

Name: _____

LINEAR FUNCTIONS

1. Vanessa wants to rent a place for her wedding reception. She obtains two quotations.

(a) The local council will charge her £30 for the use of the community hall plus £ 10 per guest.

(i) **Copy** and complete this table for charges made by the local council.

Number of guests (N)	10	30	50	70	90
Charges (C) in £					

(2)

(ii) On graph paper, using suitable scales, draw and label a graph showing the charges. Take the horizontal axis as the number of guests and the vertical axis as the charges.

(3)

(iii) Write a formula for C , in terms N , that can be used by the local council to calculate their charges.

(1)

(b) The local hotel calculates charges for their conference room using the formula:

$$C = \frac{5N}{2} + 500$$

where C is the charge in £ and N is the number of guests.

(i) Describe, **in words only**, what this formula means.

(2)

(ii) **Copy** and complete this table for the charges made by the hotel.

Number of guests (N)	0	20	40	80
Charges (C) in £				

(2)

(iii) On the same axes used in part (a)(ii), draw this graph of C . Label your graph clearly.

(2)

- (c) Explain, briefly, what the two graphs tell you about the charges made. (2)
- (d) Using your graphs or otherwise, find
- (i) the cost of renting the community hall if there are 87 guests; (2)
 - (ii) the number of guests if the hotel charges £650; (2)
 - (iii) the difference in charges between the council and the hotel if there are 82 guests at the reception. (2)
- (Total 20 marks)

QUADRATIC FUNCTIONS

2. The profit (P) in Swiss Francs made by three students selling homemade lemonade is modelled by the function

$$P = -\frac{1}{20}x^2 + 5x - 30$$

where x is the number of glasses of lemonade sold.

- (a) **Copy** and complete the table below

x	0	10	20	30	40	50	60	70	80	90
P		15			90			75	50	

- (3)
- (b) On graph paper draw axes for x and P , placing x on the horizontal axis and P on the vertical axis. Use suitable scales. Draw the graph of P against x by plotting the points. Label your graph. (5)

- (c) Use your graph to find
- (i) the maximum possible profit; (1)
 - (ii) the number of glasses that need to be sold to make the maximum profit; (1)
 - (iii) the number of glasses that need to be sold to make a profit of 80 Swiss Francs; (2)
 - (iv) the amount of money initially invested by the three students. (1)
- (d) The three students Baljeet, Jane and Fiona share the profits in the ratio of 1 : 2 : 3 respectively. If they sold 40 glasses of lemonade, calculate Fiona's share of the profits. (2)
- (Total 15 marks)**

3. A rectangle has dimensions $(5 + 2x)$ metres and $(7 - 2x)$ metres.

- (a) Show that the area, A , of the rectangle can be written as $A = 35 + 4x - 4x^2$. (1)

(b) The following is the table of values for the function $A = 35 + 4x - 4x^2$.

x	-3	-2	-1	0	1	2	3	4
A	-13	p	27	35	q	r	11	s

- (i) Calculate the values of p , q , r and s .
- (ii) On graph paper, using a scale of 1 cm for 1 unit on the x -axis and 1 cm for 5 units on the A -axis, plot the points from your table and join them up to form a smooth curve. (6)

- (c) Answer the following, using your graph or otherwise.
- (i) Write down the equation of the axis of symmetry of the curve,
 - (ii) Find one value of x for a rectangle whose area is 27 m^2 .
 - (iii) Using this value of x , write down the dimensions of the rectangle. (4)
- (d) (i) On the same graph, draw the line with equation $A = 5x + 30$.
- (ii) Hence or otherwise, solve the equation $4x^2 + x - 5 = 0$. (3)
- (Total 14 marks)**

EXPONENTIAL FUNCTIONS

4. The number (n) of bacteria in a colony after h hours is given by the formula $n = 1200 (3^{0.25h})$. Initially, there are 1200 bacteria in the colony.

- (a) Copy and complete the table below, which gives values of n and h .
Give your answers to the nearest hundred.

time in hours (h)	0	1	2	3	4
no. of bacteria (n)	1200		2100	2700	

- (2)
- (b) On graph paper, draw the graph of the above function. Use a scale of 3 cm to represent 1 hour on the horizontal axis and 4 cm to represent 1000 bacteria on the vertical axis. Label the graph clearly. (5)
- (c) Use your graph to answer each of the following, showing your method **clearly**.
- (i) How many bacteria would there be after 2 hours and 40 minutes?
Give your answer to the nearest hundred bacteria.
 - (ii) After how long will there be approximately 3000 bacteria? Give your answer to the nearest 10 minutes. (4)
- (Total 11 marks)**

5. The number of bacteria (y) present at any time is given by the formula:

$$y = 15\,000e^{-0.25t}, \text{ where } t \text{ is the time in seconds and } e = 2.72 \text{ correct to 3 s.f.}$$

- (a) Calculate the values of a , b and c to the nearest hundred in the table below:

Time in seconds (t)	0	1	2	3	4	5	6	7	8
Amount of bacteria (y) (nearest hundred)	a	11700	9100	7100	b	4300	3300	2600	c

(3)

- (b) On graph paper using 1 cm for each second on the horizontal axis and 1 cm for each thousand on the vertical axis, draw and label the graph representing this information.

