core:maths
A NEW QUALIFICATION FOR WORK, STUDY & LIFE

Homework 19C

Godalming College

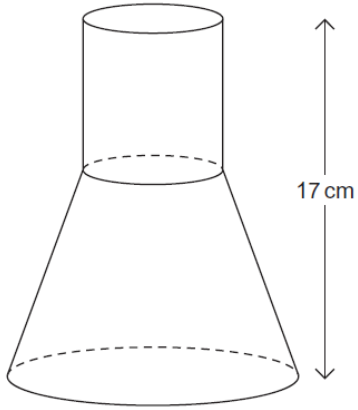
You have one week to complete this. What you hand in should be your best work, and you must attempt every question.

If you are stuck then please either consult notes or textbooks, attend a workshop, or ask your teacher.

You may need to refer to the formula book, found here:

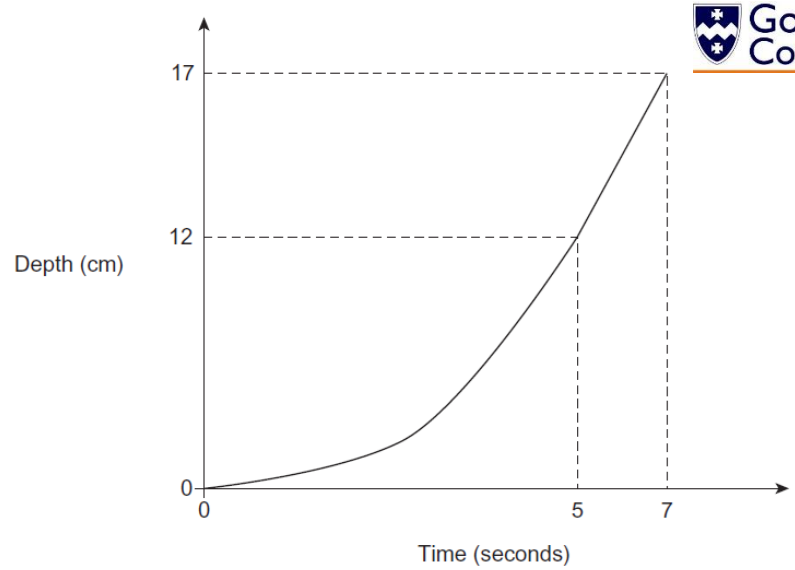
or financial information, found here:

1) The diagram shows an empty container of height 17 cm
The container consists of a cylinder on a frustum of a cone.



Water is added to the container at a constant rate for 7 seconds.

The sketch graph shows the depth of the water as the container fills.
The graph is a curve for the first 5 seconds and a straight line for the next 2 seconds.



(a) Circle the height of the cylinder.

[1 mark]

5 cm 8.5 cm 12 cm 17 cm

(b) Work out the rate of increase of the depth of water between 5 seconds and 7 seconds.
State the units of your answer.

[3 marks]

2) The mass, m kg, of sodium 24 present t hours after the mass of a particular sample is first measured can be modelled by the equation

$$m = 0.17e^{-0.0463t} \quad \text{for } t \geqslant 0$$

(a) What is the initial mass?

[1 mark]

(b) Find the half-life of sodium 24; that is, the time taken for the mass to reduce to half its initial value.

[4 marks]

(c) The graph of $m = 0.17e^{-0.0463t}$ is drawn

(i) On **Figure 1**, sketch the graph of $m = 0.34e^{-0.0463t}$ for $t \geqslant 0$

Show any points where the graph meets the axes.

[2 marks]

3) V is the value of a house, in tens of thousands of pounds.

$$V = A \times c^x$$

x is the number of years after the house is bought.

A and c are constants.

(a) The value of a house when bought is £200 000

Show that $A = 20$

[2 marks]

(b) The value of the house after 2 years is £220 500

Work out the value of c.

[4 marks]

4) A fixed mass of gas is kept at a constant temperature in a cylinder.
A piston is exerting pressure on the gas. As the piston moves, the pressure on the gas changes, and the volume of the gas also changes.

