow y = \frac{u}{2} = 2 \Rightarrow (2, 2) \quad \{1\}
\end{align*}
\]
Question 6. (8-Points)
Solve the following system of linear inequalities **geometrically**
\[
\begin{align*}
3x - 2y &> 6 \quad \Rightarrow \quad -2y > 6 - 3x \quad (\div -2) \quad \Rightarrow \quad y < \frac{3}{2}x - 3 \quad \cdots (1) \\
2x - 5y &\leq 10 \quad \Rightarrow \quad -5y \leq 10 - 2x \quad (\div -5) \quad \Rightarrow \quad y \geq \frac{2}{5}x - 2 \quad \cdots (2)
\end{align*}
\]

(1) \( y = \frac{3}{2}x - 3 \quad \frac{x}{y} = \frac{10}{-3} = \frac{10}{2} \quad (1) \)

(2) \( y = \frac{2}{5}x - 2 \quad \frac{x}{y} = \frac{10}{-2} = \frac{10}{5} \quad (1) \)

The solution region is the intersection region.  

![Graph Image]