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

Homework 13C

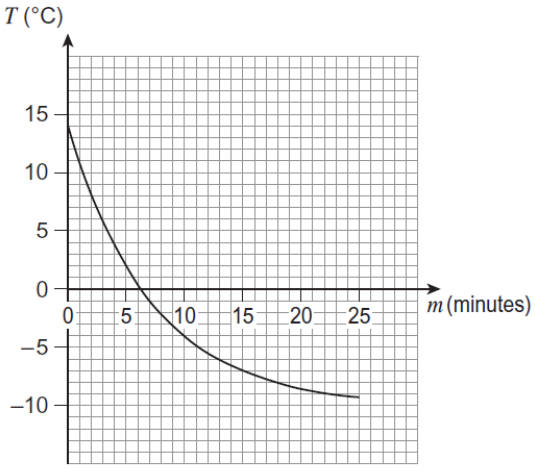
You have one week to complete this. What you hand in should be your best work, and you must attempt every question.

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 graph shows the temperature, T (°C) of bread, m (minutes) after it is placed in a freezer.



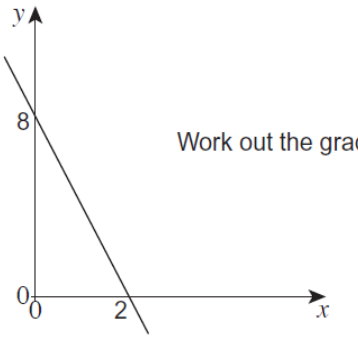
(a) How many minutes does it take for the temperature to reach 0 °C?

[1 mark]

(b) Estimate the rate at which the temperature is decreasing when $m = 3$
You **must** show your working.

[3 marks]

2) Here is a sketch of a straight line.



Work out the gradient of the line.

3) **(a)** Kate flew to Boston.
She paid £65 for UK air passenger duty. This duty was 13.4% of the cost of her return ticket to Boston.

How much did Kate pay for her return ticket to Boston?

[3 marks]

(b) In Boston, Kate paid \$192 for each night she stayed in a hotel.
The exchange rate was \$1.61 to £1.

Calculate the cost, in pounds, of each night in the hotel.

[3 marks]

(c) Kate had dinner with her friend Harry. The total cost of the dinner was \$84.
They agreed to divide the cost of their dinner in the ratio of 4:3, with Kate paying more.

How much, in dollars, did Kate pay?

[3 marks]

4) The table shows the altitude and temperature at various points on Helène's journey.

Altitude h (metres)	500	630	880	1060	1270	1540
Temperature T (°C)	9.0	8.0	6.0	4.5	3.0	0.5

Helène thinks that a linear function can be used to model the data in the table.

(a) On the grid opposite, plot the data from the table.

Draw a line of best fit.

[2 marks]

(b) Assuming that the linear model is valid for lower values of h, use your line to estimate the temperature at sea level.

[2 marks]

4) **(c)** Write down the value of the altitude at the point where your line crosses the h-axis.

What is the significance of this point?

[1 mark]

(d) Find the gradient of your line.

State the units of the gradient.

[3 marks]

(e) By how much does the temperature change as Helène goes 1000 m higher?

[1 mark]

(f) Write down the equation of your line.

[1 mark]

(g) Helène believes that conditions are good for skiing if the temperature is between $-9\,°C$ and $-1\,°C$.

Use your equation to find out if a point 2800 m above sea level would be good for skiing. Assume that the linear model continues to be valid for higher altitudes.

You must show your working.

[2 marks]

5) The table below shows the acreage, yield, production and price per bushel of durum wheat in the USA, from the year 2000 to the year 2009.

Year	Acreage (000s)		Yield per harvested acre (bushels)	Production bushels (000s)	Price per bushel (dollars)
	Planted	Harvested			
2000	3937	3572	30.7	109 805	2.66
2001	2910	2789	30.0	83 556	3.08
2002	2913	2709	29.5	79 960	4.05
2003	2915	2869	33.7	96 637	3.97
2004	2561	2363	38.0	89 893	3.85
2005	2760	2716	37.2	101 105	3.46
2006	1870	1815	29.5	53 475	4.43
2007	2156	2119	34.1	72 224	9.92
2008	2721	2574	32.6	83 827	9.26
2009	2554	2428	44.9	109 042	5.47

(a) Calculate the mean and the standard deviation of the prices per bushel of durum wheat for the years 2000 to 2009 inclusive. Give your answers correct to three significant figures. *(3 marks)*

(b) The mean and standard deviation of the prices per bushel of durum wheat from 1980 to 1989 are \$3.72 and \$0.678 respectively. Compare the mean and the standard deviation of the prices per bushel with those calculated in part **(a)**. *(2 marks)*

(c) Calculate the number of planted acres that were not harvested in the year 2000. *(1 mark)*

6) At a university, 70% of students are undergraduates and 30% of students are postgraduates.

Amy and Robert want to do a survey.

Amy decides to use simple random sampling to collect a sample of 100 students.

She uses the university database as a sample frame and she numbers each student on the database.
She then generates exactly 100 random numbers and uses these random numbers to select her sample.

(a) Give **two** reasons why Amy's method may **not** produce a sample of 100 students.

Robert decides to use quota sampling to collect a sample of 100 students.
He plans to stand outside the main building until he has interviewed 70 undergraduates and 30 postgraduates.

7) (b) Give **two** advantages of using quota sampling.

(c) Explain why this quota sample is **not** a random sample.

The total oil production in the world, y billion barrels, can be modelled by the equation

$$y = \frac{-11}{1922}(t - 62)^2 + 30$$

where t is the number of years since 1960.

