5. [9 points]

a. [3 points] The golden lion tamarin is an endangered species. However, due to conservation efforts, the number of wild golden lion tamarins has been increasing. There were 450 golden lion tamarins in the wild in 1990, and their population has grown by about 5.2% per year since then.[2] Let $L(y)$ be the number of wild golden lion tamarins y years after 1990. Find a formula for $L(y)$.

Solution: Since the population has been growing by a constant *percentage* per year, an appropriate model for $L(y)$ is exponential, say $L(y) = ab^y$. The information provided indicates that $a = 450$ and $r = 0.052$ so $b = 1.052$. Hence, a formula for $L(y)$ is $L(y) = 450(1.052)^y$.

Answer: $L(y) = 450(1.052)^y$

b. [3 points] The value of a typical new car decreases by about 9% per year. Find a formula for $V(t)$, the value of a car, in thousands of dollars, t years after purchase if its value when originally purchased was $25,000$.

Solution: Since the value decreases by a constant percentage each year, an appropriate model for $V(t)$ is exponential, so $V(t) = ab^t$. In this case, the information provided indicates that $a = 25$ (since $V(t)$ is measured in thousands of dollars) and $r = -0.09$ so $b = 0.91$. Hence a formula for $V(t)$ is $V(t) = 25(0.91)^t$.

Answer: $V(t) = 25(0.91)^t$

c. [3 points] Before concrete to pave a driveway starts to be poured, a concrete mixer contains $40,000$ pounds of concrete. If paving 54 square inches of the driveway uses 25 pounds of concrete, find a formula for $C(d)$, the amount, in pounds, of concrete remaining in the mixer after d square inches of the driveway have been paved.

Solution: To pave the driveway, concrete is used at the constant rate of 25 pounds for every 54 square inches. Hence, $C(d)$ is a linear function with constant average rate of change $-25/54$ pounds per square inch. Since the amount of concrete in the mixer when 0 inches have been paved is 40000 pounds, we see that $C(d) = 40000 - \frac{25}{54}d$.

Answer: $C(d) = 40000 - \dfrac{25}{54}d$

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[2]Source: http://www.animalinfo.org