CHECK YOUR UNDERSTANDING.

EXAMPLE 1: For each of the following functions compute the derivative, $f'(x)$, and find $f'(1)$

a) $f(x) = 2 * 3^x$ $\quad f'(x) = 2 \cdot 3^x \ln(3) \quad f'(1) = 6 \cdot \ln(3)$

b) $f(x) = 4e^x + \ln(x)$ $\quad f'(x) = 4e^x + \frac{1}{x} \quad f'(1) = 4e + 1$

c) $f(x) = 2x^3 + 3e^x$ $\quad f'(x) = 6x^2 + 3e^x \quad f'(1) = 6 + 3e$

EXAMPLE 2: Suppose that the amount of Caffeine, $C(t)$ in mg, in your bloodstream t hours after drinking a coffee is modeled by: $C(t) = 150 * (0.89)^t$. Find the rate at which the amount of caffeine in the bloodstream is changing one hour after drinking the coffee.

rounded

$C'(t) = 150\,(0.89)^t \cdot \ln(0.89)$

$C'(1) = 150\,(0.89)^1 \cdot \ln(0.89) \approx -15.56$

We approximated this to be ≈ -16 in the previous chapter

EXAMPLE 3: Suppose a population is changing at a rate of:

$$P(t) = 350(1.015)^t$$

where time is in years since 2010 and the population is in thousands.

a. What was the population in 2010?

$t=0$ $\quad P(0) = 350(1.015)^0 = 350$ thousand

b. What is the population in 2013?

$t=3$ $\quad P(3) = 350(1.015)^3 = 365.987$ thousand

c. How fast is the population changing in 2013?

derivative

$P'(t) = 350\,(1.015)^t \cdot \ln(1.015)$

$P'(3) = 350\,(1.015)^3 \cdot \ln(1.015) = 5.449 \frac{\text{thousand}}{\text{year}}$

EXAMPLE 4: Find the equation of the tangent line to $f(x) = 4e^x$ at $x = 0$

$f(0) = 4$

$f'(x) = 4e^x$

$f'(0) = 4$

$y = 4x + b$

$4 = 4(0) + b$

$\boxed{y = 4x + 4}$

EXAMPLE 5: If $g(x) = ae^x - b\ln(x)$, where a and b are constant, find $g'(x)$

$g'(x) = ae^x - b \cdot \frac{1}{x}$

or

$g'(x) = ae^x - \frac{b}{x}$