**NAME:** **Section:**

MATH 251 (1-3), Dr. Z. , Mid-Term #2, 10:20-11:40 , Mon., Nov. 20, 2006

**1**. Determine whether or not

$$\mathbf{F} = (e^x y - \cos(x+y) + 1)\mathbf{i} + (e^x - \cos(x+y) + 1)\mathbf{j}$$

is a conservative vector field. If it is, find a function $f$ that $\mathbf{F} = \bigtriangledown f$.

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**Ans.:** **F** is:

(If applicable): $f =$

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**2**. Evaluate the line integral

$$\int_C \mathbf{F} \cdot d\mathbf{r} \quad ,$$

where $C$ is given by the vector function $\mathbf{r}(t)$.

$$\mathbf{F}(x, y, z) = y\mathbf{i} + x\mathbf{j} + z\mathbf{k} \quad ,$$

$$\mathbf{r}(t) = t\mathbf{i} + t^2\mathbf{j} + 2t\mathbf{k} \quad , \quad 0 \le t \le 1 \quad .$$

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**Ans.**:

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**3**. Evaluate

$$\int\int\int_E 7(x^2+y^2)^2\,dV \quad ,$$

where $E$ is the solid that lies within the cylinder $x^2+y^2=4$, above the plane $z=0$, and below the cone $z^2=9x^2+9y^2$.

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**Ans.**:

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**4**. Evaluate the iterated integral

$$\int_0^1 \int_x^{2x} \int_0^{x+y} (6x+6y)\, dz\, dy\, dx \quad .$$

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**Ans.**:

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**5**. Use the given transformation to evaluate the integral

$$\int\int_R 4(2x+y)^2\,dA \quad ,$$

where $R$ is the triangular region with vertices $(0,0)$,$(2,-3)$, $(3,-5)$; $x = 3u - v$, $y = -5u + 2v$.

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**Ans.**:

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**6**. Evaluate the iterated integral by converting to polar coordinates.

$$\int_0^1 \int_{-\sqrt{1-x^2}}^{\sqrt{1-x^2}} xy^2 \, dy \, dx$$

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**Ans.**:

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**7**. Evaluate the iterated integral

$$\int_0^4 \int_{y/2}^2 e^{x^2}\, dx\, dy \quad .$$

(Hint: Not even Dr. Z. can do $\int e^{x^2}\, dx$, so you must be clever!)

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**Ans.**:

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**8**. Calculate the double integral

$$\int\int_R \frac{3xy^2}{x^2+1}\, dA \quad ,$$

$$R = \{(x,y)\,|\, 0 \le x \le 1\,,\, -1 \le y \le 1\,\} \quad .$$

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**Ans.**:

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**9**. Use Lagrange multipliers to find the maximum and minimum values of the function $f(x, y) = xy^2$ subject to the constraint $2x^2 + y^2 = 6$.

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**maximum value:**

**minimum value:**

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**10**. Find the local maximum and minimum **values**, and saddle point(s) of the function $f(x, y) = x^4 + y^4 - 4xy + 2$.

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**Local maximum value(s):**

**Local minimum value(s)**

**saddle point(s)**:

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