MATH 16B  CH. 4 – IMPORTANT FORMULAS  (PP. 310 – 311)

## DIFFERENTIATION FORMULAS

1) $\boxed{D_x(e^x) = e^x}$

2) $\boxed{D_x(e^u) = e^u \cdot \frac{du}{dx}}$

3) $\boxed{D_x(\ln x) = \frac{1}{x}}$ FOR $x > 0$

4) $\boxed{D_x(\ln u) = \frac{1}{u} \cdot \frac{du}{dx} = \frac{u'}{u}}$

## ADDITIONAL DIFFERENTIATION FORMULAS

1) $\boxed{D_x(a^x) = a^x \ln a}$

2) $\boxed{D_x(a^u) = a^u \ln a \cdot \frac{du}{dx}}$

3) $\boxed{D_x(\log_a x) = \frac{1}{x \ln a}}$ FOR $x > 0$

4) $\boxed{D_x(\log_a u) = \frac{1}{u \ln a} \cdot \frac{du}{dx} = \frac{u'}{u \ln a}}$

## LAWS OF LOGARITHMS

1) $\ln(xy) = \ln x + \ln y$

2) $\ln\left(\frac{x}{y}\right) = \ln x - \ln y$

3) $\ln(x^r) = r \ln x$

**WARNING**: DO NOT TRY TO SIMPLIFY

1) $\ln(x+y)$,

2) $\frac{\ln x}{\ln y}$, OR

3) $(\ln x)^r$

## IDENTITIES

$\boxed{\ln e^r = r}$ FOR ANY $r$

$\boxed{e^{\ln x} = x}$ FOR $x > 0$

## SPECIAL VALUES

$\boxed{\ln 1 = 0}$ SINCE $e^0 = 1$

$\boxed{\ln e = 1}$ SINCE $e^1 = e$

**WARNING**:

$\ln 0$ IS UNDEFINED

## EXPONENTIAL GROWTH FORMULA

$\boxed{y = Ce^{kt}}$

## CONTINUOUS COMPOUNDING OF INTEREST

$\boxed{A = Pe^{rt}}$

## DISCRETE COMPOUNDING OF INTEREST

$\boxed{A = P\left(1 + \frac{r}{n}\right)^{nt}}$

## CHANGE OF BASE FORMULA

$\boxed{\log_a x = \frac{\ln x}{\ln a}}$

$a^x = (e^{\ln a})^x = e^{(\ln a)x}$