10. (a) There are (60)(60)(24)(365) = 31,536,000 seconds in a year. Thus, assuming exponential growth, $P = 257{,}313{,}431e^{kt}$ and $257{,}313{,}432 = 257{,}313{,}431e^{(14k/31{,}536{,}000)} \Rightarrow \ln\left(\frac{257{,}313{,}432}{257{,}313{,}431}\right) = \frac{14k}{31{,}536{,}000}$ $\Rightarrow k \approx 0.0087542$

(b) $P = 257{,}313{,}431e^{(0.0087542)(15)} \approx 293{,}420{,}847$ (to the nearest integer). Answers will vary considerably with the number of decimal places retained.

26. It could take 450,000 steps for a sequential search, but at most 19 steps for a binary search because $2^{18} = 262{,}144 < 450{,}000 < 524{,}288 = 2^{19}$.

14. $\alpha = \tan^{-1}\left(\frac{4}{3}\right) \Rightarrow \sin\alpha = \frac{4}{5}$, $\cos\alpha = \frac{3}{5}$, $\sec\alpha = \frac{5}{3}$, $\csc\alpha = \frac{5}{4}$, and $\cot\alpha = \frac{3}{4}$

42. $\lim_{x \to -1^+} \cos^{-1} x = \pi$

6. $\sinh(2\ln x) = \frac{e^{2\ln x} - e^{-2\ln x}}{2} = \frac{e^{\ln x^2} - e^{\ln x^{-2}}}{2} = \frac{\left(x^2 - \frac{1}{x^2}\right)}{2} = \frac{x^4 - 1}{2x^2}$

7. $\cosh 5x + \sinh 5x = \frac{e^{5x} + e^{-5x}}{2} + \frac{e^{5x} - e^{-5x}}{2} = e^{5x}$

8. $\cosh 3x - \sinh 3x = \frac{e^{3x} + e^{-3x}}{2} - \frac{e^{3x} - e^{-3x}}{2} = e^{-3x}$

77. (a) $v = \sqrt{\frac{mg}{k}}\tanh\left(\sqrt{\frac{gk}{m}}\,t\right) \Rightarrow \frac{dv}{dt} = \sqrt{\frac{mg}{k}}\left[\operatorname{sech}^2\left(\sqrt{\frac{gk}{m}}\,t\right)\right]\left(\sqrt{\frac{gk}{m}}\right) = g\operatorname{sech}^2\left(\sqrt{\frac{gk}{m}}\,t\right)$.

Thus $m\frac{dv}{dt} = mg\operatorname{sech}^2\left(\sqrt{\frac{gk}{m}}\,t\right) = mg\left(1 - \tanh^2\left(\sqrt{\frac{gk}{m}}\,t\right)\right) = mg - kv^2$. Also, since $\tanh x = 0$ when $x = 0$, $v = 0$ when $t = 0$.

(b) $\lim_{t \to \infty} v = \lim_{t \to \infty} \sqrt{\frac{mg}{k}}\tanh\left(\sqrt{\frac{kg}{m}}\,t\right) = \sqrt{\frac{mg}{k}}\lim_{t \to \infty}\tanh\left(\sqrt{\frac{kg}{m}}\,t\right) = \sqrt{\frac{mg}{k}}(1) = \sqrt{\frac{mg}{k}}$

(c) $\sqrt{\frac{160}{0.005}} = \sqrt{\frac{160{,}000}{5}} = \frac{400}{\sqrt{5}} = 80\sqrt{5} \approx 178.89$ ft/sec