**3**. [9 points] Note that the problems on this page are not related to each other.
(*You do not have to show work. However work shown may be used to award partial credit.*)

**a**. [3 points] A salesperson at a local department store earns a base salary of \$750 per month plus a commission (bonus) of 8% of her total sales. Let $M(d)$ be the employee's total earnings, in dollars, in a month in which she sells $d$ dollars worth of merchandise. Find a formula for $M(d)$.

**Answer:** $M(d) =$ $750 + 0.08d$

**b**. [3 points] Suppose that the half-life of caffeine in a student's bloodstream is 5 hours. If the student drinks a latte that contains 150 mg of caffeine at 8 am, find a formula for $C(h)$, the amount of caffeine (in milligrams) from that latte that remains in the student's bloodstream $h$ hours after 8 am.

*Solution:* $C(h)$ is exponential with initial value 150, so $C(h) = 150b^h$ where $b$ is the decay factor of $C$. Since $75 = 150b^5$ we see that $b^5 = 0.5$ so $b = (0.5)^{1/5}$. Hence $C(h) = 150(0.5)^{h/5}$.

**Answer:** $C(h) =$ $150(0.5)^{h/5}$

**c**. [3 points] The monthly revenue of a local business varies seasonally from a low of \$35,000 in February to a high of \$75,000 in August (and back down to \$35,000 the following February). Let $R(t)$ be this company's monthly revenue, in thousands of dollars, $t$ months after January. (Note that $t = 0$ represents January, $t = 1$ represents February, etc.) Assuming that $R(t)$ is a sinusoidal function, find a formula for $R(t)$.

*Solution:* $R(t)$ is sinusoidal with an amplitude of 20 thousand dollars, an average value (corresponding to the midline) of 55 thousand dollars, and a period of 12 months. Since it attains a minimum value of when $t = 1$, we find the formula $R(t) = -20\cos(\frac{\pi}{6}(t-1)) + 55$. (There are many other possibilities.)

**Answer:** $R(t) =$ $-20\cos(\frac{\pi}{6}(t-1)) + 55$