MATHEMATICS ENRICHMENT CLUB.

Problem Sheet 18, September 15, 2015[1]

1. Is it possible to cut a square into nine squares and colour one of them white, three of them gray and ve of the black, such that squares of the same colour have the same

Senior Questions

1. Evaluate
$$\lim_{n \to \infty} \sqrt[n]{\frac{(2n)!}{n!n^n}}.$$
Hint: use calculus.

2. Let x and y be real numbers satisfying $x^4y^5 + y^4x^5 = 810$ and $x^3y^6 + y^3x^6 = 945$. Evaluate $2x^3 + (xy)^3 + 2y^3$.

3. Let the notation $\prod_{n=1}^{k} a_i$ denotes the product of a_i for $i = 1; 2; \ldots k$. For example, if $a_i = i$ then $\prod_{n=1}^{k} a_i = k!$. Find
$$\prod_{k=2}^{\infty} \cos \frac{}{2^k} .$$