The University of Melbourne–Department of Mathematics and Statistics
School Mathematics Competition, 2012
JUNIOR DIVISION
Time allowed: Two hours

These questions are designed to test your ability to analyse a problem and to express yourself clearly and accurately. The following suggestions are made for your guidance:

(1) *Considerable weight will be attached by the examiners to the method of presentation of a solution. Candidates should state as clearly as they can the reasoning by which they arrived at their results. In addition, more credit will be given for an elegant than for a clumsy solution.*

(2) *The **six** questions are not of equal length or difficulty. Generally, the later questions are more difficult than the earlier questions.*

(3) *It may be necessary to spend considerable time on a problem before any real progress is made.*

(4) *You may need to do considerable rough work but you should then write out your final solution neatly, stating your arguments carefully.*

(5) *Credit will be given for partial solutions; however a good answer to one question will normally gain you more credit than sketchy attempts at several questions.*

*Textbooks, electronic calculators and computers are **NOT** allowed. Otherwise normal examination conditions apply.*

1. The Hunger Games. In the new computer game *The Hunger Games*, to be released next month, the French, biology and geography teaching staff at a Melbourne secondary school have turned into a marauding army of flesh-eating zombies. In order to survive, you must either kill 12 French-teaching zombies, or 8 geography-teaching zombies, or 5 biology-teaching zombies. Unfortunately, there is no way of telling what subject a particular zombie teaches.
What is the minimum number of zombies that you must kill to be 100% certain you either killed 12 French-teaching zombies, or 8 geography-teaching zombies, or 5 biology-teaching zombies? Clearly explain your answer.

2. Woden's day. The word *Wednesday* comes from the Old English Wōdensdæg or "Woden's day", after an ancient God believed by some to be the precursor of Father Christmas. The year 2012 is rather special in that the month of February had exactly five Woden's days.
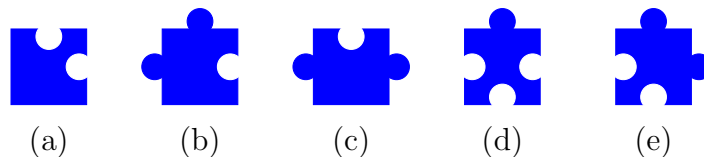In what year will this happen next?

3. Molly's mishap. Molly Meldrum suffered a fractured skull while trying to put up Christmas decorations at his home in Highett Street, Richmond late last year. As a result he spent several months in hospital. When Molly finally returned home in March he could not remember his house number. Fortunately, he did remember that it was a 3-digit number which is equal to 11 times the sum of its digits. This was enough information for the taxi driver to deliver him at exactly the right address.
What is Molly's house number?

4. A vampire without bite. Vampire Edward Cullen, played by Hollywood heartthrob Robert Pattinson, has proven to be especially popular with Melbourne girls. At a recent screening of Eclipse at Cinema Nova in Carlton, of the people attending the Edward Cullen swoon-fest, 40% of the males were children, 10% of the children were boys and 80% of the adults were male.
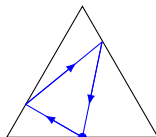Given that Cinema Nova can seat up to 100 people, how many girls watched Eclipse that day?

5. That's puzzling. . . A 7×11 jigsaw puzzle has 5 types of pieces:

(a)   (b)   (c)   (d)   (e)

How many pieces of each type make up the puzzle?

6. Going for gold. Australian hurdler Sally Pearson was named Female Athlete of the Year in 2011. This year she is hoping to continue her excellent form and win gold at the London Olympics. But can she think as fast as she can run?
Sally finds herself standing in the middle of the base of an equilateral triangle, with side lengths 100 metres. She must run from her starting position and touch a point on the left-side of the triangle (excluding the corners), then run to touch a point on the right-side of the triangle (again excluding the corners), and finally run back to the start. For example, she could run like

How long is the shortest path Sally can choose, and why?