

In-class problem linked to lecture pages 30-37:

Test the following differential with 2 methods to determine if it is exact:

$$yx^2 e^x dx + x^3 e^x dy$$

Physics 301

In-class problem linked to lecture pages 30-37:

$$dF = yx^2e^x dx + x^3e^x dy$$

Method 1 =

$$dF = g(x,y)dx + h(x,y)dy$$

$$\text{where } g = yx^2e^x$$

$$h = x^3e^x$$

$$\frac{dg}{dy} = x^2e^x$$

$$\frac{dh}{dx} = 3x^2e^x + x^3e^x = (3x^2 + x^3)e^x$$

$$\frac{dg}{dy} \neq \frac{dh}{dx} \quad \therefore \text{inexact}$$

Method 2 =

$$\text{Let } \frac{dF}{dx} = yx^2e^x \quad \text{and} \quad \frac{dF}{dy} = x^3e^x$$

$$\text{Then } F_{(1)} = \int dy x^3e^x = x^3e^x y + \text{const}$$

$$\underline{\text{or}} \quad F_{(2)} = \int dx yx^2e^x = y[x^2e^x - 2\int xe^x dx]$$

$$= y \left[x^2 e^x - 2(e^x \{x-1\}) \right]$$

$$= yx^2 e^x - 2yx e^x + 2y e^x$$

$F_{yx} \neq F_{xy}$: there is no function F : inexact