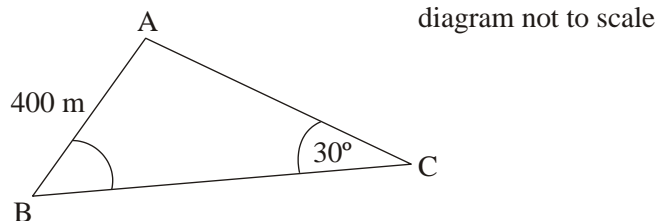


1. The figure shows a triangular area in a park surrounded by the paths AB, BC and CA, where $AB = 400$ m, $\hat{A}BC = 50^\circ$ and $\hat{B}CA = 30^\circ$.



- (a) Find the length of AC using the above information.

Diana goes along these three paths in the park at an average speed of 1.8 m s^{-1} .

- (b) Given that $BC = 788$ m, calculate how many minutes she takes to walk once around the park.

(Total 6 marks)

2. The speed of sound in air is given as 300 ms^{-1} .

- (a) How many metres does sound travel in air in one hour?

- (b) Express your answer to part (a)

(i) correct to **two** significant figures;

(ii) in the form $a \times 10^k$, where $1 \leq a < 10$ and $k \in \mathbb{Z}$.

(Total 4 marks)

3. In the following ordered data, the mean is 6 and the median is 5.

$$2, b, 3, a, 6, 9, 10, 12$$

Find each of the following

- (a) the value of a ;

- (b) the value of b .

(Total 8 marks)

4. The diagram shows a sketch of the function $f(x) = 4x^3 - 9x^2 - 12x + 3$.

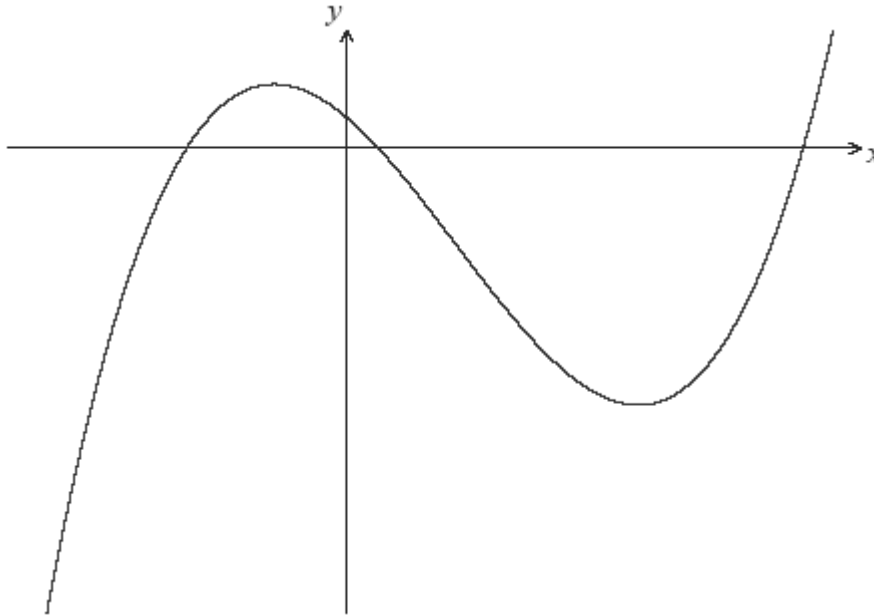


diagram not to scale

- (a) Write down the values of x where the graph of $f(x)$ intersects the x -axis. (3)

- (b) Write down $f'(x)$. (3)

- (c) Find the value of the local maximum of $y = f(x)$. (4)

Let P be the point where the graph of $f(x)$ intersects the y -axis.

- (d) Write down the coordinates of P. (1)

- (e) Find the gradient of the curve at P. (2)

The line, L , is the tangent to the graph of $f(x)$ at P.

- (f) Find the equation of L in the form $y = mx + c$. (2)

There is a second point, Q, on the curve at which the tangent to $f(x)$ is parallel to L .

- (g) Write down the gradient of the tangent at Q. (1)

- (h) Calculate the x -coordinate of Q. (3)
- (Total 19 marks)**

5. An arithmetic sequence is defined as

$$u_n = 135 + 7n, \quad n = 1, 2, 3, \dots$$

- (a) Calculate u_1 , the first term in the sequence. (2)
- (b) Show that the common difference is 7. (2)

S_n is the sum of the first n terms of the sequence.

- (c) Find an expression for S_n . Give your answer in the form $S_n = An^2 + Bn$, where A and B are constants. (3)

The first term, v_1 , of a geometric sequence is 20 and its fourth term v_4 is 67.5.

- (d) Show that the common ratio, r , of the geometric sequence is 1.5. (2)

T_n is the sum of the first n terms of the geometric sequence.

(e) Calculate T_7 , the sum of the first seven terms of the geometric sequence. (2)

(f) Use your graphic display calculator to find the smallest value of n for which $T_n > S_n$. (2)
(Total 13 marks)

6. The first three terms of an arithmetic sequence are

$$2k + 3, 5k - 2 \text{ and } 10k - 15.$$

(a) Show that $k = 4$. (3)

(b) Find the values of the first three terms of the sequence. (1)

(c) Write down the value of the common difference. (1)

(d) Calculate the 20th term of the sequence. (2)

(e) Find the sum of the first 15 terms of the sequence. (2)
(Total 9 marks)

7. Given the arithmetic sequence: $u_1 = 124, u_2 = 117, u_3 = 110, u_4 = 103, \dots$

(a) Write down the common difference of the sequence. (1)

(b) Calculate the sum of the first 50 terms of the sequence. (2)

u_k is the first term in the sequence that is negative.

(c) Find the value of k . (3)
(Total 6 marks)

8. The first term of an arithmetic sequence is 3 and the sum of the first two terms is 11.
- (a) Write down the second term of this sequence. (1)
 - (b) Write down the common difference of this sequence. (1)
 - (c) Write down the fourth term of this sequence. (1)
 - (d) The n^{th} term is the first term in this sequence greater than 1000. Find the value of n . (3)
- (Total 6 marks)**

9. A geometric sequence has second term 12 and fifth term 324.
- (a) Calculate the value of the common ratio. (4)
 - (b) Calculate the 10^{th} term of this sequence. (3)
 - (c) The k^{th} term is the first term that is greater than 2000. Find the value of k . (3)
- (Total 10 marks)**

10. Consider the geometric sequence 16, 8, a , 2, b , ...
- (a) Write down the common ratio. (1)
 - (b) Write down the value of
 - (i) a ;
 - (ii) b .(2)
 - (c) The sum of the first n terms is 31.9375. Find the value of n . (3)
- (Total 6 marks)**