1. Let $f$ be a continuous function. Show that

$$\lim_{h \to 0} \frac{1}{h} \int_t^{t+h} f(x) dx = f(t)$$

using the $\delta$-$\epsilon$ definition of limit.

2. Let $f$ be a continuous function. Prove the Fundamental Theorem of Calculus

$$\frac{d}{dt} \int_a^t f(x) dx = f(t)$$

using the limit definition of derivative and the result of the previous question.
3. Let $f$ and $g$ be functions such that
\[
\lim_{x \to a} f(x) = L \quad \text{and} \quad \lim_{x \to a} g(x) = M.
\]
Use the $\delta-\epsilon$ definition of limit to show $\lim_{x \to a} (f(x) + g(x)) = L + M$.

4. Compute the following definite integrals:

(i) $\int_0^3 (3x^2 - x + 4) \, dx$

(ii) $\int_1^2 x \sqrt{x^2 + 1} \, dx$