BTEC Assignment Brief

Qualification	Pearson BTEC International Level 3 Extended Diploma in Electrical and Electronic Engineering
Unit number and title	**Unit 7: Calculus to solve engineering problems**
Learning aim(s)	**C:** Investigate the application of calculus to solve a defined specialist engineering problem 研究如何應用微積分解決特定專業工程上的問題
Assignment title	Investigate an engineering problem using calculus 用微積分解決一項工程上的問題
Assessor	Mr. Cho Yat Yin
Learner name	
Issue date	16/3/2021
Hand in deadline	

Vocational Scenario or Context	You are working as a Junior Engineer for a small motor racing team. You have been given a proposed mathematical model to calculate the velocity of a car accelerating from rest in a straight line. The equation is: 你是一個小型賽車隊的初級工程師。您已有一個建議的數學模型，用於計算小型賽車從靜止加速到某直線速度的關係。關係式是： $$v(t) = A\left(1 - e^{-\frac{t}{t_{maxspeed}}}\right)$$ $v(t)$ is the instantaneous velocity of the car (m/s) $v(t)$ 小型賽車的瞬間速度 (米/秒) t is the time in seconds t 是時間 (秒) $t_{maxspeed}$ is the time to reach the maximum speed in seconds $t_{maxspeed}$是達至最高速度時所需的時間(秒) A is a constant. A 是常數 The Team Manager has asked you to carry out an analysis of the model and produce a written report. As part of the analysis you have been given some data on a known model. 團隊經理要求您對模型進行分析並提交書面報告。您已獲得一些已知模型的資料作為分析的一部分。

Task 1	Produce a report that contains written descriptions, analysis and mathematics that shows how calculus can be used to solve an engineering problem. The tasks are to: 編寫一份報告，其中包含有書面描述、分析和數學運算，用以說明如何使用微積分解決工程問題。任務包括： ● Use thinking methods to analyse the given engineering problem, e.g. break the problem down into a series of manageable elements, and produce a specification 使用思維方法來分析已給定的工程問題，例如將問題分解為一系列可管理的元素，並引生出一個規範

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- Prepare a valid proposal for solving the problem and present it
  準備解決該問題的有效建議並作介紹
- Produce mathematical models for the identified elements of the problem
  為問題的已識別元素建立數學模型
- Apply calculus methods to produce answers for each of the elements
  應用微積分方法為每個元素找出答案
- Bring the elements together in a formal presentation
  以正式的形式將各要素匯總在一起作介紹

In your proposal you need to outline the problem and the methods needed to solve it. You need to include how to
在您的建議中，您需要概述該問題以及解決該問題所需的方法。您需要包括如何

1. Identify the 確定
   - units of the coefficient A
     係數 A 的單位
   - physical meaning of A 係數
     A 的物理意義
   - velocity of the car at $t = 0$
     $t = 0$ 時的汽車速度
   - asymptote of this function as $t \rightarrow \infty$?
     函數 $t \rightarrow \infty$ 的漸近線？
2. Sketch a graph of velocity vs. time.
   繪製速度與時間的圖。
3. Derive an equation $x(t)$ for the instantaneous position of the car as a function of time. Identify the
   推導出汽車的瞬時位置隨時間變化的方程 $x(t)$。確定
   - value x when $t = 0$ s
     當 $t = 0$ 秒時的 x 值
   - asymptote of this function as $t \rightarrow \infty$
     當 $t \rightarrow \infty$ 時方程 $x(t)$的漸近線
4. Sketch a graph of position vs. time.
   繪製位置與時間的圖表。
5. Derive an equation $a(t)$ for the instantaneous acceleration of the car as a function of time. Identify the
   推導出汽車的瞬時加速度隨時間變化的方程$a(t)$。確定
   - acceleration of the car at $t = 0 s$
     當 $t = 0$ 秒時的加速度值
   - asymptote of this function as $t \rightarrow \infty$
     當 $t \rightarrow \infty$ 時方程$a(t)$的漸近線
6. Sketch a graph of acceleration vs. time.
   繪製加速度與時間的圖表。
7. Apply your mathematical models to your allocated car. Use the given data for the 0 – 28 m/s and 400m times to calculate the:
   將數學模型應用到你分配的汽車上。使用 0 – 28 m/s 和 400m 的給定資料計算：
   - value of the coefficient A
     係數 A 的值

