1) Let \( f(x) = 16x^2 - 42x \)
Use the definition of a derivative as a limit to prove that \( f'(x) = 32x - 42 \)
Show each step in your calculation and be sure to use proper terminology in each step of your proof.

2) 
\[
\lim_{x \to \infty} \frac{4 - 56e^{9x}}{8e^{9x} + 2}
\]

\[
\lim_{x \to 3\pi} \frac{\sin^2(x)}{1 + \cos(x)}
\]

\[
\lim_{x \to \infty} \frac{(6x + 6)^2}{7 - 4x^2}
\]

3) 
\[
\lim_{x \to \infty} \frac{4\arctan(x^2 \sin(x))}{e^{5x}}
\]

4) 
\[
\int_{4}^{6} \frac{5x}{(x^2 + 2)^2} \, dx
\]
5) \[ \int_{-16}^{-8} (15(x + 12)^2 + \frac{4}{(x + 12)^2 + 16}) \, dx \]

6) \[ \int sec^{27}(x) tan^{3}(x) \, dx \]

7) \[ \int 2xe^{-x} \, dx \]

8) \[ \int_{0}^{\pi} t \sin(5t) \, dt \]

9) Evaluate the following limit

\[ \lim_{n \to \infty} \sum_{k=1}^{n} \frac{56 + 48nk + 5}{n^3} \]

10) A spherical balloon is being inflated so that its diameter is increasing at a constant rate of 5 \( cm/min \). How quickly is the volume of the balloon increasing when the diameter is 50 \( cm \)?