THE UNIVERSITY
OF QUEENSLAND
AUSTRALIA

2021 UQ/QAMT Problem Solving Competition - Year 7 & 8 Paper

Two hours allowed. Rulers and non-CAS calculators may be used.
All questions have equal value with marks for working as well as correct answers.

Question 1

Veronika is creating buildings using cubes with side lengths of 1 m. The first cube building consists of four cubes and has a surface area of 15 m^2. The next cube building is created from the previous one by adding exactly three cubes. The figure below shows the first and the second cube building. What is the surface area of the 2021st cube building?
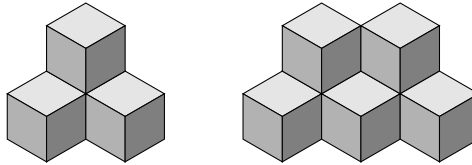
Question 2

Suppose there are n different integers written on a board. The product of the two highest is equal to 2021. The product of the two lowest is also equal to 2021. What is the largest value of n for which this is possible?

Question 3

Suppose the triangle ABC has a point D on the BC side so that AD is perpendicular to BC, and we know the lengths $\overline{BD} = 12, \overline{CD} = 3$ and $\overline{AD} = 6$. What is the angle $\angle BAC$?

Question 4

Is it possible to colour all positive integers with red or blue so that any two numbers differing by 5 are different colours, and doubling any number gives a number of a different colour? If not, what is the smallest n where it is not possible to colour the first n positive integers in this way?

Question 5

Suppose we have a triangle ABC such that the perimeter is 24 cm and three times the length AC equals four times the length AB. Four such triangles are arranged into a 'windmill' figure with no overlaps, as shown. What is the perimeter of this new figure?