Give all numerical answers to 3 *sf* unless the question states otherwise. You are expected to type out your answers onto the computer. Use of mathematical typing software is not required so expressions such as 1.5^4 can be written as 1.5^4. You **do not** need to type out all stages of your answer just the key parts and the calculation that you have done to get to your answer. Intermediate working can be completed on paper which will **not be marked.** You should **use a scientific calculator,** but your method must be clear.

Paper B Total = 100 marks

1.

The table below shows the number of patients arriving in hospital Accident departments and the percentage of those who waited more than 4 hours in December 2022.

	Region A	Region B	Region C
Number of arrivals	21 577	11 505	a)iii)
Percentage of arrivals waiting more than 4 hours	23%	a)ii)	41%
Number of patients waiting more than 4 hours	a)i)	5868	5773

a) Find the missing numbers in the table, giving your answers to the nearest integer.
   i) The number of patients in region A who waited more than 4 hours in 2022
   ii) The percentage of arrivals in region B who waited more than 4 hours.
   iii) The number of arrivals in Region C

6 marks

b) Find the percentage of patients arriving in hospital in Regions A, B and C combined who had to wait more than 4 hours.

4 marks

The table below shows the same data for December 2023

|	Region A	Region B	Region C
Number of arrivals	20 980	11 162	11 937
Percentage of arrivals waiting more than 4 hours	17%	43%	37%
Number of patients waiting more than 4 hours	3567	4780	5773

c) Between December 2022 and December 2023 the number of arrivals has decreased and the number waiting more than 4 hours has also decreased.
Assuming the same decrease in number of arrivals and number waiting more than 4 hours between December 2023 and December 2024 as that between December 2022 and December 2023 find the percentage of arrivals in region B that are expected to wait more than 4 hours in December 2024.

4 marks

Total 14 marks

2. The following graph shows the average life expectancy given to the nearest year for the world, Nepal and the Netherlands. The life expectancies are shown for every 5 years.
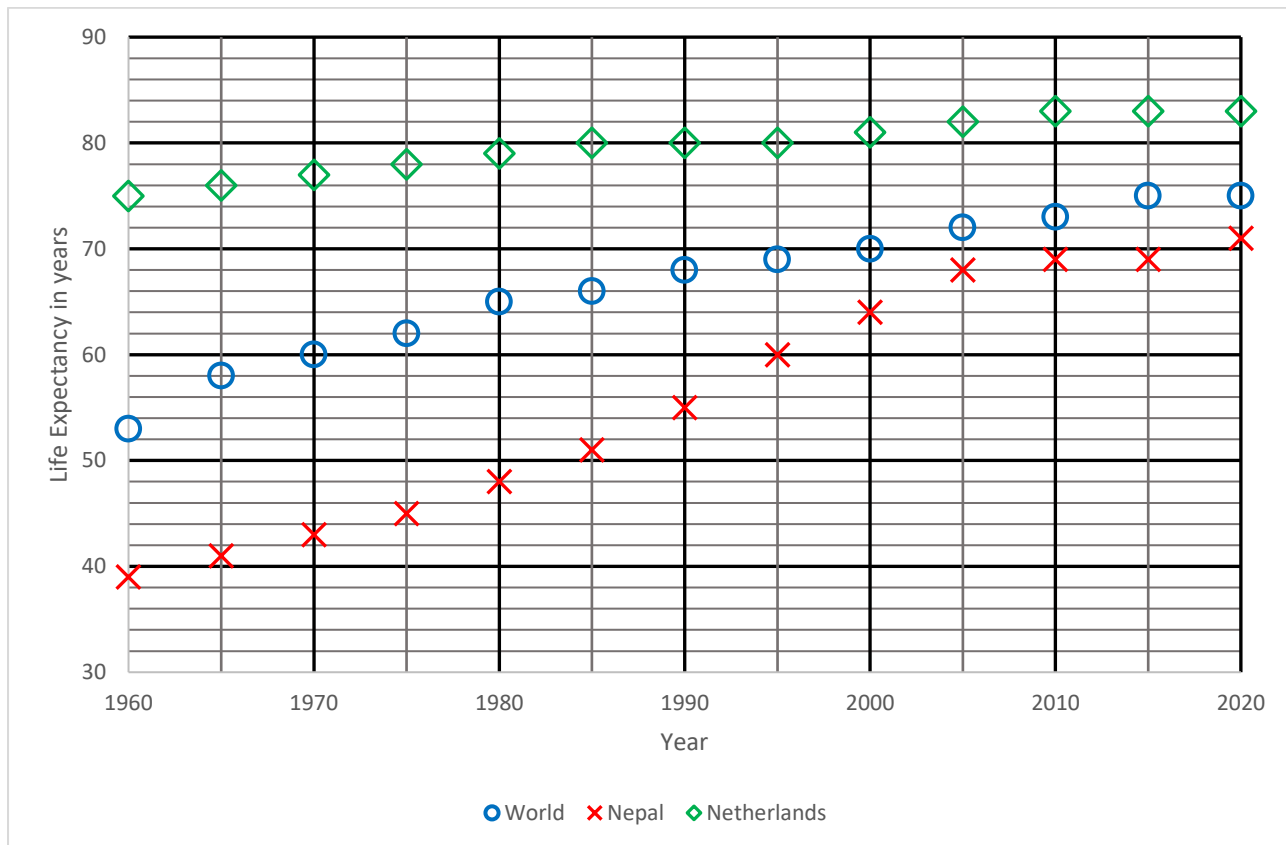
a) Find