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	● maximum velocity 最大速度 ● maximum acceleration. 最大加速度。
Checklist of evidence required	Your informal report should contain: 您的非正式報告應包括： ● written descriptions, 書面說明， ● analysis 分析 ● worked solutions to the problems 問題的解決方案 Each worked solution should be laid out clearly and contain brief explanations of the stages of the calculation to indicate your understanding of how calculus can be used to solve an engineering problem. Diagrams and sketches should be well presented and clearly labelled. 應清楚列出每個已解決的方案，並包含計算階段的簡要說明，以表明您對如何使用微積分方法解決工程問題的理解。圖解和繪圖應該清楚地呈現和標明。

Criteria covered by this task:		
Unit/Criteria reference	To achieve the criteria you must show that you are able to: 要達到標準，必須顯出你能夠：	Evidence
7/C.D3	Critically analyse, using technically correct language and a logical structure, a complex engineering problem, synthesising and applying calculus and a mathematical model to generate an accurate solution. 批判性地分析，技術性地使用正確的語言和邏輯結構，將一個複雜的工程問題，用綜合和應用微積分和數學模型，找出精確的解決方案。	
7/C.M3	Analyse an engineering problem, explaining the reasons for each element of the proposed solution 分析一個工程問題，解釋所提解決方案中每個元素的原因。	
7/C.M4	Solve accurately, using calculus methods and a mathematical model, a given engineering problem. 利用微積分方法和數學模型，精確地解決一個指定的工程問題。	
7/C.P7	Define a given engineering problem and present a proposal to solve it. 定義一個給定的工程問題並提出解決該問題的建議。	
7/C.P8	Solve, using calculus methods and a mathematical model, a given engineering problem. 利用微積分方法和數學模型，解決一個指定的工程問題。	

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| Sources of information to support you with this Assignment | mathsisfun.com/index.htm

mathcentre.ac.uk/students/topics |
|---|---|
| Other assessment materials attached to this Assignment Brief | Table of 0-28 m/s, 400m and time to reach maximum speed times. |

Learner declaration

I certify that the work submitted for this assignment is my own. I have clearly referenced any sources used in the work. I understand that false declaration is a form of malpractice.

Learner's signature: Date:

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Candidate	Car model	t(0-28 m/s) (s)	t(400m) (s)	$t_{maxspeed}$ (s)
1	1994 Ford SVT Boss Mustang 10.0L Concept	1.9	10.50	7.1
2	2002 Chevrolet Corvette (Lingenfelter 427 Twin Turbo)	2.0	9.10	6.8
3	Bugatti Veyron 16.4 Grand Sport Vitesse - [2012]	2.5	9.21	10.2
4	Caterham 7 620 R 2.0 L Supercharged - [2013]	2.8	10.91	7.0
5	Ariel Atom V8 500 - [2008]	2.3	10.80	5.0
6	Bugatti Veyron 8.0 litre W16 Super Sport - [2010]	2.5	9.75	8.0
7	Caparo T1 2.4 V8 - [2006]	2.5	8.23	7.0
8	Hennessey Venom GT - [2010]	2.5	8.64	8.5
9	Radical RXC 3.5 V6 Twin Turbo - [2014]	2.6	10.46	7.0
10	Ascari A10 5.0 V8 - [2006]	2.8	10.36	7.8
12	Lamborghini Veneno 6.5 V12 - [2013]	2.8	9.92	8.5
13	Porsche 918 Spyder 4.6 V8 - [2013]	2.8	11.49	8.2
14	Caterham 7 Superlight R500 - [2009]	2.9	11.32	8.0
15	Ferrari F12 tdf 6.3 V12 - [2015]	2.9	10.18	7.4

