18. With S_n denoting the sum of the first n terms of an arithmetic sequence, we are given that $S_1 = 9$ and $S_2 = 20$.

(a) Find the second term.

(b) Calculate the common difference of the sequence.

(c) Find the fourth term.

21. In an arithmetic sequence of positive terms, a_n represents the nth term. Given that $\dfrac{a_5}{a_{12}} = \dfrac{6}{13}$ and $a_1 \times a_3 = 32$, find $\displaystyle\sum_{i=1}^{100} a_i$

26. Consider the arithmetic sequence $85, 78, 71, \ldots$
Find the sum of its positive terms.

32. Consider the infinite geometric series:

$$1 + \left(\frac{3x}{5}\right) + \left(\frac{3x}{5}\right)^2 + \left(\frac{3x}{5}\right)^3 + \ldots$$

(a) For what values of x does the series converge?

(b) Find the sum of the series if $x = 1.5$

36. Find $\displaystyle\sum_{r=1}^{50} \ln(2^r)$, giving the answer in the form $a \ln 2$, where $a \in \mathbb{Q}$

37. Consider the sequence $\{a_n\}$ defined recursively by:

$$a_{n+1} = 3a_n - 2a_{n-1}, \, n \in \mathbb{Z}^+, \text{ with } a_0 = 1, \, a_1 = 2$$

(a) Find a_2, a_3, and a_4.

(b) (i) Find the explicit form for a_n in terms of n.

(ii) Verify that your answer to part (i) satisfies the given recursive definition.

38. The sum to infinity of a geometric sequence with all positive terms is 27, and the sum of the first two terms is 15. Find the value of:

(a) the common ratio

(b) the first term.

39. The first four terms of an arithmetic sequence are $2, a - b, 2a + b + 7$, and $a - 3b$, where a and b are constants. Find a and b.

41. Three consecutive terms of an arithmetic sequence are: a, 1, and b. The terms 1, a, and b are consecutive terms of a geometric sequence. If $a \neq b$, find the value of a and of b.

42. The diagram opposite shows a sector AOB of a circle of radius 1 and centre O, where $A\widehat{O}B = \theta$.

The lines (AB_1), (A_1B_2), and (A_2B_3) are perpendicular to OB. A_1B_1 and A_2B_2 are arcs of circles with centre O.

Calculate the sum to infinity of the arc lengths:
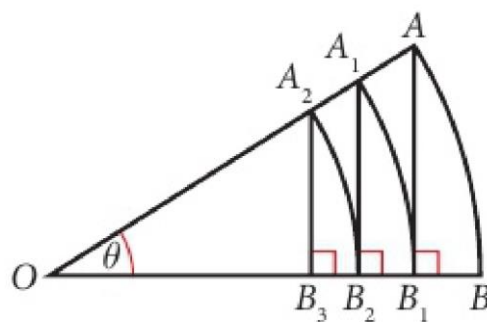
$AB + A_1B_1 + A_2B_2 + A_3B_3 + \ldots$

Figure 3.7 Diagram for question 42

46. The sum of the first n terms of an arithmetic sequence $\{u_n\}$ is given by the formula $S_n = 4n^2 - 2n$. Three terms of this sequence, u_2, u_m and u_{32}, are consecutive terms in a geometric sequence. Find m.