

2005 Mathematics (2)

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Solution(s):

From user: ar857

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a) $(12x + 5y - 9) dx + (5x + 2y - 4) dy = 0$ is exact

$$f = 6x^2 + 5xy - 9x + \frac{5}{2}y^2 - 4y + C$$

b) $(x+y) dx + 2xy dy = 0$ is exact

$$e^{\int \frac{1-2}{2x} dx} = \mu \Rightarrow \mu = e^{-\frac{1}{2} \ln x} = \frac{1}{\sqrt{x}}$$

c) $\frac{(x^2-y^2) dx}{(x^2+y^2)^2} + \frac{2xy dy}{(x^2+y^2)^2}$

$$\frac{-2y(x^2+y^2)^{\frac{3}{2}} + (x^2-y^2) \cdot 2 \cdot 2y}{(x^2+y^2)^3} = \frac{-6yx^2 + 2y^3}{(x^2+y^2)^3}$$

$$\frac{2y(x^2+y^2) - 2xy \cdot 2 \cdot 2x}{(x^2+y^2)^2} = \frac{2y^3 - 6x^2y}{(x^2+y^2)^2}$$

$$2x \int \frac{y}{(x^2+y^2)^2} dy = x \int \frac{1}{u^2} du = -\frac{x}{u} = \frac{-x}{x^2+y^2}$$

is exact

$$\frac{d}{dx} \left(\frac{-x}{x^2+y^2} \right) = \frac{-x^2-y^2+2x^2}{(x^2+y^2)^2} = \frac{-x}{(x^2+y^2)^2}$$

9E

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10E*

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