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BTEC Assignment Brief

Qualification	Pearson BTEC International Level 3 Extended Diploma in Electrical and Electronic Engineering
Unit number and title	**Unit 7: Calculus to solve engineering problems**
Learning aim(s)	**B:** Examine how Integral calculus can be used to solve engineering problems 　　研究如何用積分解決工程上的問題
Assignment title	Solving engineering problems that involve integration differentiation 解決涉及積分的工程問題
Assessor	Mr. Cho Yat Yin
Learner name	
Issue date	16/3/2021
Hand in deadline	

Vocational Scenario or Context	You are working as an apprentice engineer at a company involved in the research, design production and maintenance of bespoke engineering solutions for larger customers. 您是一家從事為大客戶定製工程解決方案的研究、設計生產和維修的學徒工程師。 Part of your apprenticeship is to spend time working in all departments, however a certain level of understanding needs to be shown before the managing director allows apprentices into the design team and so she has developed a series of questions on integration to determine if you are suitable. 學徒訓練期間會被分配到所有部門作學習。在允許學徒進入設計團隊之前，總經理設定了一系列關於積分的問題，學徒需要表現出對積分問題有一定程度的理解，以確定你是否合適到設計團隊學習。 https://www.systransoft.com/lp/chinese-translation/

Task 1	1　The tasks are to: 　　任務是： 　　a)　Find the indefinite integral of the function 　　　　求以下函數的不定積分 $$y = 3t^2 + 2e^{3t} + \frac{1}{t} + 2\cos 3t$$ 　　b)　Calculate the definite integral 　　　　求以下函數的定積分 $$\int_{1}^{2} 3t^2 + 2e^{3t} + \frac{1}{t} + 2\cos 3t \, dt$$

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2 An object is moving with a uniform acceleration $a = 2ms^{-2}$, determine the functions for:
   一個物體以 $a = 2ms^{-2}$ 的均加速度移動，求：

   a) Velocity $v(ms^{-1})$ – given $v(0) = 10ms^{-1}$
      初速度為 10/秒的速度函數式。
   b) Displacement $s(m)$ – given $s(0) = 5m$
      起始位移是 5 米的位移函數式。
   c) Calculate the values of v and s for:
      i) $t = 2s$
      ii) $t = 5s$

      求在以下瞬間的速度及位移：
      i) $t = 2$秒
      ii) $t = 5$秒

3 The extension, y, of a material with an applied force, F, is given by $y = e^{F \times 1 \times 10^{-3}}$.
   一物件的伸展與受作用力(應力)的關係可以函數
   $$y = e^{F \times 1 \times 10^{-3}}$$表示

   a) Calculate the work done if the force increases from 100N to 500N using:
      i) An analytical integration technique
      ii) A numerical integration technique

      如果作用力(應力)由 100 牛頓增加至 500 牛頓，用以下方法：
      i) 分析積分法
      ii) 數值積分法
      求力所作的功。

   [Note: the work done is given by the area under the curve]
   [注意：功可由伸展曲線與作用力(應力) 所包圍的面積求出]

   b) Compare the two answers
      比較 i) 和 ii) 兩部分的結果。
   c) Using a computer spreadsheet increase the number of values used for your numerical method
      使用電子表格在數值積分法時增加作用力(應力)在 100 牛頓至 500 牛頓內的變動值。
   d) Analyse any affect the size of numerical step has on the result.
      分析變動值的大小對數值積分法的影響。
      https://www.mathsisfun.com/calculus/integral-approximations.html

4 For the function $v = 12\sin 4\theta$, calculate the:
   求範圍在 $0 \le \theta \le \frac{\pi}{4}$ 弧度內函數 $v = 12\sin 4\theta$ 的：
   a) Mean 平均值。
   b) Root mean square (RMS) 均方根值。

Over a range of $0 \leq \theta \leq \frac{\pi}{4}$ radians.

