1.   A toy store ordered 18 large and 7 small bags of identical marbles. When they were delivered it was discovered that the bags had broken open with all the marbles loose in the container. How did the store clerks make up the bags with the proper number of marbles in each, if the total number of marbles was 233?

2.   I didn't realize there was a power-cut during the night, so I leave to walk to the station as usual, when the electric clock in the hall (which is usually correct) says 8 o'clock. So I am surprised when I get to the station and the clock there says 9.30, which the ticket inspector assures me is the correct time. I catch the next train, and when I get back in the evening, as I set out for home, the station clock says 7.30. Of course, I'm tired now, so I can only walk at two-thirds of the pace I managed in the morning. When I get home, the hall clock says 7 o'clock. Assuming there hasn't been another power cut during the day, how long was the power off last night?

3.   The points A (3, 4), B (1, k) and C (4, –3) are three vertices of a rectangle $ABCD$.   Find all possible values of k. [*Note: the rectangle is labelled cyclically as usual.*]

4.   A rectangular piece of card $ABCD$ measures 15 cm by 20 cm. The card is folded so that A folds exactly onto the opposite corner C. Calculate the length of the crease.

5.   Solve the system of equations
$$x^2 - xy + y^2 = 3$$
$$x^2 - y^2 = 3.$$

6.   *ABCDEF* is a cyclic hexagon in which *AF* is parallel to *CD*. *BC* meets *EF* at *M* and *BA* meets *DE* at *L*.   Prove that *LM* is parallel to *DC*.

7.   Find all pairs of non-negative integers (m, n) which are solutions to the equation

$$3(2^m) + 1 = n^2.$$

8.   Which positive integer less than 2012 has the most factors?
[*You must establish why this has the most.*]

When (i.e. which year after 2012) will this answer next be equalled?
When will it lose its Gold Medal position?

Deadline for receipt of solutions: 30th January 2012