3.5 Derivatives of General Exponential and Logarithmic Functions

The Derivative of $f(x) = b^x$

$$\frac{d}{dx}[b^x] =$$

Example 1 Find the derivative of $f(x) = 5 \cdot 3^x$

Example 2 Find the critical numbers for $f(x) = x \cdot 5^{1-x^2}$

Example 3 The value of houses has been increasing approximately 30% every five years. Find a model for the value of a $215,000 house. Estimate the value in 20 years, and find the expected increase in value in 20 years.

The Derivative of $f(x) = \log_b(x)$

$$\frac{d}{dx}[\log_b(x)] =$$

Example 4 Find the equation of the line tangent to the graph of $f(x) = \log_2(x^2 + 4)$ when $x = 2$

Example 5 Differentiate $f(x) = 5^{x+1} \log_5(x + 1)$

Example 6 An annuity is a savings account into which equal periodic payments are made. The future value of an annuity is given by:

$$A(t) = \frac{\text{pmt}\left[\left(1+\frac{r}{n}\right)^{nt} - 1\right]}{\frac{r}{n}}$$

where n is the number of payments per year, r is the yearly interest rate, and t is time in years. Find the future value of an annuity that earns 4.2% with monthly payments of \$500 for 10 years, 20 yrs, 50 yrs. Find the rate of growth in year 20.