Name: Answer Key

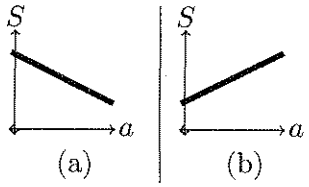
**Directions:** Show all work. No credit for answers without work.

1. **[3 parts, 1 point each]** The number of sales per month, $S$, is a function of the amount, $a$ (in dollars), spent on advertising that month, so $S = f(a)$.

   (a) Translate the statement $f(2500) = 1800$ into English.

   When \$2500 is spent on advertising, there are 1,800 sales per month.

   (b) Which graph is more likely to represent this function? Answer (a) or (b).

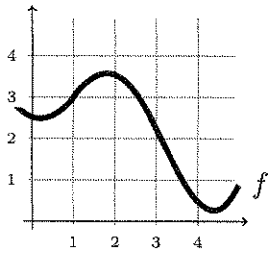
   (b)

   (c) What does the vertical intercept of the graph of this function represent, in terms of sales and advertising?

   It represents the number of sales per month that occur without any advertising.

2. **[2 parts, 1 point each]**

   (a) Estimate the average rate of change of $f$ from $x = 1$ to $x = 4$.

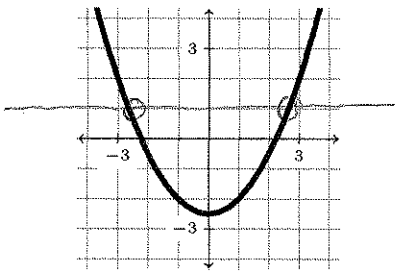
   
   

   $$ARC = \frac{f(4) - f(1)}{4 - 1}$$

   $$= \frac{\frac{1}{2} - 3}{3} = \frac{1}{6} - 1$$

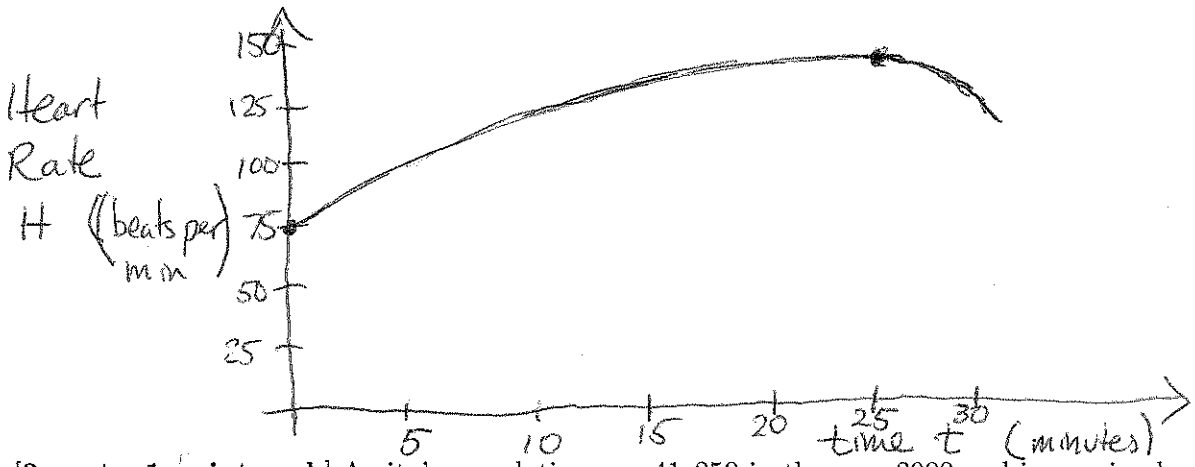
   $$= \boxed{\frac{-5}{6}}$$

   (b) Find the value(s) of $x$ so that $f(x) = 1$.

   $f(x) = 1$ when $\boxed{x = -2.5 \text{ or } x = 2.5}$.

3. [**2 points**] Steve's resting heart rate is 75 beats per minute. At time $t = 0$, Steve begins a 30 minute workout. After 25 minutes, Steve's heart reaches its maximum rate of 140 beats per minute, at which point Steve begins his cool-down routine and his heart rate declines. Draw a graph of Steve's heart rate $H$ as a function of time $t$. Label your axes and provide units.




4. [**3 parts, 1 point each**] A city's population was 41,250 in the year 2000 and is growing by 550 people per year.

   (a) Give a formula for the city's population $P$ as a function of the number of years $t$ since 2000.

$m = 550, \quad (x_0, y_0) = (0, 41{,}250)$

$y - y_0 = m(x - x_0)$

$y - 41250 = 550(x - 0)$

$y = 550x + 41250$

$\boxed{P = 550t + 41250}$

   (b) What is the population predicted to be in 2015?

$P = 550 \cdot 15 + 41250 = \boxed{49{,}500}$

   (c) When is the population expected to reach 80,000?

$80{,}000 = 550t + 41250$

$38750 = 550t$

$t \approx 70.45$

Population reaches 80,000 in the year $\boxed{2070}$.