[Note the trigonometric identity $\cos 2\theta = 1 - 2\sin^2 \theta$]
[注意:三角學公式中 $\cos 2\theta = 1 - 2\sin^2 \theta$]

5 A complex function can be modelled by the equation:
一個覆函數方程式如下:
$$y = \cos(x^3)\, 3x^2$$

Find the indefinite integral of the function

($\int \cos(x^3) 3x^2 \, dx$) using a substitution method.

用($\int \cos(x^3) 3x^2 \, dx$)代入(替換)方法求其不定積分。

https://www.mathsisfun.com/calculus/integration-by-substitution.html

6 The acceleration of an object moving in a strange way has been modelled as $a = e^x x$.
一個物體奇妙移動的軌跡如以 $a = e^x x$ 模擬

a) Use integration by parts to find an equation to model the velocity v if $v = \int e^x x \, dx$.
如果速度為 $v = \int e^x x \, dx$,用部份積分法模擬其速度。

b) Is the problem any different if you find $v = \int x e^x \, dx$?
如果速度改為 $v = \int x e^x \, dx$ 作模擬與 $v = \int e^x x \, dx$ 作模擬有分別嗎?
https://www.mathsisfun.com/calculus/integration-by-parts.html

7 Newton's laws of cooling proposes that the rate of change of temperature is proportional to the temperature difference to the ambient (room) temperature. And can be modelled using the equation:
牛頓冷却定律認為溫度變化率是物件表面的溫度與周圍環境(室)的溫度成正比。而且可以用公式來模擬:

$$\frac{dT}{dt} = -k(T - T_a)$$

This can also be written as:
公式可重整為:

$$\frac{dT}{T - T_a} = -k \, dt$$

Where: 其中
$T = Temperature\ of\ material$ 物料表面的溫度
$T_a = Ambient\ (room)\ temperature$ 周圍環境(室)溫度
$k = A\ cooling\ constant$ 冷却系數

a) Integrate both sides of the equation and show that the temperature difference is given by:
將方程的兩側積分,證明溫度差是:

	$(T - T_a) = C_o e^{-kt}$ [C_o is a constant for this problem] [其中C_o是個常數] b) Calculate C_o if the initial temperature is 70℃ and $T_a = 20℃$. 如果物料表面的初始溫度及周圍環境(室)溫度分別是70℃及$T_a = 20℃$，計算C_o的值。
Checklist of evidence required	Your informal report should contain: • analysis • worked solutions to the problems Each worked solution should be laid out clearly and contain brief explanations of the stages of the calculation to indicate your understanding of how calculus can be used to solve an engineering problem. Graphs should be well presented and clearly labelled and comparisons between methods should be accurate and well presented. 您的非正式報告應包括： • 分析 • 已解決的問題。 每個已解決的問題都應清楚列出，並包含計算階段的簡要說明，以表明您對如何使用演算來解決工程問題的理解。每個圖表應該清晰描述，明確標注。對比各種方法時應精準。

Criteria covered by this task:

Unit/Criteria reference	To achieve the criteria you must show that you are able to: 要達到標準，必須顯出你能夠：	Evidence
7/B.D1	Evaluate, using technically correct language and a logical structure, the correct integral calculus and numerical integration solutions for each type of given routine and non-routine functions, including at least two set in an engineering context. 使用正確的專門用語和邏輯結構，對每種指定的一般和非一般的函數在正確分析積分法和數值積分法答案作評估，解釋如何在至少兩個函數中優化其變數。	
7/B.M2	Find accurately the integral calculus and numerical integration solutions for each type of given routine and non-routine function, and find the properties of periodic functions. 用分析積分法和數值積分法準確地找出每種指定的一般和非一般的函數的答案，並查找周期函數的屬性。	
7/B.P4	Find the indefinite integral for each type of given routine function. 求每種指定一般函數類型的不定積分。	
7/B.P5	Find the numerical value of the definite integral for each type of given routine function. 用數值積分法求每類指定一般函數內的定積分。	
7/B.P6	Find, using numerical integration and integral calculus, the area under curves for each type of given routine definitive function. 用分析積分法和數值積分法找出一般指定函數曲線的面積。	

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Sources of information to support you with this Assignment	mathsisfun.com/index.htm
	mathcentre.ac.uk/students/topics

Learner declaration

I certify that the work submitted for this assignment is my own. I have clearly referenced any sources used in the work. I understand that false declaration is a form of malpractice.

