MATHEMATICS ENRICHMENT CLUB.
Problem Sheet 10, July 25, 2016

1. Suppose we have a 12 12 grid of (white) squares. We can paint some of them black. What is the minimum number we need to paint such that every 3 4 and 4 3 rectangle has at least one black square in it?

2.

Senior Questions

1. Find all prime numbers p such that $2^p + p^2$ is also a prime number.

2. Let f be a real-valued function. Solve

$$f(x^3) + f(y^3) = (x + y)(f(x^2) + f(y^2) \quad f(xy)).$$

3. Find integers $x; y$ such that

$$y^2 + 3x^2y^2 = 30x^2 + 517.$$