Department of Mathematical Sciences

MAB108 Mathematics for Physics 3

Coursework 1 (due 18th Nov)

Work submitted late without good cause will receive zero marks.

Coursework should be handed into the departmental general office in mathematical sciences (W183) during the following hours:

Monday-Thursday: 9.00am to 4.30pm.
Friday: 9.30am to 12.00 noon, 2.00pm to 4.00 pm.

You must sign a coursework header sheet declaring the work submitted to be your own.

Marks will be awarded for clarity of presentation. You will receive a rating out of 100 points for the coursework. The weight of the coursework in the overall module evaluation is 20 percent. Word processing is **not** required.

1. Evaluate $\int_\Gamma \underline{F}$ where $\underline{F}(x,y) = (x^2 - y, y^2)$ from $(1,1)$ to $(4,2)$ along
   (a) the parabola $y^2 = x$,
   (b) straight lines from $(1,1)$ to $(4,1)$ and then to $(4,2)$,
   (c) the curve $x = 2t^2 + t + 1$, $y = t^2 + 1$.

   30 points

2. Evaluate the following double integrals
   (a) $\int\int_\Omega y\,dxdy$, where Ω is a region in the $xy-$plane bounded by the curves $y = \sqrt{1-x^2}$ and $y = 0$ with $0 \le x \le 1$.
   (b) $\int_0^1 \left\{ \int_x^1 \exp(y^2) dy \right\} dx$ (Hint: Reverse order of integration.)

   25 points

3. Verify Green's theorem for the following integral

$$\int_\Gamma (xy\,dx + x\,dy)\,,$$

   where Γ is the square bounded by the lines $x = 0$, $x = 1$, $y = 0$ and $y = 1$.

   20 points

4. Evaluate the following surface integral $\int\int_S z dS$. Here the surface S is a hemisphere

$$x^2 + y^2 + z^2 = 1, \qquad z \ge 0.$$

   25 points

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