(5)

- (c) Using your graph, answer the following questions:

(i) After how many seconds will there be 5000 bacteria? Give your answer correct to the nearest tenth of a second.

(ii) How many bacteria will there be after 6.8 seconds? Give your answer correct to the nearest hundred bacteria.

(iii) Will there be a time when there are no bacteria left? Explain your answer.

(6)

(Total 14 marks)

TRIGONOMETRY

6. Three right pyramids *Andal*, *Batsu* and *Cartos* were discovered in the dense jungle of *Marhartmasol*. Each pyramid has a square base with centres A, B and C respectively.

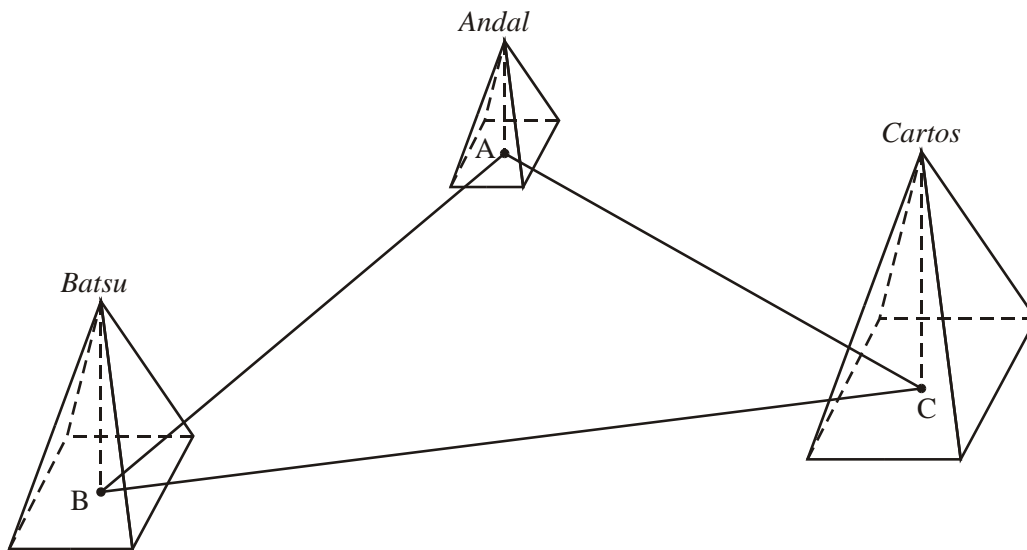


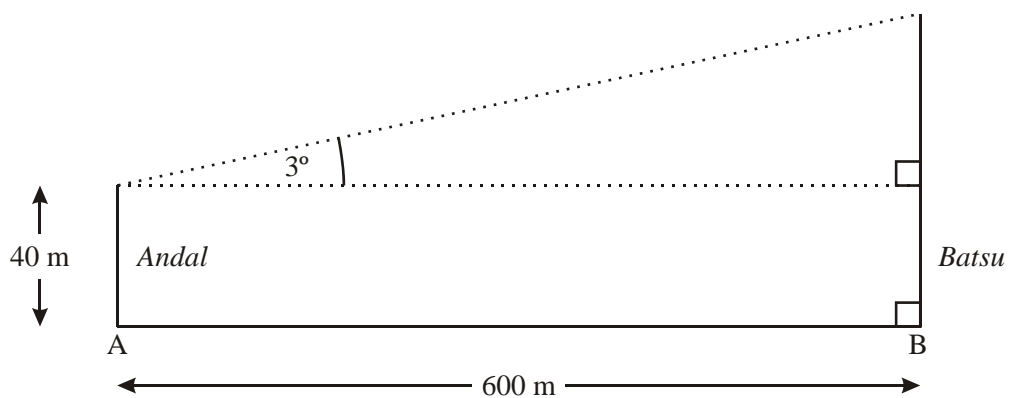
Diagram not to scale

A surveying team was lowered from a helicopter to the top of *Andal* to take measurements of the area. *Andal* is 40 metres high. The angle of elevation from the top of *Andal* to the top of *Batsu* is 3° . The horizontal distance from A, the centre of the base of *Andal*, to B, the centre of the base of *Batsu* is 600 metres.

