**BTEC Assignment Brief**

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| **Qualification** | Pearson BTEC Level 3 National Extended Diploma in Engineering |
| **Unit number and title** | **Unit 7: Calculus to solve engineering problems** |
| **Learning aim(s)** (For NQF only) | **B:** Examine how Integral calculus can be used to solve engineering problems |
| **Assignment title** | Solving engineering problems that involve differentiation |
| **Assessor** |  |
| **Issue date** |  |
| **Hand in deadline**  |  |
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| **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.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. |
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| **Task 1** | 1 The tasks are to:1. Find the indefinite integral of the function
2. Calculate the definite integral

2 An object is moving with a uniform acceleration , determine the functions for:1. Velocity – given
2. Displacement – given
3. Calculate the values of and for:

3 The extension, , of a material with an applied force, , is given by .1. Calculate the work done if the force increases from 100N to 500N using:
2. An analytical integration technique
3. A numerical integration technique

*[Note: the work done is given by the area under the curve]*1. Compare the two answers
2. Using a computer spreadsheet increase the number of values used for your numerical method
3. Analyse any affect the size of numerical step has on the result.

4 For the function , calculate the:1. Mean
2. Root mean square (RMS)

Over a range of radians.*[Note the trigonometric identity ]* 5 A complex function can be modelled by the equation:Find the indefinite integral of the function using a substitution method. 6 The acceleration of an object moving in a strange way has been modelled as .1. Use integration by parts to find an equation to model the velocity if .
2. Is the problem any different if you find?

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:This can also be written as:Where:1. Integrate both sides of the equation and show that the temperature difference is given by:

]1. Calculate if the initial temperature is and .
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| **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. |
| **Criteria covered by this task:** |
| Unit/Criteria reference | To achieve the criteria you must show that you are able to: |
| 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. |
| 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. |
| 7/B.P4 | Find the indefinite integral for each type of given routine function. |
| 7/B.P5 | Find the numerical value of the definite integral for each type of given routine function. |
| 7/B.P6 | Find, using numerical integration and integral calculus, the area under curves for each type of given routine definitive function. |
| **Sources of information to support you with this Assignment** | <http://www.mathsisfun.com/index.htm><http://www.mathcentre.ac.uk/students/topics> |
| **Other assessment materials attached to this Assignment Brief** |  |