i) The life expectancy in Nepal in 1995.

ii) The difference in life expectancies in Nepal and the Netherlands in 2020.

iii) The increase in world life expectancies between 1960 and 2020.

5 marks

b) To model the data an equation is calculated for a straight line joining the World life expectancy from 1970 to 2015.

i) Work out the equation of the line. Give your answer in the form $y = mx + c$, where y is the life expectancy in years and x is the year and m and c are constants to be determined.

ii) Use the equation to predict the life expectancy in 2025 and comment on the validity of your answer.

iii) Give a real-life reason why life expectancies might fall.

iv) Give a reason why it was better to use 1970 rather than 1960 as the first data point.

v) Determine the year in which model would predict a world life expectancy of 85.

12 marks

c) The data for the Netherlands is modelled by the equation $y = 0.1352x - 189.21$, where y is the life expectancy in years and x is the year.

i) Find the first year in which the model would predict that the life expectancy of the Netherlands would exceed 85.

ii) Use your answer to b)i) and the equation for the Netherlands to find the first year in which the equations would predict that the life expectancy for the Netherlands would be lower than that for the World.

7 marks

d) To model the data for Nepal it was decided to use a non-linear model. The equation calculated was $y = -3.17016 \times 10^{-4}x^3 + 1.89171x^2 - 3761.95x + 2.49326 \times 10^6$.

i) Each figure in the equation has been written to a n significant figures. Write down the value of n.

ii) Two figures in the equation have been written in standard form. Write both of these in normal form.

iii) Use the equation to predict the life expectance in 2040 and comment on the validity of the model.
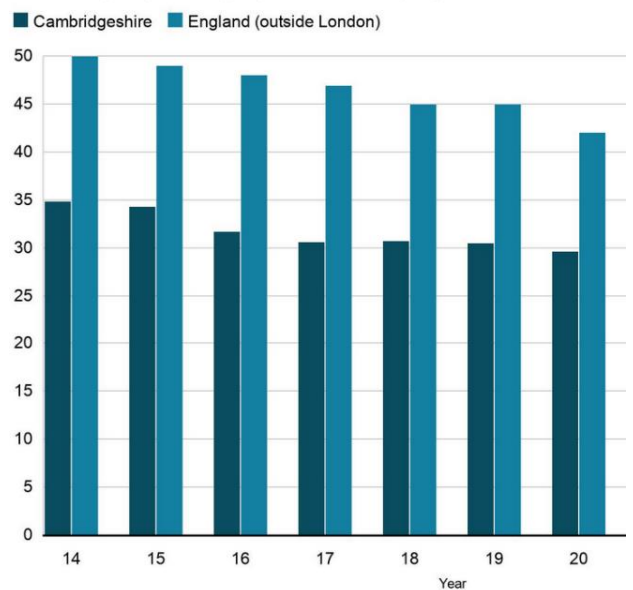
5 marks

Total 29 marks

3. Passenger bus journeys in England outside of London have decreased over recent years.

The graph shows data for each year for passenger journeys per person per year.

