F07

Midterm Examination #1 MATH3132 Mathematical Methods for Engineers 3

Time: 60 Minutes

Student Name (Print): _____

Student Signature: _____

Student Number: _____

INSTRUCTIONS:

1. No aids permitted.
2. If insufficient space is provided for a solution to a problem, continue your work on the back of the previous page.
3. Check that your examination booklet contains 4 pages.

Formulae

$$\oint_C P\,dx + Q\,dy = \iint_R \left(\frac{\partial Q}{\partial x} - \frac{\partial P}{\partial y}\right) dA \qquad \oiint_S \mathbf{F}\cdot\hat{\mathbf{n}}\,dS = \iiint_V \nabla\cdot\mathbf{F}\,dV$$

$$\oint_C \mathbf{F}\cdot d\mathbf{r} = \iint_S (\nabla\times\mathbf{F})\cdot\hat{\mathbf{n}}\,dS$$

10 **1.** Evaluate the line integral

$$\int_C 32y\,ds$$

where C is the curve $x = y^2$, $z = 4 + x$ from the point $(4, 2, 8)$ to the point $(1, 1, 5)$.

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7 **2.** Evaluate the line integral

$$\int_C \frac{x}{x^2+y^2}dx + \frac{y}{x^2+y^2}dy,$$

where C consists of the three straight line segments joining successively the points $(2,0)$, $(2,1)$, $(-2,1)$, and $(-2,0)$.

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9 **3.** Evaluate the surface integral

$$\oiint_S [(x^2+y^2)\hat{\mathbf{i}} + x^3\hat{\mathbf{j}} + (3z+\sin x)\hat{\mathbf{k}}] \cdot \hat{\mathbf{n}}\, dS,$$

where S is the closed surface that bounds the volume enclosed by the surfaces

$$x^2+y^2=4, \quad z=1, \quad z=-1,$$

and $\hat{\mathbf{n}}$ is the unit inward pointing normal to S.

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14 **4.** Evaluate the surface integral

$$\iint_S (y\hat{\mathbf{i}} - x\hat{\mathbf{j}} + z\hat{\mathbf{k}}) \cdot \hat{\mathbf{n}}\, dS$$

where S is that part of the surface $z = 9 - x^2 - y^2$ above the xy-plane, and $\hat{\mathbf{n}}$ is the unit normal to S with positive z-component.