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ASSIGNMENT  
CHEMICAL ENGINEERING

1. If  $y = e^{x^2+x}$   
show that

$$y'' = y'(2x+1) + 2y$$

and hence prove that

$$y^{(n+2)} = (2n+1)y^{(n+1)} + 2(n+1)y^n$$

Soln.

$$y = e^{x^2+x}$$

$$\ln y = x^2 + x$$

Differentiating both sides

$$\frac{1}{y} \frac{dy}{dx} = 2x+1$$

Multiply both sides by y

$$\frac{dy}{dx} = (2x+1)y$$

$$\frac{d^2y}{dx^2} = u \frac{dv}{dx} + v \frac{du}{dx}$$

$$u = y \quad \frac{du}{dx} = \frac{dy}{dy} \cdot \frac{dy}{dx} = 1 \cdot \frac{dy}{dx}$$

$$v = 2x+1 \quad \frac{dv}{dx} = 2$$

So that

$$\frac{d^2y}{dx^2} = (2x+1) \cdot 1 \frac{dy}{dx} + 2y$$

$$\frac{d^2y}{dx^2} = (2x+1) \frac{dy}{dx} + 2y$$

$$y'' = y'(2x+1) + 2y$$

$$y'' = y'(2x+1) + 2y$$

$$y^{(n+2)} = y^{(n+1)}(2x+1) + 2y^n$$