

2006 Mathematics (2)

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1A

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2A*

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3B

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Solution(s):

From user: ar857

2006 II 3

a) $F_1 = (y, z \cos(yz) + x, y \cos(yz))$ is conservative ✓ ~~(why?)~~

$F_2 = (e^{yz}, e^{yz}, 0)$ is not conservative X ✓ (why?)

$F_3 = (2xy + \sin x, x^2z, x^2y)$ is conservative ✓

$F_1 = \nabla \phi_1$ $\phi_1 = \sin(yz) + yx + c$ ✓

$F_3 = \nabla \phi_3$ $\phi_3 = x^2y - \cos x + c$ ✓

b) $\int_C F_3 \cdot dr$

i) $= \int_0^\pi (2e^{t^3} + \sin t + t^3 + t^3) dt = \int_0^\pi 4t^3 \sin t dt = \pi^4 + 2$

ii) $\int_0^\pi t^3 + \int_0^\pi t^3 + \int_0^\pi 2t^3 \sin t = \frac{1}{4}\pi^4 + \frac{1}{4}\pi^4 + \frac{1}{2}\pi^4 + 2 = \pi^4 + 2$

4B

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5C

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6C*

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7D

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Handwritten solution for a differential equation problem. The text is written on lined paper and includes the following steps:

2006 II 7

a) $(2xy^2 + 4) dx + 2(x^2y - 3) dy = 0$ is exact
 $x^2y^2 + 4x - 6y = C$

b) $(y^2 - x) dx + 2y dy = 0$ not exact
Potential function $\frac{\partial y}{\partial x} = \frac{1}{y} \Rightarrow \mu = e^x$
 $e^x y^2 - x e^x + 2y e^x = 0 \Rightarrow \int x e^x = x e^x - \int e^x = e^x (x - 1)$
 $C = y^2 e^x + (x - 1) e^x = (y^2 + x - 1) e^x$

c) $(\cos x - x \sin x + y^2) dx + 2xy dy = 0$ is exact
 $\sin x + x \cos x - \sin x + xy^2 = C$
 $x \cos x + xy^2 = C$

8D

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9E

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10E*

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11F

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