# Activity 5.6 – Definite Integrals of Exponentials and Logarithms

1. (a) $\Delta x = 0.4$

   (b) $\int_0^2 3e^{x^2}\,dx \approx \left(3e^{(0.2)^2} + 3e^{(0.6)^2} + 3e^{(1)^2} + 3e^{(1.4)^2} + 3e^{(1.8)^2}\right)\cdot 0.4 \approx 45.390565$

2. (a) $\int_{-1}^{1} e^{5.2x}\,dx = \left(\dfrac{e^{5.2x}}{5.2}\right)\Bigg|_{-1}^{1} = \dfrac{e^{5.2}}{5.2} - \dfrac{e^{-5.2}}{5.2} \approx 34.86$

   (b) $\int_0^1 10^x\,dx = \left(\dfrac{10^x}{\ln 10}\right)\Bigg|_0^1 = \dfrac{10}{\ln 10} - \dfrac{1}{\ln 10} \approx 3.91$

3. (a) The initial rate is $a$ = 0.5, so $R(t) = 0.5b^t$. Also, $R(120) = 0.5b^{120} = 0.25$. From this last equation, $b^{120} = 0.5$, so $b = \sqrt[120]{0.5} \approx 0.9942$. The formula for $R(t)$ is $R(t) = 0.5(0.9942)^t$ million gallons per minute.

   (b) $R(280) = 0.5(0.9942)^{280} \approx 0.0981$ million gallons per minute.

   (c) $\int_0^{280} 0.5(0.9942)^t\,dt = \left(\dfrac{0.5(0.9942)^t}{\ln(0.9942)}\right)\Bigg|_0^{280} \approx 69.0938$ million gallons

4. (a) $\int_1^x \dfrac{1}{t}\,dt = (\ln|t|)\big|_1^x = \ln|x| - \ln|1| = \ln x$

   (b) $\int_1^x \frac{1}{t}\,dt = \ln x = 1$ implies that $x = e$.