A scientist models the relationship between the volume, $V\,\text{m}^3$, of the gas and the pressure, P pascals (Pa), on the gas with a model that states that the volume of the gas is inversely proportional to the pressure; that is

$$V = \frac{k}{P}$$

where k is a constant.

The volume of the gas is $6\,\text{m}^3$ when its pressure is $50\,\text{Pa}$.

(a) Find k and hence express V in terms of P.

[1 mark]

(b) Use your answer to part **(a)** to complete the table opposite.

[1 mark]

(c) On the grid opposite, draw a graph of V against P for $30 \leqslant P \leqslant 150$.

[2 marks]

(d) (i) Find the gradient of the graph when $P = 45$.

[2 marks]

(ii) State the units of this gradient.

[1 mark]

(iii) Interpret the meaning of this gradient.

[1 mark]

5) Henrietta lives on a small farm where she keeps some hens.

For a period of 35 weeks during the hens' first laying season, she records, **each week**, the total number of eggs laid by the hens.

Her records are shown in the table.

(i) state values for the mode and the range;

[2 marks]

(ii) find values for the median and the interquartile range;

[3 marks]

(iii) calculate values for the mean and the standard deviation.

[4 marks]

6) The table below shows information about the ages of the 136 people who lived in St. Martin's in the Isles of Scilly in March 2011

(a) Draw a cumulative frequency diagram on the grid opposite to show the data.
You may use the spare column in the table for any calculation required.

[4 marks]

(b) Use your cumulative frequency diagram to find:

(b) (i) the median;

[1 mark]

(b) (ii) the interquartile range.

[2 marks]

(c) Cartmel is a village in Cumbria.
The ages of people living in Cartmel in March 2011 were also recorded.
These are shown in the box and whisker diagram below.
For March 2011, compare the ages of people living in Cartmel with the ages of people living in St.Martin's.

[4 marks]

7) In the USA, the price of a Kindle with free 3G was $\$202$.
The exchange rate was $\$1.62$ to £1.

Calculate the cost of the Kindle in pounds (£).

The price of a block of butter in 2015 was half the price it was in 2017.

8) Taking 2015 as the base year, what is the index number for the price of butter in 2017?
Circle your answer.

[1 mark]

