Fayoum University
Faculty of Engineering
First Year
Department of Civil Engineering

Final Exam of: Date: 9 / 1 /2016-
Mathematics 2A (MATH101) Allowed time: 3 Hours

Answer the following questions:

Question (1) (16-points)

(a) Show that the function $f(x,y)=2x^4+e^{4y}-4x^2e^y$ has exactly two critical points, both of which are local minima.

(b) Find the maximum and minimum of the function $f(x,y,z)=4x^2+y^2+z^2$ subject to $x^4+y^4+z^4=1$

Question (2) (18-points)

(a) Evaluate the following integral $\int_0^1\int_{\sqrt{y}}^1 \frac{3}{4+x^3}\,dxdy$

(b) Find the centre of mass of the lamina bounded by $y=x^2-4, y=5$ if the density is the square of the distance from the y - axis.

(c) Find the area using line integral of the region bounded by $x^{2/3}+y^{2/3}=1$ (Hint: use $x=\cos^3 t, y=\sin^3 t$)

Question(3) (18-points)

(a) Find the volume of the solid below $z=\sqrt{x^2+y^2}$ and above $z=0$ and inside $x^2+(y-1)^2=1$

(b) Compute $\iiint_R \frac{1}{z}\,dV$, where R is the closed region bounded by $z=e^{xy}, z=1, y=x+1, y=0, x=0.$

Question(4) (18-points)

(a) Compute the line integral $\int_C (2xe^{x^2}-2y)dx+(2y-2x)dy$, where C runs from (1,2) to (-1,1)

(b) Evaluate the work done by the force $\mathbf{F}(\mathbf{x},\mathbf{y})=(4xy-2x)\mathbf{i}+(2x^2-x)\mathbf{j}$, acting on an object as it moves along the parabola $y=x^2$ from (-2,4) to (2,4).

(c) Compute the surface area of the portion of the plane $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1,\ a,b,c>0,$ that is in the first octant.

With My Best Wishes
Prof. Dr. Mohamed Eissa Sayed-Ahmed