

## Problems

1. It is given that

$$x + \frac{1}{x} = k.$$

It is also given that

$$x^n + \frac{1}{x^n},$$

where  $n > 3$ , gives a polynomial of order  $n$  in  $k$ . Find an expression (in descending powers of  $k$ ) for the first three terms of this polynomial.

2. A triangle, with each of its sides a whole number of centimetres in length, has an area of  $7446 \text{ cm}^2$ . Moreover, the side-lengths form an arithmetic sequence with the middle term even. Find the lengths of the sides of this triangle.
3. Points  $A$ ,  $B$ ,  $C$  and  $D$  lie, in that order, on the circumference of a circle such that

$$\text{arc}AB = \text{arc}BD.$$

Let  $M$  be the foot of the perpendicular from  $B$  onto  $AC$ . Prove that

$$AM = DC + CM.$$

## Answers

1.  $k^n - nk^{n-2} + \frac{n}{2}(n+3)k^{n-4} - \dots$ .
2.  $\{149, 292, 435\}$ .