

AQA, Edexcel, OCR

A Level

A Level Mathematics

Understand and use proportional relationships and their graphs

Name:

M M E

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Total Marks:

B7- Understand and use proportional relationships and their graphs- Questions

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- 1) For each of the tables, state the form of the relationship as a formula, complete the missing values and match the table to the one-word description of the type of relationship. [12]

x	y
-3	9
-2	
-1	1
0	0
1	
2	
3	9

t	c
12	-2.8
13	-2.2
14	-1.6
15	-1
16	
17	0.2
18	0.8

n	p
5	50
6	62
7	98
8	
9	182
10	200
11	

a	b
1	3
2	17
3	1
4	3
5	9
6	2
7	

Linear

Quadratic

Cubic

Exponential

None

- 2) i) Demonstrate graphically Poiseuille's Law, which is defined as:

$$Q = \frac{\pi P r^4}{8\eta l} \quad [2]$$

where Q is Flow Rate, P is Pressure, r is radius, η is Fluid Viscosity and l is length of tubing.

You may assume that all parameters are fixed, except for radius, r .

- ii) Then use it to explain why Arteriosclerosis (the thickening of the artery walls) causes health complications. [2]

- 3) i) A virus has broken out. Each day that passes, t , the number of people infected, P , doubles. Show that this can be modelled as follows:

$$P = B e^{kt} \quad [2]$$

where B and k are constants.

- ii) Initially 4 people are known to be infected. State the value of B . [1]

- iii) After 20 days, 218 people are infected. Work out the value of k (to 2dp), thus generating a solution for the modelling of this virus. [1]

- iv) Dr Lewis says that the constants B , k and t must all be positive integer values. Construct an argument in favour of, or rejecting her assertion. [2]

- v) Suggest an amendment that could be made to this model to make it more realistic. [1]

- 4) Sketch the graph of the function that has the derivative: [1]

$$\frac{dy}{dx} = ky$$

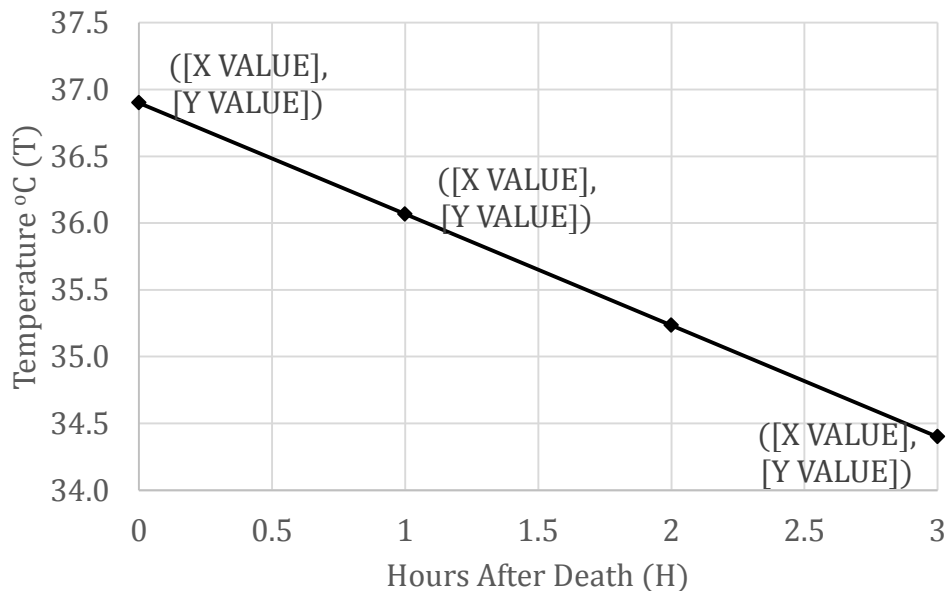
No marks will be awarded for working out.

- 5) The number of bacteria growing in a petri dish is proportional to the number of days it has been allowed to grow for. [1]

$$N = e^{0.1t}$$

What will be the rate of growth on the 100th day.

- 6) The Glaister equation is a simple estimate of the hours elapsed since death based on the body temperature. You have only a small amount of the graph, to create a model then, extrapolate from this to work out body temperature after: [3]
- 10 hours [1]
 - 24 hours [1]
 - By example, show the problem with such a simplistic model. [1]



- 7) You want to save £10,000 in a high interest account for five years. Best Bank offer you 5 years at 5% compound interest and Yellow Bank offer you 4 years at 6% compound, then 0% for the final year. Sketch your savings projection for both banks to help you decide which option will give you the best return. [3]
- 8) Find the general solution for the following: [6]

a) $\frac{dy}{dx} = x^2y^2$ b) $\frac{dk}{dm} = ke^m$ c) $\frac{dy}{dx} = y\sin x$

- 9) The height a ball reaches decreases by 10% every time it bounces off the floor. The ball initially starts 2m above the ground. Using a graph, or other method, determine how high the ball would be on the fourth bounce. [2]