The year 2014 is shown as 14 on the horizontal axis and 2015 as 15 etc.

a) From the graph estimate to the nearest whole number the number of bus journeys taken per person in 2014 for i) Cambridgeshire ii) England (outside London).

2   marks

b) It is claimed that in 2014 people in Cambridgeshire took about 1/3 fewer bus journeys than overall in England (outside London). Does the data suggest that 1/3 is an over or an underestimate? Give numerical reasons for your answer.

3   marks

Passenger journeys per head of population

c) Has the number of bus journeys per person per year decreased more in Cambridgeshire than overall in England (outside London)? Give numerical reasons for your answer.

2   marks

d) The following table shows the number of bus journeys in millions.

Year	2018	2019	2020	2023
Cambridgeshire		19.9	19.3	17.3
England (outside London)	2 122	2 113	1 982	1 617

i)   There were 600 000 less bus journeys in Cambridgeshire in 2020 than 2018. How many bus journeys in Cambridgeshire were there in 2018?

ii)   Find the percentage decrease in the number of bus journeys in Cambridgeshire between 2019 and 2020.

iii)   Assuming this annual percentage decrease continued between 2020 and 2021 find the expected number of bus journeys in 2021.

iv)   Would this annual percentage decrease if it continued give more or less bus journeys than the figures given for 2023?

v)   Assume a constant annual percentage decrease in bus journeys for England (outside London) between 2020 and 2023. Find this annual percentage decrease.

13 Marks

e) The following table shows the number of bus journeys per person.

Year	2018	2019	2020	2023
Cambridgeshire	30.7	30.5	29.6	25.5
England (outside London)	45.3	44.9	41.9	33.9

    i)   For which of the years 2018 or 2019 is the claim that people in Cambridgeshire took about 1/3 fewer bus journeys than overall in England (outside London) best supported. Give a numerical reason for your answer.

    ii)   Use the data for 2023 to find a similar approximate claim giving your answer as a fraction in the form 1/n.

5   marks

f) Using both the table in d) and the table in e) to find:
    i)   The number of people living in Cambridgeshire in 2023.
    ii)   The number of people living in Cambridge in 2023 as a percentage of those living in England (outside London).

5 marks

Total 30 marks

4.

The volume of a pyramid is given by the formula $V = \frac{1}{3}Ah$ where A is the area of the base and h is the vertical height.

The Pyramid of Khafre in Egypt has a square base 215.25m long by 215.25m wide and a vertical height of 136.4m.
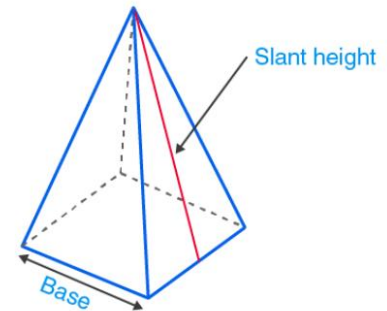
a) Calculate

 i)the area of the square base.

ii) the volume of the pyramid.

4 marks

Each of the sloping triangular faces were originally covered in a layer of decorative limestone blocks.

b) Use Pythagoras theorem to calculate

i) the slant height of each of the triangular faces.

ii) the total area covered in the layer of blocks

6 marks

The pyramid originally had a height of 143.5m as each of the sloping triangular faces were covered in a layer of decorative limestone blocks.

c) Assume the difference in height is the thickness of the blocks and calculate

i) the thickness of the blocks.

ii) the original length and width of the base (assuming that the length and width are increased by the same amount as the height).

iii) The original volume.

iv) The volume of the limestone blocks as percentage of the original volume.

7 marks

La Dante pyramid in Guatemala is 72 m high and has a volume of roughly 2.8 million m³.

Given that the number 2.8 million has been rounded to 2 significant figures

d) Calculate the smallest length and width of the square base of La Dante Pyramid.

6 marks

The bent pyramid has two sections. The lower section is steeper than the upper section.

It is believed that this was due to concerns that if it carried on at the same steepness it would be too heavy and collapse.

The length of each side of the square base is 189.43m.

The lower section is 47.04m high and the top of this section is a square of side length 123.58m.

The total height is 104.71m.

e) How much higher would the pyramid have been if the steepness of the base continued to the top?

4 marks

Total 27 marks