1. The sides of a triangle are in the ratio of 2 : 3 : 4. Find the cosine of
   the smallest angle.

2. Find all solutions to
   \[ x^{\log x} = \frac{x^3}{100} \]
   where \( \log x = \log_{10} x \).

3. Let \( p, q \) and \( r \) be integers such that
   \[ f(x) = x^4 + 4x^3 + 6px^2 + 4qx + r \]
   is divisible by \( x^3 + 3x^2 + 9x + 3 \). Find \( p + q + r \).

4. If \( \sin x + \cos x = -1/5 \) and \( 3\pi/4 \leq x \leq \pi \), find \( \cos(2x) \).

5. Show that
   \[ \frac{1}{2} - \frac{1}{3} + \frac{1}{4} \cdots - \frac{1}{2005} + \frac{1}{2006} > \frac{1}{5} \cdot \]

6. Let \( f(x) = ax^2 + bx + c \) where \( a, b \) and \( c \) are integers and 5 divides \( f(n) \)
   for any integer \( n \). Show that \( a, b \) and \( c \) are each divisible by 5.

7. The real numbers \( a, b \) and \( c \) are such that \( a + b + c = 5 \) and
   \[ \frac{1}{a+b} + \frac{1}{b+c} + \frac{1}{c+a} = \frac{2}{3} \cdot \]
   Find the value of
   \[ \frac{c}{a+b} + \frac{a}{b+c} + \frac{b}{c+a} . \]

8. If a tetrahedron (a solid with 4 equilateral triangles as faces) has edge
   length 1 for each edge. What is the height of the tetrahedron?

9. A grasshopper jumps along a number line starting at the point 0. The
   first jump takes him 1 cm, the second 2 cm, the third 3 cm and so on. Each
   jump takes him to the right or to the left. Can the grasshopper return to the point 0 on the 73rd jump?

10. Can one find 2006 positive integers whose sum is equal to its product?