QUESTION ONE

a) A salesman has the following record of sales during three months for three items A, B and C which have different rates of commission.

<table>
<thead>
<tr>
<th>Months</th>
<th>Sales units</th>
<th>Total commission drawn in KES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>January</td>
<td>90</td>
<td>100</td>
</tr>
<tr>
<td>February</td>
<td>130</td>
<td>50</td>
</tr>
<tr>
<td>March</td>
<td>60</td>
<td>100</td>
</tr>
</tbody>
</table>

Find out the rates of commission on the items A, B and C.

(9 marks)

b) In an economy, there are two industries P and Q. The following table gives the supply and demand positions in thousands of Kenya shillings:

<table>
<thead>
<tr>
<th>PRODUCER</th>
<th>USER</th>
<th>FINAL DEMAND</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>Q</td>
<td>20</td>
<td>30</td>
</tr>
</tbody>
</table>

Determine the outputs when the final demand changes to 35 for P and 42 for Q.

(7 marks)

c) A certain manufacturing concern has total cost function $C = 15 + 9x - 6x^2 + x^3$. Find x, when the total cost is minimum.

(7 marks)

d) The relationship between profit $P$ and advertising cost $x$ is given by $P = \frac{4000x}{500 + x} - x$.

Find $x$, which maximizes $P$.

(7 marks)

(Total: 30 marks)

QUESTION TWO

a) The elasticity of demand with respect to price $p$ for a commodity is $-\frac{5}{x}$, $x > 5$

when the demand is $x$. Find the demand function if the price is 2 and demand is 7.

Also find the revenue function.

(6 marks)

b) If the marginal revenue a commodity is $MR = \frac{e^x}{100} + x + x^2$, Find the revenue function.

(4 marks)

c) The marginal revenue function (in thousands of Kenya shillings) of a commodity is $7 + e^{0.05x}$ where $x$ is the number of units sold. Find the total revenue from the sale of 100 units.

(4 marks)

d) The marginal cost and marginal revenue are $20 + \frac{x}{20}$ and 30 respectively. The fixed cost is sh. 200. Determine the maximum profit.

(6 marks)

(Total: 20 marks)
QUESTION THREE
a) Two newspapers A and B are published a city. Their present market shares are 15% for A and 85% for B. Of those who bought A the previous year, 65% continue to buy it again while the rest switch over to B. Of those who bought B the previous year, 55% buy it again and 45% switch over to A. Find their market shares after two years.

b) A firm produces x tonnes of output at a total cost \( C(x) = \frac{1}{10}x^3 - 4x^2 + 20x + 5 \)

Find
i) Average cost
ii) Average fixed cost
iii) Average variable cost
iv) Marginal average cost
v) Marginal cost

(Total: 20 marks)

QUESTION FOUR
a) Using the pass code matrix
\[ A = \begin{pmatrix} 3 & 1 \\ 2 & 1 \end{pmatrix} \]

i) Code the message: CONSUMER
ii) Decode the message: 68, 48, 81, 60, 61, 42, 28, 27.

b) The technology matrix of an economic system of two industries is
\[ \begin{pmatrix} 2 & 1 \\ 5 & 10 \\ 7 & 3 \\ 10 & 5 \end{pmatrix} \]

Find the output levels when the final demand changes to 34 and 51 units.

b) A new railway transit system has just gone into operation in Nairobi. Of those who use the new system this year 20% will switch over to using buses next year and 80% will continue to use the new railway system. Of those who use buses this year 70% will continue to use the buses next and 30% will switch over to the new system. Suppose the population of the city remains constant and that 60% of the commuters use the new system and 40% of the commuters use buses this year.

Required:
i) What percent of commuters will be using the new railway system after one year?
ii) What percent of commuters will be using the new system in the long run?

(Total: 20 marks)

QUESTION FIVE
a) Differentiate the following
i) \( y = \sin(2x - 3) \)
ii) \( y = (3x + 5)^4 \)
iii) \( y = \ln(3x - 4) \)
iv) \( y = x^2 e^x \)

b) Evaluate
i) \[ \frac{4x^2 + 1}{x(2x - 1)^2} \] (4 marks)

ii) \[ 5(e^{1-3x})dx \] (4 marks)

(Total: 20 marks)