|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| An experiment was carried out based on the equation  and the following dataset was obtained:   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  | 0.14 | 1.40 | 1.94 | 1.97 | 6.59 | 7.10 | 7.75 | 8.38 | |  | 0.58 | 2.07 | 2.72 | 2.84 | 8.57 | 8.84 | 9.2 | 9.75 |   Your tasks are as follows:   1. Calculate the centroid, 2. Sketch the graph, 3. Determine the gradient from the graph, 4. Calculate the uncertainty of the graph, 5. Compare the gradient of the graph and 6. Determine the value of and its uncertainty 7. Determine the percentage of error. 8. Comment on the results. |
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**Suggested Solutions**

**Theoretical**

|  |  |
| --- | --- |
| **Equation** |  |

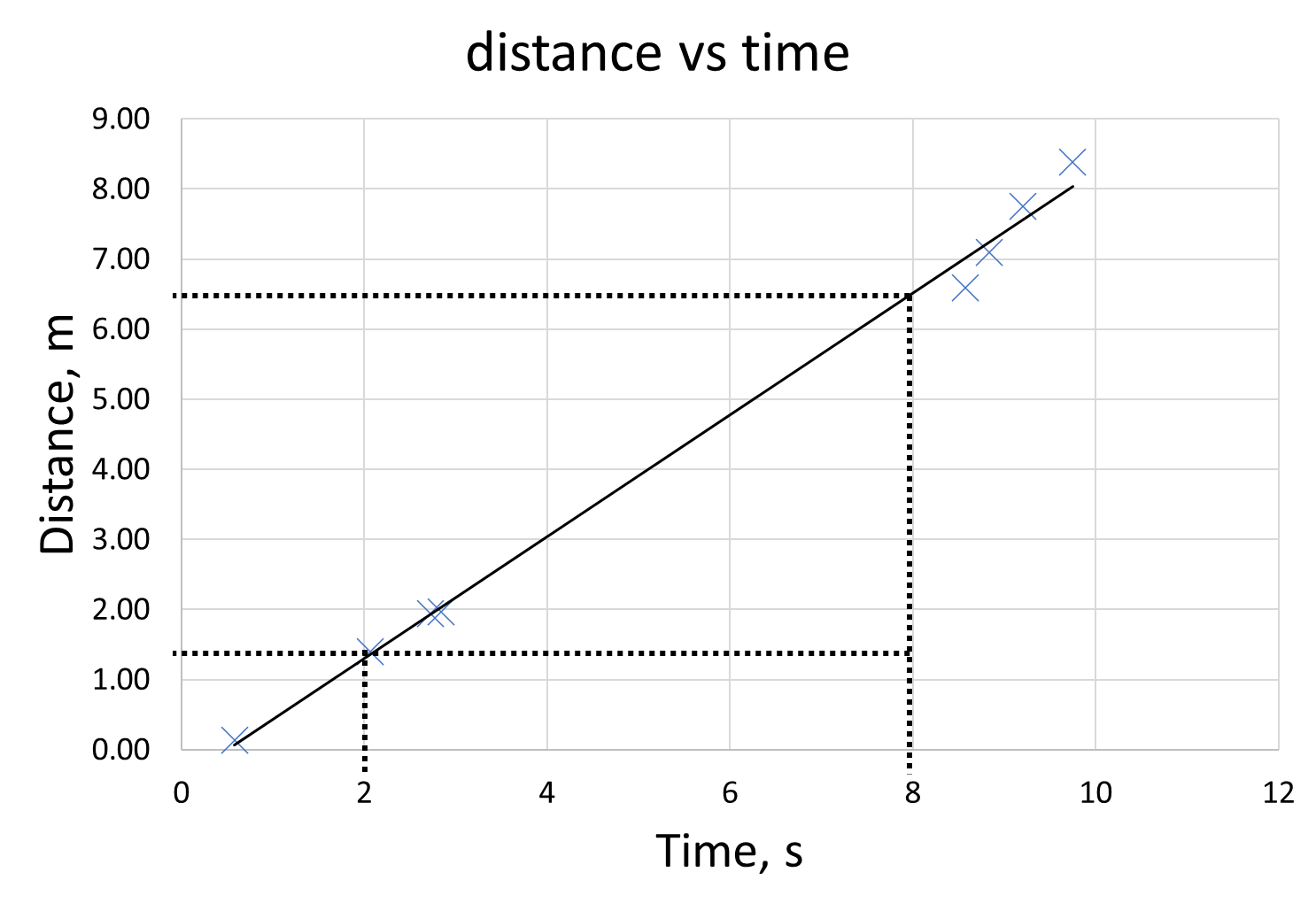
**Experimental Dataset**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0.14 | 1.40 | 1.94 | 1.97 | 6.59 | 7.10 | 7.75 | 8.38 |
|  | 0.58 | 2.07 | 2.72 | 2.84 | 8.57 | 8.84 | 9.2 | 9.75 |