(b) Complete the table of values on the page opposite. *(2 marks)*

(c) On the grid on the page opposite, complete the graph of

$$y = \frac{-11}{1922}(t - 62)^2 + 30 \quad \text{for} \quad 0 \leqslant t \leqslant 120$$ *(2 marks)*

(d) Use your graph to find:

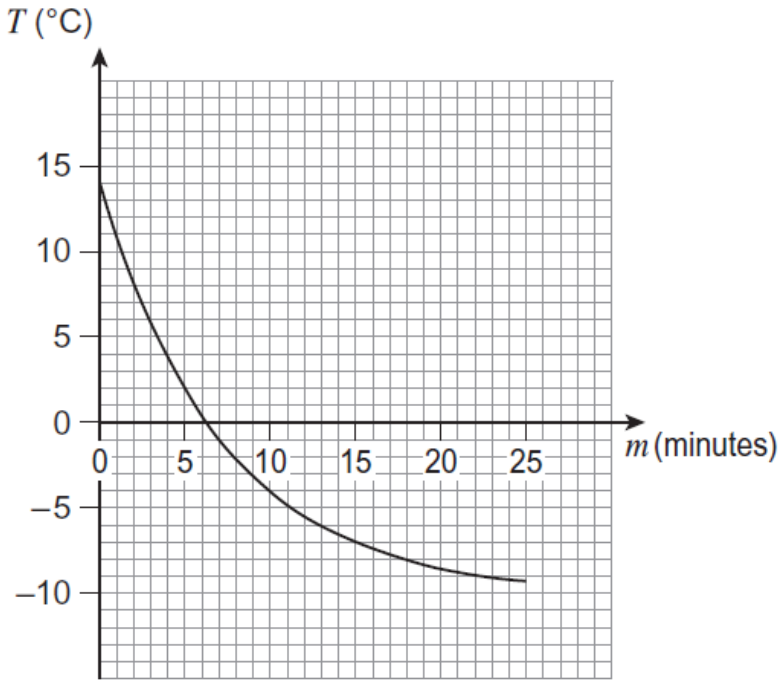
(i) the years in which the model predicts $y = 25$; *(2 marks)*

(ii) the gradient of the curve when $t = 30$. *(2 marks)*

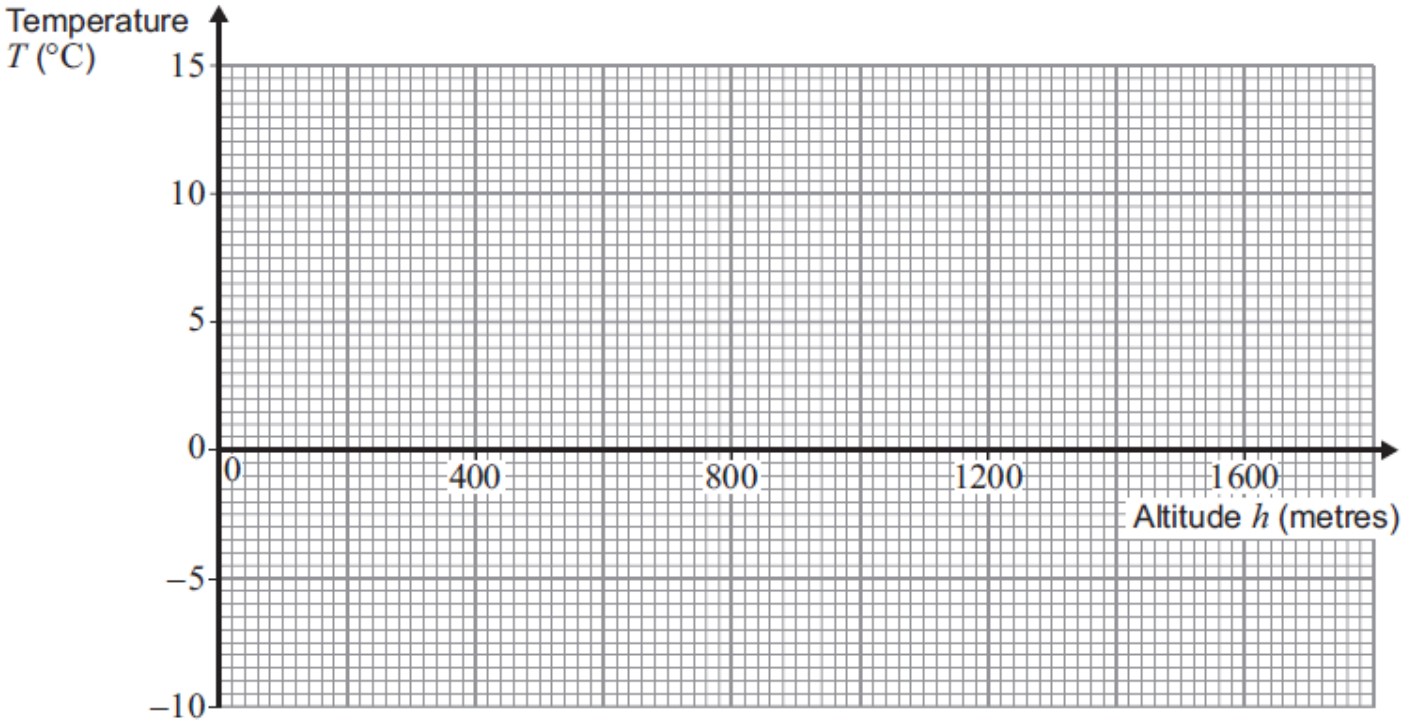
(e) Interpret your answer to **(d)(ii)** in terms of the context of the question. *(2 marks)*

Homework 13C – Answer sheet

1)



4)



Homework 13C – Answer sheet

t	0	20	40	60	80	100	120
y	8.0	19.9	27.2				

7)