3-dimensional Fundamental Theorems: Sample Problems

Please print out a copy of this and bring it with you to class. We will go over these sample problems when classes resume after the Thanksgiving break.

Ex (i). Calculate the flux of $\vec{F} = 3xy\vec{i} + y^2\vec{j} - x^2y^4\vec{k}$ across the **surface of the tetrahedron** with vertices $(0,0,0), (1,0,0), (0,2,0), (0,0,3)$ with **positive orientation**.

Ex (ii) Compute the work done by $\vec{F} = x^2z\vec{i} + xy^2\vec{j} + z^2\vec{k}$ along the **curve** C which is the curve of intersection of the plane $x + y + z = 1$ and the cylinder $x^2 + y^2 = 9$, **oriented clockwise** as viewed from above.

Ex (iii) Calculate the flux of $\vec{F} = z\tan^{-1}(y^2)\vec{i} + z^3\ln(x^2+1)\vec{j} - z\vec{k}$ across the **part of the paraboloid** $x^2 + y^2 + z = 2$ that lies above the plane $z = 1$, with **upward orientation**.

Ex (iv) Compute $\iint_S \mathbf{curl}\vec{F} \bullet d\vec{S}$ where $\vec{F} = xy\vec{i} + e^x\vec{j} + xy^2\vec{k}$ and **S** consists of the four **sides of the pyramid** with vertices $(0,0,0), (1,0,0), (0,0,1), (1,0,1)$ and $(0,1,0)$, oriented in the direction of the **positive y-axis**. ♠
