1. (Review) Find the derivative of $f(x)=\ln (\sin (x)) e^{2 x}$
2. (Warm-up) Suppose that $F$ is an antiderivative of $f$ and $G$ is an antiderivative of $g$. That is, $F^{\prime}(x)=f(x)$ and $G^{\prime}(x)=g(x)$. Answer the following with True or False.
(a) If $f=g$, then $F=G$.
(b) If $F$ and $G$ differ by a constant (that is, $F(x)=G(x)+k$ for some constant $k$ ), then $f=g$.
(c) If $f$ and $g$ differ by a constant, then $F=G$.
3. Suppose $F$ is an antiderivative of $f$.
(a) Show that $\frac{1}{2} F(2 x)$ is an antiderivative of $f(2 x)$.
(b) What is the antiderivative of $f(k x)$, where $k$ is a constant?
4. Find the antiderivatives of the following functions. You can check your answers by differentiating.
(a) $x^{3}$
(b) $e^{3 x}$
(c) $\frac{1}{x}$
(d) $3 x^{2}+4 x+2$
(e) (Challenge) $2 x \sin (x)+x^{2} \cos (x)$
(f) (Challenge) $\cos \left(x^{2}\right) \cdot 2 x$
5. A base jumper dives off a cliff that is 200 meters high.
(a) Assuming that the acceleration due to gravity is approximately $9.8 \mathrm{~m} / \mathrm{s}$, what is his velocity as a function of time?
(b) What is his position as a function of time?
(c) He pulls his chute when he is 100 meters off the ground. What is his speed at this instant?