0.5 50 150 200

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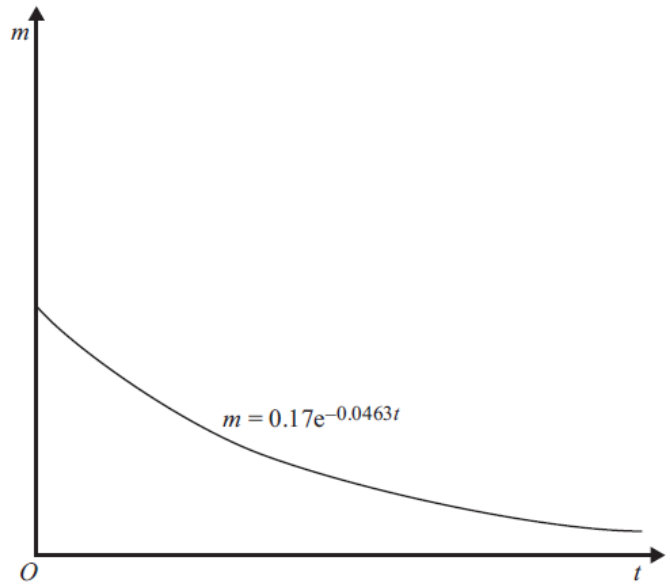
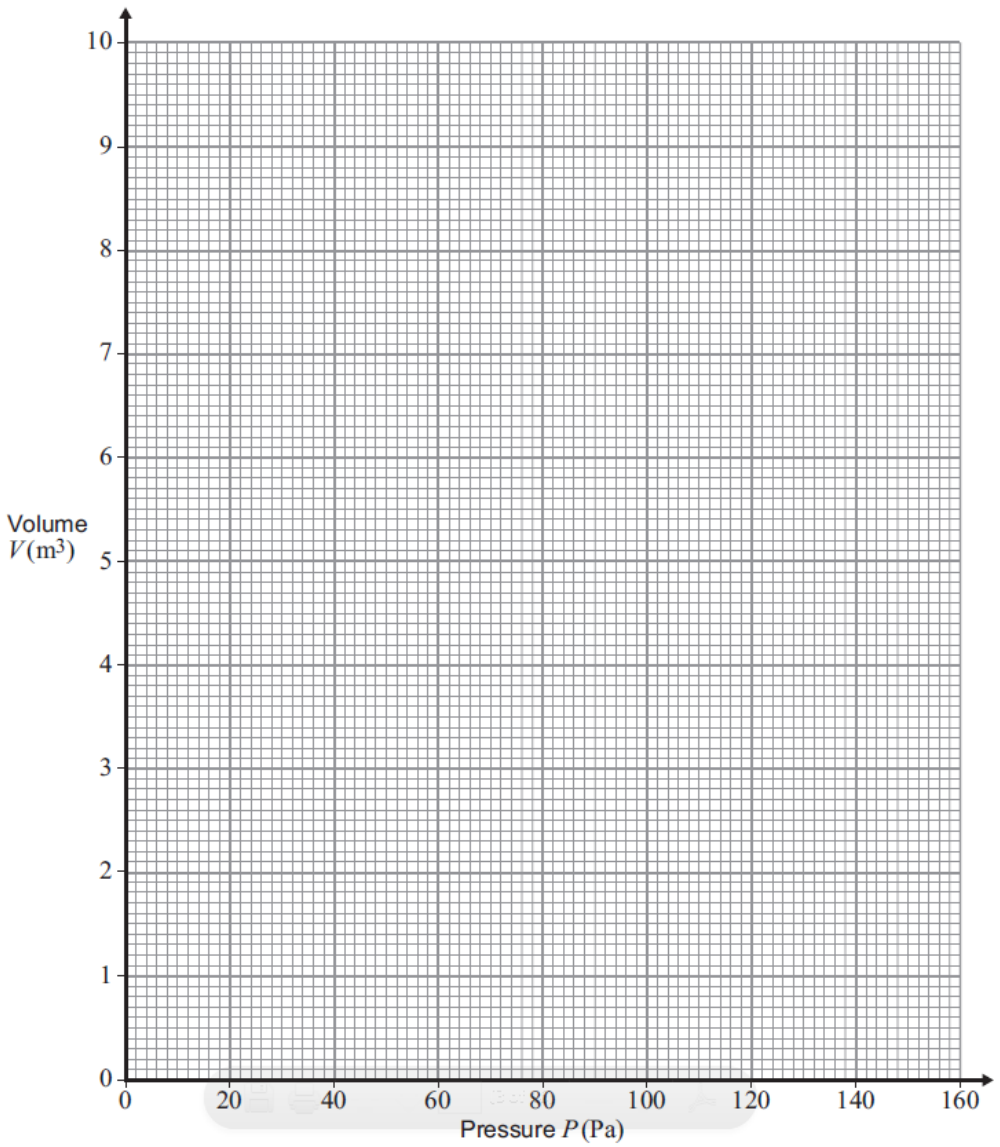
2)

Figure 1



4)

P	30	40	50	75	100	150
V			6			



Homework 19C – Answer sheet

6)

Total number of eggs laid in a week (x)	Number of weeks (f)
66	1
67	2
68	3
69	5
70	7
71	8
72	4
73	2
74	2
75	1
Total	**35**

7)

Age, a years	Number of people	
$0 \leqslant a < 20$	22	
$20 \leqslant a < 40$	42	
$40 \leqslant a < 60$	31	
$60 \leqslant a < 80$	31	
$80 \leqslant a < 100$	10	
Total	136