

MAS115: Week 8 activity

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<h1>Brainteasers</h1>

<p>Here are some fun brainteasers. The solutions can be found on Sam Marsh's homepage.</p>

<h2>The problem with hats</h2>

<p>There are 100 prisoners stood in a line, each with either a black or a white hat on. Each person can see everybody else's hat, but not their own. One by one, moving down the line, they have to say one word - either black or white. If the colour they say matches that of their hat, they survive, otherwise they die.</p>

<p>Now, the people were allowed to devise a strategy before being given the hats. The question is, what's the best strategy to pick? In other words, how many people can you save?</p>

<h2>The pigeon-hole principle</h2>

<p>The pigeon-hole principle is the following statement.</p>

<p>If there are more than n letters to be placed into n pigeon-holes then some pigeon-hole will contain more than one letter.</p>

<p>Here's a statement which looks like some difficult number theory, but just comes down to the pigeon-hole principle.</p>

<p>Let n be any positive integer. Show that there exist two different powers of n whose difference is divisible by 1000.</p>

<p>Can you prove it?</p>

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