2. (a) The number $e$ is defined as the base $a$ such that the slope of the tangent line to the graph of $y = a^x$ at $x = 0$ is exactly 1.
(b) $e \approx 2.71828$.
(c) The natural exponential function is the function $f(x) = e^x$.

3. The graphs are below. All four are increasing because all four bases are greater than 1. They also share the same $y$-intercept.

9. If $f(x) = 2^x$, then our function is $-f(-x)$. Thus, its graph will be reflected across both the $x$- and $y$-axes.

16. (a) Since the domains of both $\sin(x)$ and $e^x$ are $\mathbb{R}$, the domain of $g$ is $\mathbb{R}$.
(b) The potential problem here is that we might accidentally try to take the square root of a negative number. To avoid this, we require $1 - 2^t \geq 0$. This gives $1 \geq 2^t$, or $2^t \leq 1$. From our knowledge of exponential functions, we know that this means $t \leq 0$.

17. We have $f(x) = Ca^x$, $f(1) = 6$, and $f(3) = 24$. Thus $6 = Ca^1$ and $24 = Ca^3$. Therefore, $4 = \frac{24}{6} = \frac{Ca^3}{Ca} = a^2$. Since $a$ must be positive, we have $a = 2$. Thus, from $6 = Ca$, we get $C = 3$. The function is $f(x) = 3 \cdot 2^x$.

21. Since 2 feet is 24 inches, we have $f(x) = 24^2 = 576$. In feet, this is $\frac{576}{12} = 48$. On the other hand, $2^{24} = 16777216$, which is $\frac{16777216}{12} \approx 1,398,101$ feet, or $\frac{1398101}{5280} \approx 264.79$ miles. Yikes!

26. (a) Since 60 hours is four half-lives, there will be $2 \cdot \left(\frac{1}{2}\right)^4 = 0.125$ g.
(b) Since $t$ hours is $\frac{t}{15}$ half-lives, there will be $A(t) = 2 \cdot \left(\frac{1}{2}\right)^{t/15}$ g.

(c) Four days is 96 hours, so there should be $2 \cdot \left(\frac{1}{2}\right)^{96/15} \approx 0.02368307136$ grams left.

(d) I will graph both $y = A(t)$ and $y = 0.01$ on the same axes and locate the intersection. It appears to be at around 100 hours.