**Centroid:**

Centroid

**Graph:**



**Gradient and y-intercept Calculation:**

From graph, take 2 points

Calculate the gradient between these two points,

Calculating gradient can be done using value for gradient and one of the points above,

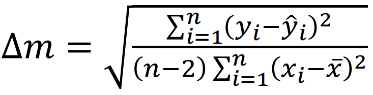
Equation of straight line is then

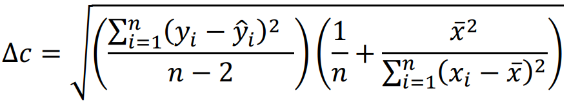
**Uncertainty Table:**

Here, values of is calculated from eq. [1].

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |
| 0.58 | -4.99 | 24.91 | 0.14 | 0.07 | 0.07 | 0.00 |
| 2.07 | -3.50 | 12.26 | 1.40 | 1.37 | 0.03 | 0.00 |
| 2.72 | -2.85 | 8.13 | 1.94 | 1.93 | 0.01 | 0.00 |
| 2.84 | -2.73 | 7.46 | 1.97 | 2.03 | -0.06 | 0.00 |
| 8.57 | 3.00 | 8.99 | 6.59 | 7.02 | -0.43 | 0.18 |
| 8.84 | 3.27 | 10.68 | 7.10 | 7.25 | -0.15 | 0.02 |
| 9.20 | 3.63 | 13.17 | 7.75 | 7.56 | 0.19 | 0.04 |
| 9.75 | 4.18 | 17.46 | 8.38 | 8.04 | 0.34 | 0.12 |
| 44.57 |  | 103.06 |  |  |  | 0.36 |

**Calculation of gradient and y-intercept uncertainty:**

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****

**Experimental and Theoretical equation comparison**

compared with

So, the experimental value of u (along with its uncertainty) is

**Percentage of difference**

**Self Practice**

Data Analysis Practice Sheet

sr

An experiment was carried out based on the equation

and the following dataset was obtained:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 4.81 | 6.15 | 9.67 | 10.28 | 10.90 | 11.93 | 16.16 | 20.00 |
|  | 1.24 | 1.65 | 2.70 | 2.88 | 3.07 | 3.38 | 4.65 | 5.80 |

Your tasks are as follows:

1. Calculate the centroid,
2. Sketch the graph,
3. Determine the gradient from the graph,
4. Calculate the uncertainty of the graph,
5. Compare the gradient of the graph and
6. Determine the value of and its uncertainty
7. Determine the percentage of error.
8. Comment on the results.

**Suggested Solutions**

**Theoretical**

|  |  |
| --- | --- |
| **Equation** |  |

**Experimental Dataset**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 4.81 | 6.15 | 9.67 | 10.28 | 10.90 | 11.93 | 16.16 | 20.00 |
|  | 1.24 | 1.65 | 2.70 | 2.88 | 3.07 | 3.38 | 4.65 | 5.80 |

**Centroid:**

Centroid

**Graph:**

**Gradient and y-intercept Calculation:**

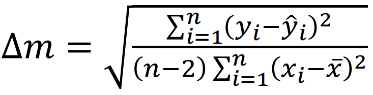
Equation of straight line is then

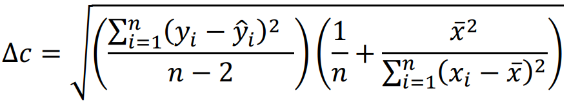
**Uncertainty Table:**

Here, values of is calculated from eq. [1].

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |
| 1.24 | -1.93 | 3.73 | 4.81 | 4.35 | 0.46 | 0.21 |
| 1.65 | -1.52 | 2.31 | 6.15 | 5.79 | 0.36 | 0.13 |
| 2.70 | -0.47 | 0.22 | 9.67 | 9.48 | 0.19 | 0.04 |
| 2.88 | -0.29 | 0.08 | 10.28 | 10.11 | 0.17 | 0.03 |
| 3.07 | -0.10 | 0.01 | 10.90 | 10.78 | 0.12 | 0.01 |
| 3.38 | 0.21 | 0.04 | 11.93 | 11.86 | 0.07 | 0 |
| 4.65 | 1.48 | 2.19 | 16.16 | 16.32 | -0.16 | 0.03 |
| 5.80 | 2.63 | 6.91 | 20.00 | 20.36 | -0.36 | 0.13 |
| 25.37 |  | 15.49 |  |  |  | 0.58 |

**Calculation of gradient and y-intercept uncertainty:**

****

****

**Experimental and Theoretical equation comparison**

compared with

So, the experimental value of u (along with its uncertainty) is

**Percentage of difference**