Learner's signature: Date:

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BTEC Assignment Brief

Qualification	Pearson BTEC International Level 3 Extended Diploma in Electrical and Electronic Engineering
Unit number and title	**Unit 7: Calculus to solve engineering problems**
Learning aim(s)	**A:** Examine how differential calculus can be used to solve engineering problems 研究如何用微分解決工程上的問題
Assignment title	Solving engineering problems that involve differentiation 解決涉及微分的工程問題
Assessor	Mr. Cho Yat Yin
Learner name	
Issue date	16/3/2021
Hand in deadline	

Vocational Scenario or Context	You are working as an apprentice engineer at a company involved in the research, design production and maintenance of bespoke engineering solutions for larger customers. 您是一家從事為大客戶定製工程解決方案的研究、設計生產和維修的學徒工程師。 Part of your apprenticeship is to spend time working in all departments, however a certain level of understanding needs to be shown before the managing director allows apprentices into the design team and so she has developed a series of questions on differentiation to determine if you are suitable. 學徒訓練期間會被分配到所有部門作學習。在允許學徒進入設計團隊之前，總經理設定了一系列關於微分的問題，學徒需要表現出對微分問題有一定程度的理解，以確定你是否合適到設計團隊學習。 https://www.translate.com/english-chinese-traditional https://www.systransoft.com/lp/chinese-translation/

Task 1	Produce a report that contains written descriptions, analysis and mathematics that shows how calculus can be used to solve engineering problems as set out below. 學習報告包括以書面描述、分析實際情況和數學的運用，顯示如何使用微積分解決工程問題，如下所示: 1 The equation for a distance, s(m), travelled in time t(s) by an object starting with an initial velocity u(ms^{-1}) and uniform acceleration a(ms^{-2}) is: 關於物件的距離 s（m）與時間 t（s），可以用初速度 u（ms^{-1}）和均加速度 a（ms^{-2}） 的方程式來表示: $$s = ut + \frac{1}{2}at^2$$ The tasks are to: 任務是:

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a) Plot a graph of distance (s) vs time (t) for the first 10s of motion if $u = 10ms^{-1}$ and $a = 5ms^{-2}$.
依方程式繪製距離（s） 與時間 （t）在 $u = 10ms^{-1}$ 和 $a = 5ms^{-2}$的運動中的前 10 秒的軌跡圖。

b) Determine the gradient of the graph at $t = 2s$ and $t = 6s$.
確定時間在 $t = 2s$ 和 $t = 6s$ 的梯度(斜率)。

c) Differentiate the equation to find the functions for
對距離的方程作微分, 求
   i) Velocity $\left(v = \frac{ds}{dt}\right)$ 速度。
   ii) Acceleration $\left(a = \frac{dv}{dt} = \frac{d^2s}{dt^2}\right)$ 加速度。

d) Use your result from part c to calculate the velocity at $t = 2s$ and $t = 6s$.
使用 c) 部分的結果, 計算 $t = 2$ 秒 和 $t = 6$ 秒時的速度。

e) Compare your results for part b and part d.
比較 b) 和 c) 兩部分的結果。

2 The displacement of a mass is given by the function
如一個物件的位移用以下正弦函數式表示
$y = \sin 3t$.

The tasks are to:
任務是：

a) Draw a graph of the displacement y(m) against time t(s) for the time $t = 0s$ to $t = 2.s$.
依正弦函數式繪製位移 y（m）與時間（t）由 $t = 0$ 秒至 $t = 2$ 秒的軌跡圖。

b) Identify the position of any turning points and whether they are maxima, minima or points of inflexion.
確定任何轉接點的位置，哪點轉捩點是最高(極大值)、最低(極小值)或拐點?

c) Calculate the turning points of the function using differential calculus and show which are maxima, minima or points of inflexion by using the second derivative.

