

7. If $y = x^3 + 3^x$, then find $\frac{dy}{dx}$.

$$y' = 3x^2 + \ln 3 \cdot 3^x$$

8. The population of the United States was 4 million in 1790 and 180 million in 1960. If the rate of growth is assumed proportional to the number present, what estimate would you give for the population in 2020? (You may leave "ln" in your answer.)

$A(t)$ = population at time t
 $t=0$ is 1790

$$A(t) = A(0)e^{kt}$$

$$A(0) = 4 \cdot 10^6$$

$$A(170) = 180 \cdot 10^6$$

Find $A(230)$

$$180 \cdot 10^6 = A(170) = 4 \cdot 10^6 e^{k \cdot 170}$$

$$45 = \frac{180}{4} = e^{k \cdot 170}$$

$$\frac{\ln 45}{170} = k$$

$$A(230) = 4 \cdot 10^6 e^{\frac{\ln 45}{170} \cdot 230}$$