1. (Review:) Using the limit definition of the derivative, find the derivative of $f(x)=3 x^{2}+x$.
2. (Warm-up:) Evaluate the following limit using L'Hôpital's rule: $\lim _{x \rightarrow 0} \frac{\sin (2 x)-x}{3 x}$.
3. Evaluate $\lim _{x \rightarrow \infty} x^{\frac{1}{x}}$.
4. Find the linear approximation for $e^{x}$ at $x=1$, and use it to estimate the value of $e^{1.1}$.
5. A sample of bacteria is growing in a petri dish. If the sample grows outwards in a circle, what is the approximate change in the area that the bacteria covers as the radius changes from 3 cm to 3.1 cm ?
6. Evaluate $\lim _{x \rightarrow 0^{+}} \sin (x)^{\frac{1}{x^{2}}}$.
7. Evaluate $\lim _{x \rightarrow 2^{+}}\left(\frac{1}{x-2}-\frac{1}{\ln (x-1)}\right)$.
8. (Group 1) Suppose that the outside temperature at $t$ hours after 9:00am is given by $10 \sin \left(\frac{\pi}{12} t\right)+$ 60. Without using a calculator, estimate the temperature at 9:02pm.
9. (Group 2) If a spherical balloon is measured to have radius 10 cm , with a potential error of up to 0.01 cm , what is the maximum possible error in volume?