- (a) Use the diagram below to find the height of *Batsu*.

(3)

Diagram not to scale



(b) *Cartos* is found to be 92 metres high and the angle of elevation from the top of *Andal* to the top of *Cartos* is 4° .

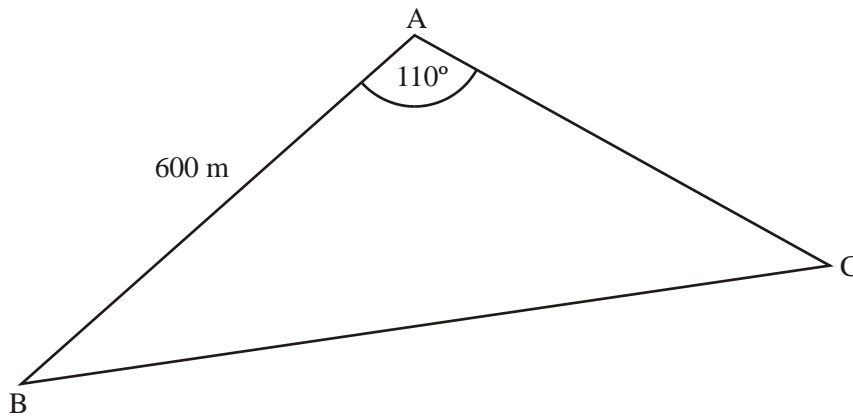
(i) Draw a diagram similar to the diagram in part (a) to show the relationship between *Andal* and *Cartos*.

(ii) What is the horizontal distance from A to C?

(4)

(c) The diagram below represents measurements relative to the centres of the bases of the pyramids. The surveyors determined the angle at A to be 110° , and the distance AB to be 600 m.

Diagram not to scale



(i) What is the distance between B and C? Give your answer to the nearest metre.

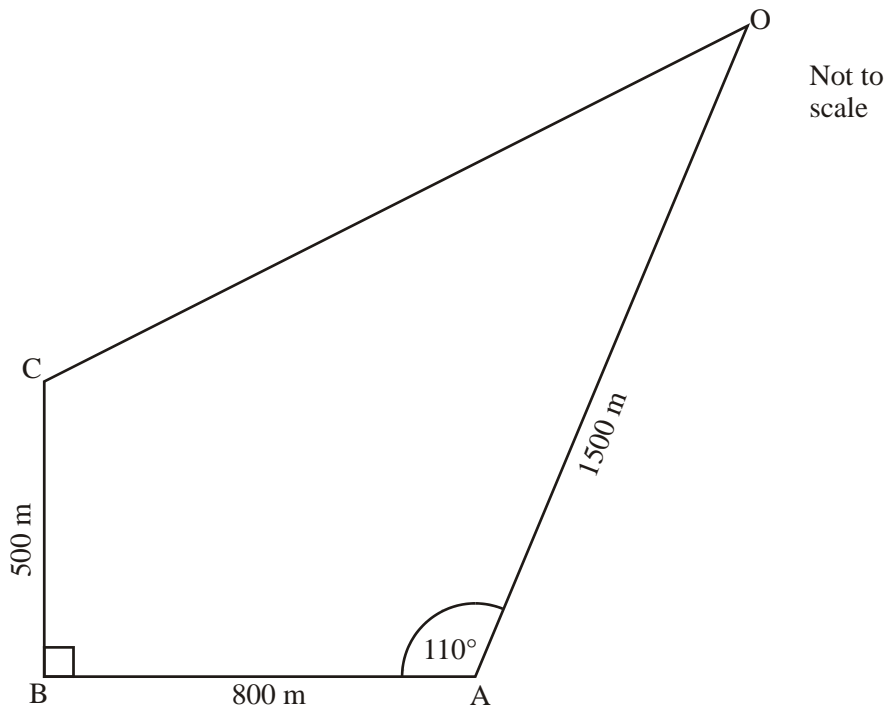
(ii) What is the size of angle ACB?

(iii) What is the area of the land inside triangle ABC?

(8)

(Total 15 marks)

7. A cross-country running course is given in the diagram below. Runners start and finish at point O.



- (a) Show that the distance CA is 943 m correct to 3 s.f. (2)
- (b) Show that angle BCA is 58.0° correct to 3 s.f. (2)
- (c) (i) Calculate the angle CAO. (3)
 (ii) Calculate the distance CO. (5)
- (d) Calculate the area enclosed by the course OABC. (4)
- (e) Gonzales runs at a speed of 4 m s^{-1} . Calculate the time, in minutes, taken for him to complete the course. (3)

(Total 16 marks)