Algebraic Modelling: Linear Equations

The profit made by a t-shirt printing company depends on the number of t-shirts bought, printed and sold.

When the company buys, prints and sells 1000 t-shirts, the company's monthly **profit** is $4 000. When the company buys, prints and sells 400 t-shirts, the company's monthly **loss** is $2 000.

(a)   Determine the **linear model** that represents the monthly profit for this company.

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(b)   Algebraically determine the number of t-shirts that are required to be bought, printed and sold each month to make a **minimum** monthly profit.

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(c)   The printed t-shirts are sold at $15 each.

   (i)   Write the **revenue equation** for this company.

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   (ii)   Determine the **variable** and **fixed** costs for this company.

Question 3 (Approximately 16 minutes)

One way of obtaining more revenue from tax is to change the Australian income tax structure.

It is proposed that the tax brackets and rates will be:

Income I	Tax Payable T
$0 – $34 000	20c for each $1
$34 001 – $150 000	$6 800 plus 40c for each $1 over $34 000
over $150 000	$53 200 plus 50c for each $1 over $150 000

(a)   Determine the linear equation that represents the tax payable on income in the bracket $0 – $34 000.

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(b)   Determine the linear equation that represents the tax payable on income in the bracket $34 001 – $150 000.

A tour boat company offers cruises at $45 per person for the first 30 passengers. When there are more than 30 passengers, the **extra passengers** are charged at a discounted rate of $35 per person.

The boat is licensed to carry a maximum of 50 passengers.

The tour boat company has fixed costs of $650 per cruise. The variable cost per person is $20.

(a)　Determine the company's:

　　(i)　Cost Equation

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　　(ii)　Revenue Equation when there are 30 or fewer passengers

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　　(iii)　Revenue Equation when there are more than 30 passengers

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(b)　The company breaks even with **fewer than 30** passengers. **Algebraically** determine the **minimum** number of passengers required to make a profit.

Question 2 (Approximately 14 minutes)

Michael runs a garden maintenance business.

Michael charges $110 for each garden he maintains. Each garden costs him $45 to work on, whilst he has fixed costs of $600 per week. He can maintain 25 gardens per week.

If he employs another two workers, Michael can maintain between 25 and 40 gardens per week. This increases his fixed costs to $2 015 per week. His other costs remain the same.

(a)   Determine Michael's:

    (i)   Revenue equation.

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    (ii)   Cost equation for 0 to 25 gardens.

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    (iii)   Cost equation for 25 to 40 gardens.

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(b)   Algebraically determine the **two break even points** for Michael's business.

2010 Exam

Kathryn sells (soap) bubble makers at a market for $10 each.

Each bubble maker costs her $4.25 to make and she has to pay a fee of $50 to sell these at the market.

(a)   What is Kathryn's:

Revenue equation?..

Cost equation? ....

(b)   Determine how many bubble makers must Kathryn sell to make a (minimum) profit.

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When Kathryn sells more than 50 bubble makers, she needs more room at the market and so the fee she has to pay increases to $90. If her selling price and variable costs remain the same:

(c)   Determine Kathryn's new **profit equation** when she sells over 50 bubble makers.

Industrial users of electricity in the Northern Territory are charged (C) the following rates for electricity (E, in MWh) each month.

Electricity E (MWh)	Charges C ($)
0 to 10	$3.40 per MWh
10 to 30	$34 + $2.30 per MWh over 10 MWh
30 to 80	$80 + $1.70 per MWh over 30 MWh

A graph showing the charges for industries using up to 80 MWh of electricity is shown.
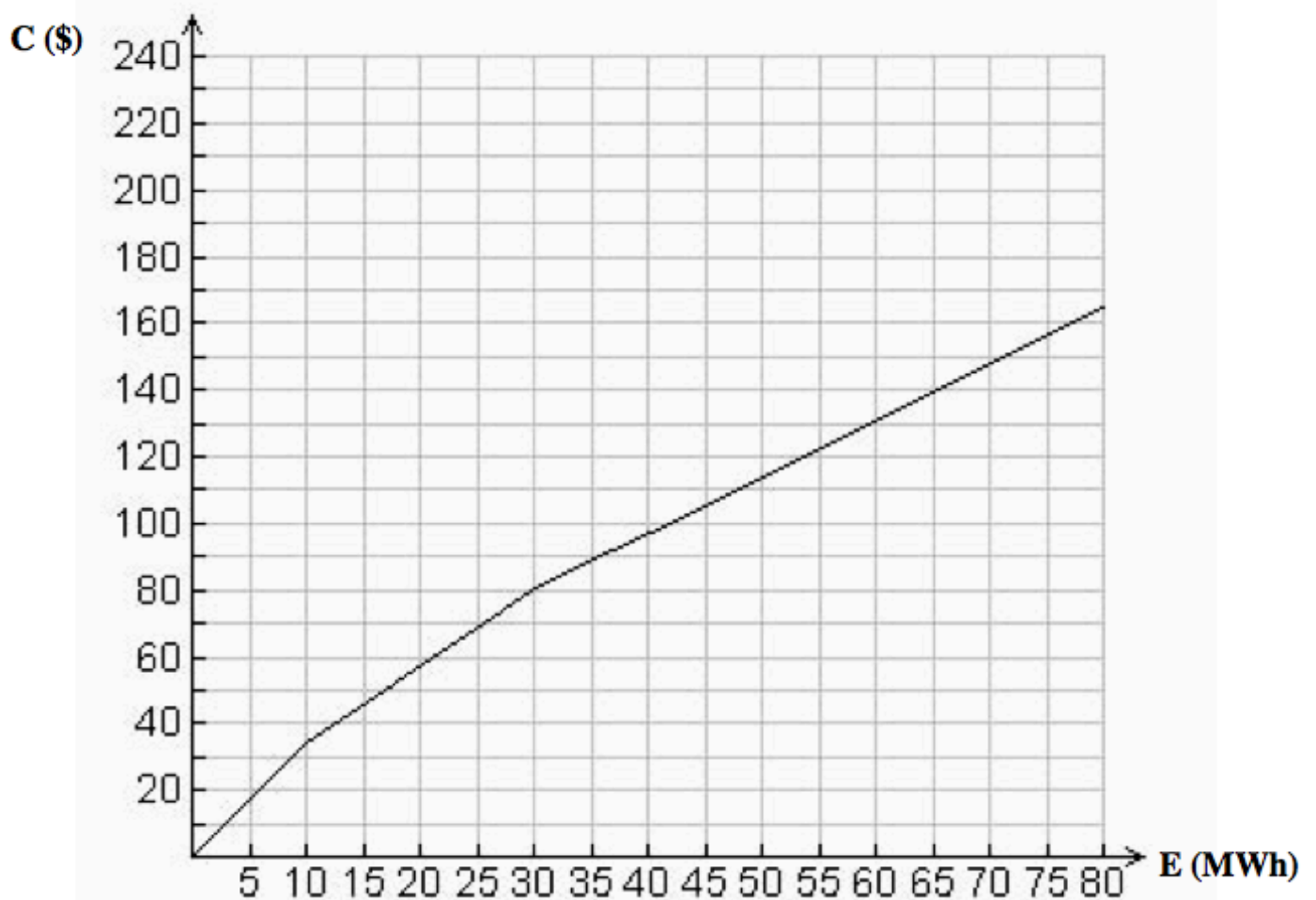
Question 2 (continued)

(b)   Find the equation of the line representing the charges (C) for an industry user that consumes between 10 MWh and 30 MWh of electricity (E).