Section 31.3: cont'd

Thursday, April 09, 2015
10:29 AM

recall: $u = x + y$

how do you find du?

($du = \frac{du}{dx}\,dx$ for $u(x)$)

$$du = \frac{\partial u}{\partial x}\,dx + \frac{\partial u}{\partial y}\,dy$$

$$= 1 \cdot dx + 1 \cdot dy$$

$$u = \sin x + e^y$$

$$du = \cos x\,dx + e^y dy$$

Solve: $\sec(xy)\,dx + x\,dy + y\,dx = 0$

method #1: substitution

let $u = xy$

$du = x\,dy + y\,dx$

$$\sec u\,dx + du = 0$$

$$dx + \frac{du}{\sec u} = 0$$

$$dx + \cos u\,du = 0$$

now integrate:

$$x + \sin v = C$$

$$\boxed{x + \sin xy = C}$$

method #2: direct

$$\sec(xy)\,dx + x\,dy + y\,dx = 0$$

$$\sec(xy)\,dx + d(xy) = 0$$

$$dx + \frac{d(xy)}{\sec(xy)} = 0$$

$$dx + \cos(xy)\,d(xy) = 0$$

$$\boxed{x + \sin(xy) = C}$$

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solve: $x\,dy - y\,dx + y^2\,dx = 0$

$$\frac{x\,dy - y\,dx}{y^2} + dx = 0$$

note: $v = \frac{x}{y}$

$dv = \frac{y\,dx - x\,dy}{y^2}$

method #1: substitution → use this

$$-du + dx = 0$$

$$-v + x = C$$

$$\boxed{-\frac{x}{y} + x = C}$$

method #2:

$$\frac{x\,dy - y\,dx}{y^2} + dx = 0$$

$$-d\left(\frac{x}{y}\right) + dx = 0$$

$$\boxed{-\frac{x}{y} + x = C}$$
