

Please show **all** your work! Answers without supporting work will not be given credit.
Write answers in spaces provided.

Name: _____

1. [4 pts] What would be the best substitution to make to solve the given integral?

$$\int 3e^{3x} \cos(e^{3x}) \sin^5(e^{3x}) dx$$

Solution: First let's rewrite the integral.

$$\int 3e^{3x} \cos(e^{3x}) \sin^5(e^{3x}) dx = \int 3e^{3x} \cos(e^{3x}) [\sin(e^{3x})]^5 dx$$

Hence the best substitution to solve the given integral is

$$u = \sin(e^{3x}) \quad [4 \text{ pts}]$$

We can check this by calculating du :

$$du = \cos(e^{3x}) \cdot e^{3x} \cdot 3 dx$$

all of which are in the integrand.

2. [6 pts] Compute $\int \frac{9x}{\sqrt{3x+1}} dx$

Solution:

$$\begin{aligned} \int \frac{9x}{\sqrt{3x+1}} dx & \stackrel{u=3x+1 \iff x=(u-1)/3}{du=3 dx \iff du/3=dx} \int \frac{9}{u^{1/2}} \cdot \frac{u-1}{3} \cdot \frac{du}{3} \\ & = \int u^{1/2} - u^{-1/2} du \\ & = \left(\frac{2}{3} u^{3/2} - \frac{2}{1} u^{1/2} \right) + C \\ & = \frac{2}{3} (3x+1)^{3/2} - 2(3x+1)^{1/2} + C \end{aligned}$$

How I graded?

- 2 pt for u-substitution
- 2 pt for integration
- 2 pt for plugging u back