1. For each of the following functions, compute the slope of the tangent line to the graph at the point indicated.

(a) $f(x) = 3x^2 + 2x + 7$, at $x = -1$

$f'(x) = 3 \cdot (2x) + 2 + 0 = 6x + 2$, so $f'(-1) = 6(-1) + 2 = -6 + 2 = -4$.

(b) $g(x) = \dfrac{1}{x}$, at $x = 3$

$g'(x) = -\frac{1}{x^2}$ (power rule or reciprocal rule), so $g'(3) = -\frac{1}{9}$.

(c) $h(t) = t \cdot 5^t$, at $t = 0$

$h'(t) = t' \cdot (5^t) + t \cdot (5^t)' = 5^t + t(\ln 5)5^t$, so $h'(0) = 5^0 + 0(\ln 5)5^0 = 5^0 = 1$.

2. The following table gives the number (in millions) of Visa cards worldwide for 1996 through 2000. (Source: www.visa.com)

Year	1996	1998	2000	2002
Visa cards (millions)	510	656	1000	1200

Roughly how fast was the number of Visa cards growing in 1999? (Give units.)

We can approximate this by the average rate of change between 1998 and 2000:
$$\frac{1000 - 656}{2} = \frac{344}{2} = 172 \text{ million cards per year.}$$

3. A certain tall, out-of-work actor has decided to start his own footwear company, Shoebacca. He's trying to figure out how many people he should hire to work in his factory. Let $f(x)$ be the number of pairs of fashionable women's shoes that his company can make in one day if he has x people working for him.

(a) Explain, in words, the meaning of the following:

(i) $f(10) = 100$

If he has ten workers, he can make 100 pairs of shoes per day.

(ii) $f^{-1}(50) = 6$

To make 50 pairs of shoes per day, he needs 6 workers.

(b) What is $f'(5)$ telling you? What are the units? Do you expect it to be positive or negative? Why?

Roughly, $f'(5)$ is the number of extra pairs of shoes per day that he could make if he increased the number of workers from 5 to 6. The units are (pairs of shoes per day) per worker. We expect it to be positive: If he has more workers, he can make more pairs of shoes per day.

(c) True or false: Shoes are more interesting than cars.

4. The function $f(x)$ is graphed below. Sketch the graph of $f'(x)$ beneath it.
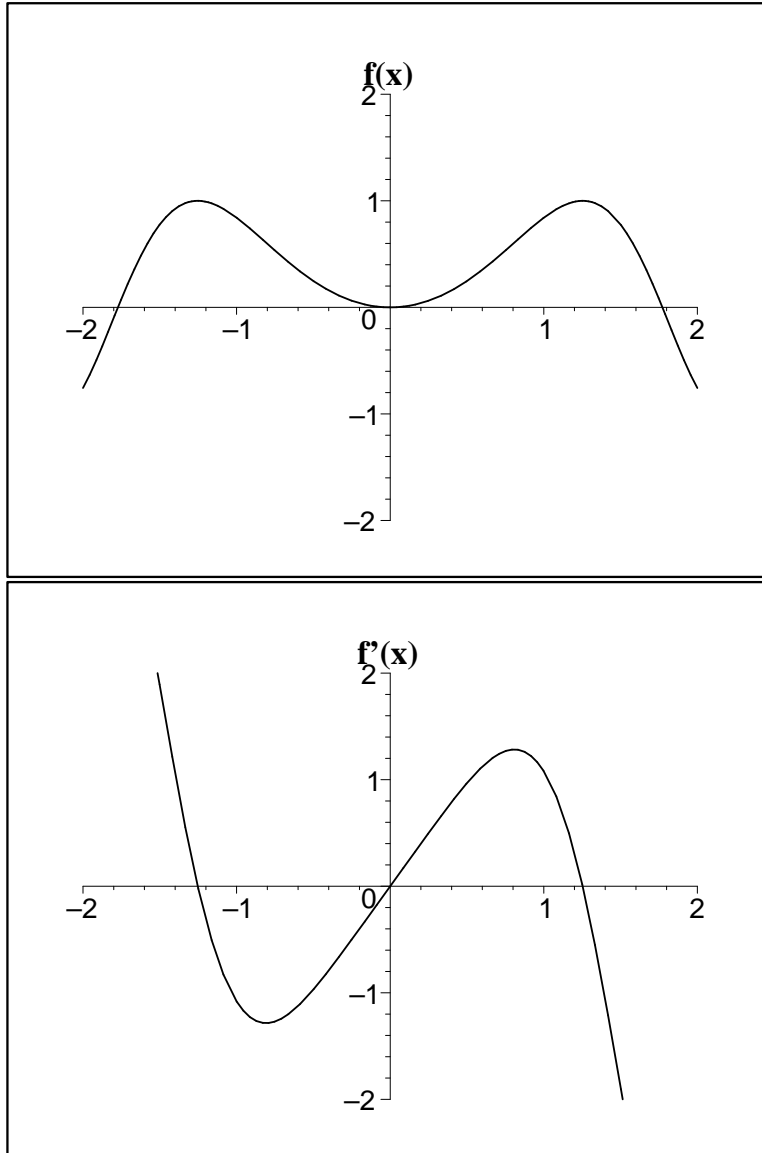
5. My arch-enemy Sideshow Bob has started a monkey colony in my attic, and they're reproducing. After t months, there are $m(t) = 10e^t$ monkeys in my attic.
 (a) How long does it take for the number of monkeys to triple?
   There are $m(0) = 10e^0 = 10$ monkeys to start with. So we want to know how long it will be until there are 30 monkeys. So we solve $10e^t = 30$, $e^t = 3$, or $t = \ln 3 \approx 1.1$ months.
 (b) How fast is the number of monkeys growing after 3 months? (Give units.)
   In other words, what is $m'(3)$? Well, $m'(t) = (10e^t)' = 10e^t$, so $m'(3) = 10e^3 \approx 201$ monkeys/month.

EXTRA CREDIT Sketch the tangent lion.