使用微分的第二次導數計算函數的轉捩點，顯示其中的最大值、最小值或拐點。

Compare your results from parts b and c.
比較 b) 和 c) 兩部分的結果。

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3 The equation for the instantaneous voltage across a discharging capacitor is given by $v = V_O e^{-\frac{t}{\tau}}$, where V_O is the initial voltage and τ is the time constant of the circuit.
放電電容器的暫態電壓方程式是 $v = V_O e^{-\frac{t}{\tau}}$，其中 V_O 是初始電壓，τ 是電路的時間常數。

The tasks are to:
任務是：

a) Draw a graph of voltage against time for $V_O = 12V$ and $\tau = 2s$, between $t = 0s$ and $t = 10s$.
在 t=0 和 t=10s 之間繪製 V_O=12V 和 τ=2s 的電壓與時間的關係圖。

b) Calculate the gradient at $t = 2s$ and $t = 4s$.
計算在 t=2 秒 和 t=4 秒的梯度(斜率)。

c) Differentiate $v = 12e^{-\frac{t}{2}}$ and calculate the value of $\frac{dv}{dt}$ at $t = 2s$ and $t = 4s$.
求 $\frac{dv}{dt}$ 在 t=2 秒 和 t=4 秒時的值。

d) Compare your answers for part b and part c.
比較 b) 和 c) 兩部分的結果。

e) Calculate the second derivative of the instantaneous voltage $\left(\frac{d^2v}{dt^2}\right)$.
計算暫態電壓方程式的的第二次導數 $\left(\frac{d^2v}{dt^2}\right)$。

4 The same capacitor circuit is now charged up to 12V and the instantaneous voltage is $v = 12\left(1 - e^{-\frac{t}{2}}\right)$.
相同的電容器電路現在充電高至 12V，暫態電壓為
$v = 12\left(1 - e^{-\frac{t}{2}}\right)$

The tasks are to:
任務是：

a) Differentiate v with respect to t to give an equation for $\frac{dv}{dt}$.
對暫態電壓方程式以 t 作第一次導數

b) Calculate the value of $\frac{dv}{dt}$ at $t = 2s$ and $t = 4s$.
求 $\frac{dv}{dt}$ 在 t=2 秒 和 t=4 秒時的值。

c) Find the second derivative $\left(\frac{d^2v}{dt^2}\right)$.
求暫態電壓方程式的的第二次導數 $\left(\frac{d^2v}{dt^2}\right)$。

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5　The gain of an amplifier is found to be $G = 20 \log(10V_{out})$：
　　放大器的增益為$G = 20 \log(10V_{out})$

The tasks are to find equations for:
任務是查找以下方程：

　　a)　$\frac{dG}{dV_{Out}}$

　　b)　$\frac{d^2G}{dV_{Out}^2}$

6　The displacement, y(m), of a body in damped oscillation is $y = 2e^{-t}\sin 3t$.
　　阻尼振蕩中主體的位移是 $y = 2e^{-t}\sin 3t$.

The task is to:
任務是：

　　a)　Use the Product Rule to find an equation for the velocity of the object if $v = \frac{dy}{dt}$.
　　　　使用微分的乘積規則法找物體的速度方程式 $v = \frac{dy}{dt}$。

7　The velocity of a moving vehicle is given by the equation $v = (2t + 3)^4$
　　如某移動車輛的速度可由方程 $v = (2t + 3)^4$ 表示

The task is to:
任務是：

　　a)　Use the Chain Rule to determine an equation for the acceleration when $a = \frac{dv}{dt}$.
　　　　使用微分的連鎖規則法找移動車輛的均速度方程式 $a = \frac{dv}{dt}$。

8　A communication signal is given by the function $y = \frac{\sin t}{t}$
　　如某通訊信號的函數式為 $y = \frac{\sin t}{t}$

The task is to:
任務是：

　　a)　Derive and equation for $\frac{dy}{dt}$ using the Quotient Rule.
　　　　使用微分的商數規則法找 $\frac{dy}{dt}$。

