



2003 QAMT Competition Year 9&10 Paper



Attempt as many problems as you can in the time allowed. Working and explanations (even for the multiple choice problems) should be set out fully in clear English. The judges will take into consideration the quality of expression and ingenuity of your attempts at solutions.

You must put your full name and school on all working handed in.

Question 1. How many times in one day do the hands of a clock form a right angle?

1 mark

- A 22 B 24 C 44 D 46 E 48

Question 2. The digits 1234 are written in increasing order. You may insert any number of plus or minus signs between any of the digits to produce an answer. For example

1 mark

$$1 - 2 + 34 \text{ gives the answer } 33.$$

How many distinct positive answers can you attain?

- A 4 B 12 C 17 D 26 E 27

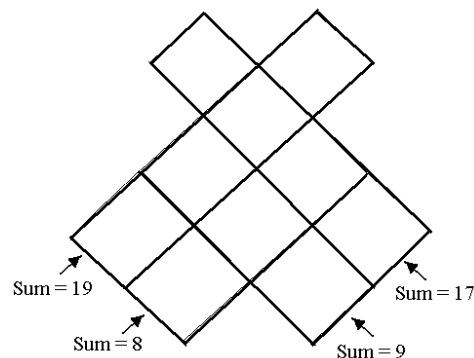
Question 3. If numbers a, b, c satisfy $a+b+c = 0$ and $a^2+b^2+c^2 = 1$ then what is $a^4+b^4+c^4$?

1 mark

- A $\frac{1}{4}$ B $\frac{1}{2}$ C 1 D 4 E None of these

Question 4. Whole numbers from 1 to 7 are to be placed in the cells of this figure. Each number may be used once, twice or not at all. The numbers in the four sloping rows shown must have the sum given and the numbers must decrease in size going down each of these four rows. Find all ways in which this can be done.

2 marks



Question 5. Start with any three digit number in which the hundreds digit is at least two more than the ones digit. Reverse the digits. Subtract the smaller number from the larger to obtain their difference. Now reverse the digits of the difference. Add this number to the difference. Prove that, no matter what your starting number was, the result is always 1089.

2 marks

Question 6: A vault is set to open in some number of years into the future. The control panel on the vault is a series of switches, numbered from 1 to 10 (from left to right). Each switch is set either to 1 or 0. The number of years until vault will open is coded into the switches.

3 marks

If the n^{th} switch is “1”, it means that the doors will stay shut for a further 2^{n-1} years if n is even, or 2^{n-1} fewer years if n is odd. If a switch is set to “0” there is no effect.

For instance 1 1 0 0 1 0 0 0 0 1 will open in $-2^0 + 2^1 - 2^4 + 2^9 = 497$ years.

How should the switches be set to make the vault open in 200 years time?

 MIM Holdings	 UQ Physical Sciences Scholarship	 UQ Engineering	 Australian Bureau of Statistics
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