# Exponential Functions - Differentiation and Integration

## Differentiation

$$\frac{d}{dx}\left(e^x\right) = e^x$$

$$\frac{d}{dx}\left(e^u\right) = e^u \frac{du}{dx}$$

## Integration

$$\int e^x dx = e^x + C$$

Directions: For questions 1 through 3, find the derivative.

1. $y = e^{3x}$

2. $y = e^{\sqrt{x}}$

3. $y = \ln\left(\dfrac{1+e^x}{1-e^x}\right)$

Directions: For question 4, use implicit differentiation to find $\dfrac{dy}{dx}$.

4. $e^{xy} - \ln(xy) + xe^y = e^x \ln x^3$

Directions: For questions 5 through 9, evaluate the definite integral.

5. $\displaystyle\int_0^1 \frac{e^x - e^{-x}}{e^x + e^{-x}}\, dx$

6. $\displaystyle\int_0^{\sqrt{2}} \frac{e^{2x} - 3e^x + 2}{e^x}\, dx$

7. $\displaystyle\int_{\sqrt{2}}^{\sqrt{3}} x^2 e^{x^3} \, dx$

8. $\displaystyle\int_{\ln 2}^{\ln 3} \frac{e^{\frac{1}{x}}}{x^2} \, dx$

9. $\displaystyle\int_{\frac{\pi}{2}}^{\frac{3\pi}{4}} \frac{\cos x \cdot e^{\csc x}}{1-\cos^2 x}\, dx$

Directions: For question 10, find the extrema and points of inflection.

10. $f(x) = \dfrac{1}{\sqrt{2\pi}}e^{-\frac{x^2}{2}}$