9　A company is required to fence off the area around a robot arm to comply with health and safety law. They have 750m of fencing available
　　一家公司必須將機器人手臂周圍的區域隔離起來，以遵守健康和安全法。他們有 750m 的圍欄。

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The task is to:
任務是：

  a) Find the maximum area they can fence off?
     找到他們能圍住的最大面積？

10 You plan to make a simple, open topped box from a piece
    of sheet metal by cutting a square – of equal size – from
    each corner and folding up the sides as shown in the
    diagram:
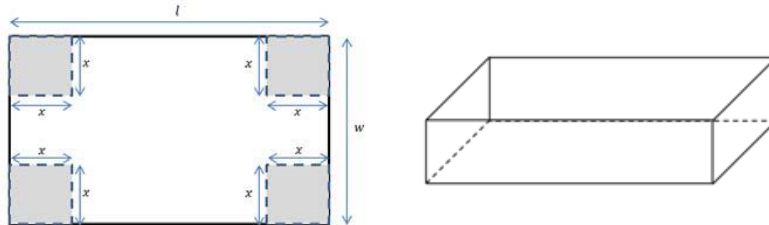
您計畫從一塊金屬件中每個角處切出一個正方形。如將兩側折疊起
來, 形成一個簡單、開放的頂蓋盒, 如圖所示：

If $l = 200mm$ and $w = 150mm$ calculate:
如果 $l = 200mm$ and $w = 150mm$ 計算：
  a) The value of x which will give the maximum volume
     將給出最大體積框的 x 值。
  b) The maximum volume of the box
     盒的最大體積是多少?
  c) Comment of the value obtained in part b.
     評論 b)部份的結果。

Checklist of evidence required	Your informal report should contain: ● analysis ● worked solutions to the problems Each worked solution should be laid out clearly and contain brief explanations of the stages of the calculation to indicate your understanding of how calculus can be used to solve an engineering problem. You explanation should be detailed in response to questions 9 and 10 to show how the variables are optimised in each case. Graphs should be well presented and clearly labelled and comparisons between methods should be accurate and well presented. 您的非正式報告應包括： • 分析 • 已解決的問題。 每個已解決的問題都應清楚列出，並包含計算階段的簡要說明，以表明您對如何使用演算來解決工程問題的理解。您應在回答問題 9 和 10 時詳細說明如何在每種情況下優化其中的變數。每個圖表應該清晰描述，明確標注。對比各種方法時應精準。

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Criteria covered by this task:		
Unit/Criteria reference	To achieve the criteria you must show that you are able to: 要達到標準，必須顯出你能夠：	Evidence
7/A.D1	Evaluate, using technically correct language and a logical structure, the correct graphical and analytical differential calculus solutions for each type of given routine and non-routine function, explaining how the variables could be optimised in at least two functions. 使用正確的專門用語和邏輯結構，對每種指定的一般和非一般的函數在正確圖形和解析微分的答案作評估，解釋如何在至少兩個函數中優化其變數。	
7/A.M1	Find accurately the graphical and analytical differential calculus solutions and, where appropriate, turning points for each type of given routine and non-routine function and compare the results. 用圖解法及解析法準確地找出各類指定的一般和非一般函數的微分答案，然後適當地對指定的各類一般和非一般函數的各類轉捩點，並比較兩者的結果。	
7/A.P1	Find the first and second derivatives for each type of given routine function. 求每種指定一般函數類型的第一次和第二次導數。	
7/A.P2	Find, graphically and analytically, at least two gradients for each type of given routine function. 用圖解法及解析法求每類指定一般函數內的最少兩個梯度(斜率) 。	
7/A.P3	Find the turning points for given routine polynomial and trigonometric functions. 找出一般指定多項式及三角函數的拐點。	

Sources of information to support you with this Assignment	mathsisfun.com/index.htm mathcentre.ac.uk/students/topics

Learner declaration

I certify that the work submitted for this assignment is my own. I have clearly referenced any sources used in the work. I understand that false declaration is a form of malpractice.

Learner's signature: Date:

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