Calculus AB

Lesson: Tuesday, April 7

Learning Target:

Students will integrate exponential equations with a base of e.

Let’s Get Started:

Read Article: Review u-substitution

Watch Video: https://youtu.be/1ct7LUx23io

Practice:

1. To integrate the equation e^x we will first have to remember the derivative: $\frac{d}{dx}(e^u) = e^u \cdot u'$

2. Since Integration is the anti-derivative we get the following Integral formulas:

$$\int e^x dx = e^x + C \qquad \int e^u du = e^u + C$$

3. These formulas along with u-substitiution were used to complete the following problem:

$$\int e^{(3x+1)} dx$$

$$u = 3x+1$$

$$du = 3dx$$

$$\frac{1}{3}du = dx$$

$$\frac{1}{3}\int e^u du = \frac{1}{3}e^u + C$$

$$= \frac{1}{3}e^{3x+1} + C$$

Here are a few more worked out examples:

$$\int 5xe^{(-x^2)}dx$$

$$5\int xe^{(-x^2)}dx$$

$$u = -x^2$$

$$du = -2x\,dx$$

$$-\frac{1}{2}du = x\,dx$$

$$-\frac{5}{2}\int e^u du = -\frac{5}{2}e^u + c$$

$$-\frac{5}{2}e^{(-x^2)} + C$$

Product Rule

Example 3) Find the derivative: $y = x^2e^{-x} - e^x$

$u = x^2 \quad v = e^{-x}$

$u' = 2x \quad v' = -e^{-x}$

$$y' = [2xe^{-x} + (-x^2e^{-x})] - e^x$$

$$= \frac{2x}{e^x} - \frac{x^2}{e^x} - e^x$$

Practice: Evaluate the following.

$$\int 36x^2 e^{4x^3+3}\,dx;\ u = 4x^3 + 3$$

$$\int \frac{20e^{5x}}{e^{5x}+3}\,dx$$

$$\int 10\sin -2x \cdot e^{\cos -2x}\,dx$$

$$\int \frac{5e^{-3+\ln 3x}}{x}\,dx$$

Answer Key:

Once you have completed the problems, check your answers here.

$$\int 36x^2 e^{4x^3+3}\,dx;\ u = 4x^3 + 3$$

$$3e^{4x^3+3} + C$$

$$\int \frac{20e^{5x}}{e^{5x}+3}\,dx$$

$$4\ln\left|e^{5x}+3\right| + C$$

$$\int 10\sin -2x \cdot e^{\cos -2x}\,dx$$

$$5e^{\cos -2x} + C$$

$$\int \frac{5e^{-3+\ln 3x}}{x}\,dx$$

$$5e^{-3+\ln 3x} + C$$

Additional Practice:

[Extra Practice Problems with Answers]

In your Calculus book Read through Section 5.4 and complete problems 86, 90, 96, 98, and 103 on page 359