**Assignment – Be Able to use Algebraic Methods**

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| **Name:** |  |

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| **Criteria** | **P1: Be Able to Use Algebraic Methods** | **Achieved** | **Not achieved** | **Date** |
| **P2**  **Pass Criteria Outcome** | Solve a linear equation by plotting a straight line graph using experimental data and use it to deduce the gradient, intercept and equation of the line. |  |  |  |
| **M1**  **Merit Criteria Outcome** | Solve a pair of simultaneous equations in two unknowns |  |  |  |
| **D1**  **Distinction Criteria Outcome** | Solve a pair of simultaneous equations, one linear and one quadratic, in two unknowns |  |  |  |

**Part One**

1. Give a short definition of the following terms in your own words. You may use diagrams to help.

* **Cartesian coordinates**
* **Origin**
* **Gradient**
* **Positive gradient**
* **Negative gradient**
* **Y Intercept**
* **Quadrants**
* **Rise and run**

2. Explain why data connected by linear equations and obtained from experiments may not lie exactly on a line when plotted on a graph.

3. Give one specific example of why a point may not lie exactly on the line.

**Part Two**

**Hooke’s Law**

In 1676 a scientist called Robert Hooke realised that the more force that is put onto a piece of elastic or a spring the more it will stretch. He found that the length increased by the same amount every time the force was increased by a fixed amount. This is called Hooke’s law.

Table one shows the results of an experiment to find the extension of an elastic band when a load is attached to it.

4. Complete the extension column.

**Table 1** Stretching a rubber band (original dimensions: 95 mm x 6.0 mm x 0.85 mm)

|  |  |  |
| --- | --- | --- |
| **Load /N** | **Length /mm** | **Extension /mm** |
| 0 | 95 | 0 |
| 1.0 | 112 |  |
| 2.0 | 137 |  |
| 3.0 | 168 |  |
| 4.0 | 207 |  |
| 5.0 | 242 |  |
| 6.0 | 275 |  |
| 7.0 | 306 |  |
| 8.0 | 328 |  |

5. Draw a line graph by hand using graph paper to show the load vs the extension. Remember to label the graph.

6. What is the gradient of the line?

7. What is the intercept of the line?

8. Work out the equation of the line.

9. Verify your equation by calculating it using two sets of coordinates from the table. Show your working.

10. Extrapolate from your graph the extension with a load of 1.5N. Show this on the graph.

11. Now work out what it would be using the equation.

12. Compare your two results. How similar are they?

**Part Three**

The following table shows the properties of saturated liquid mercury.

|  |  |
| --- | --- |
| **Temperature T in °C** | **Density p in kg/me** |
| 0 | 13595 |
| 20 | 13545 |
| 50 | 13472 |
| 100 | 13351 |
| 150 |  |
| 200 |  |
| 250 |  |
| 300 |  |

13. Copy the table into Excel.

14. Draw a graph of the first five sets of values in Excel. Label the graph. Paste in here.

15. What is the gradient of the line?

16. What is the intercept of the line?

17. Work out the equation of the line.

18. Complete the table using the equation. Paste in below.

19. Plot a new graph in Excel with all the values from the table. Remember to label the graph. Paste the graph below.

**Part Four**

20. The resistance of a filament lamp is measured as the voltage is increased from 0 volts to 14 volts in increments of two volts.

The results for the resistance are:

0.5Ω 1.5 Ω 2.2 Ω 3.2 Ω 4.2 Ω 5.0 Ω 6.0 Ω 6.9 Ω

Create a table below showing voltage and resistance.

21. Plot the graph using graph paper with the voltage on the x axis.

22. Draw a line of best fit.

23. Calculate the gradient, intercept and equation of the line.