A Few Mathematics Questions

- What are the similarities and differences between odd and even numbers? Illustrate these similarities/differences with examples.

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  H. Given that
  $$\log_{10} 2 = 0.3010 \text{ to 4 d.p. and that } 10^{0.2} < 2$$
  it is possible to deduce that

  (a) 2^{100} begins in a 1 and is 30 digits long;
  (b) 2^{100} begins in a 2 and is 30 digits long;
  (c) 2^{100} begins in a 1 and is 31 digits long;
  (d) 2^{100} begins in a 2 and is 31 digits long.

- A triangle has its lengths in an arithmetic progression with difference d. The area of the triangle is t. Find the lengths and angles of the triangle.

- A group of n people are captured and buried so that they are all in a line, one behind each other, such that each person can only see the people directly in front of them (i.e. their heads cannot turn). A hat is placed on each of them, each hat is coloured in one of k different colours. If a person correctly calls out the colour of their hat they are spared, otherwise they are executed.
  Assuming that (strangely) the group of n people know that all of this is about to happen to them and can plan a strategy, what is the largest number of people that can be guaranteed to stay alive?

- Calculate the standard deviation of the set of numbers $\{1,2,3\}$. What number when added to this set leaves the standard deviation unchanged