

MATH 242 - WS4

02/01/2024

- Evaluate each integral using IBP:

$$\begin{aligned}
 \text{(a) } \int \ln(x^2 - 3x) dx &= \int (x^2 - 3x) \ln(x) dx \\
 u = \ln(x) &\quad \left| \begin{array}{l} du = \frac{1}{x} dx \\ v = x^2 - 3x \end{array} \right. \\
 \frac{du}{x} & \\
 &= \left(\frac{x^3}{3} - \frac{3x^2}{2} \right) \ln(x) - \int \left(\frac{x^2}{3} - \frac{3x}{2} \right) dx \\
 &= \boxed{\left(\frac{x^3}{3} - \frac{3x^2}{2} \right) \ln(x) - \frac{x^3}{9} + \frac{3x^2}{4} + C}
 \end{aligned}$$

$$\text{(b) } \int x^2 \sin(3x) dx$$

$$\begin{aligned}
 &= -\frac{x^2}{3} \cos(3x) + \frac{2x}{9} \sin(3x) + \frac{2}{27} \cos(3x) + C
 \end{aligned}$$

$$\begin{aligned}
 u = x^2 &\quad \left| \begin{array}{l} du = 2x \sin(3x) dx \\ dv = \sin(3x) dx \end{array} \right. \\
 2x & \quad \oplus -\frac{1}{3} \cos(3x) \\
 2 & \quad \ominus -\frac{1}{9} \sin(3x) \\
 0 & \quad \oplus \quad \ominus \quad \frac{1}{27} \cos(3x)
 \end{aligned}$$

$$\text{Note: } [xe^x - e^x]' = e^x + xe^x - e^x = xe^x$$

(class)
we found
by IBP

$$(c) \int_0^1 e^{\sqrt{x}} dx \text{ (Hint: first take a u-substitution } t = \sqrt{x})$$

$$t = \sqrt{x} \\ dt = \frac{1}{2\sqrt{x}} dx$$

$$\begin{aligned} & 2 \int_0^1 te^t dt \\ \hookrightarrow &= 2 \left(te^t - e^t \right) \Big|_0^1 \\ & \quad \quad \quad \Big|_{t=0} \end{aligned}$$

$$= 2((e - e) - (0 - 1)) = \boxed{2}$$