M&S MATH EXERCISES

The following exercises will be discussed during the math lecture on the on campus day. They are a selection of the topics that will appear on the test, but do not cover all topics. Make sure to attempt the exericses in preparation for the on campus lecture. A full solution will be given during the discussion.

Exercise 1
Find the number α such that the equation

$$\frac{x^{-\frac{1}{2}}}{x\sqrt{x^{\alpha}}} = \frac{x^3}{x\sqrt{x}}$$

holds for all $x > 0$.

Exercise 2
Rewrite the quotient

$$\frac{\sin^2(2t)}{\cos(3t)}$$

in terms of $C = \cos(t)$. Note that here t may equal any number not of the form $\frac{\pi}{6} + \frac{k\pi}{3}$ for integer k.

Exercise 3

Make a sketch of the graph of the function

$$f(x) = \frac{2x^3 + x^2 - 7x - 4}{x^2 - 4}$$

make sure to include all important features of the graph eg. asymptotes and roots.

Exercise 4

Compute the area of the region between the curves in the xy-plane with the following equations: $y = 0$, $y = \cos(3x + \pi)$, $x = -\frac{\pi}{3}$ and $x = -\frac{\pi}{6}$.

Exercise 5
The function

$$f(x) = e^{(2-x)(x-1)}$$

takes a maximum. Find the the x-value(s) at which this maximum is attained and the maximum value itself.

Exercise 6

Suppose an object has position

$$(8 + 2t, t^2 - 1)$$

at time t in seconds. Find the time T at which it is moving parallel to the line with equation $6x - 2y = -2$.

Exercise 7

A light ray moving from left to right follows the line with equation $y = 1$ until it meets the line with equation $x + 2y = 0$. At that point it reflects such that the angle of the incoming ray with the line is equal to the angle of the outgoing ray with the line. Find the x-coordinate of the point at which the outgoing ray intersects the x-axis.