THE UNIVERSITY
OF QUEENSLAND
AUSTRALIA

2015 UQ/QAMT Problem Solving Competition - Year 9 & 10 Paper

Two hours allowed. All questions have equal value. Non-CAS calculators may be used.

Question 1
In 2015 your mobile phone bill is $500. It goes up 15% per year. In 2019 you receive a coupon giving you a 25% discount for that year. How much do you pay per year on average from 2015 to 2019?
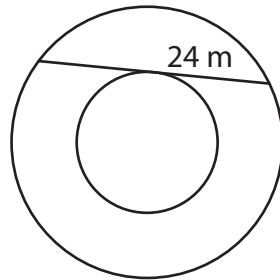
Question 2
Supposing that

$$f\left(\frac{x+1}{x}\right) = \frac{1}{x^2} - 10,$$

what is the value of $f(46)$?

Question 3
Suppose we have two concentric circles, as shown in the figure below. A chord of the outer circle has length 24 m and is tangent to the inner circle. What is the area between the outer and inner circles?

Question 4
A survey on fruit preference found that 40% of all students liked bananas while 70% of all students liked apples. Suppose $x\%$ of the students have opposite preferences for bananas and apples. What are the maximum and the minimum possible values of x?

Question 5
Let $c > 0$ and let $P(x)$ be a polynomial with integer coefficients such that

$$
\begin{aligned}
P(1) = P(3) = P(5) &= c \\
\text{and} \quad P(2) = P(4) = P(6) &= 0.
\end{aligned}
$$

What is the smallest possible value of c?

WOLFRAM