6. [12 points]

a. [3 points] Let \( f \) be a positive, continuous function. Which of the following are antiderivatives of \( f \) whose graphs go through the point \((1, 0)\)? Circle all that apply.

\[
\int_0^1 f(t) \, dt \quad \int_0^x f(t) \, dt + \int_0^1 f(t) \, dt \quad \int_0^x f(t) \, dt \\
\int_2^{2x} f(t/2) \, dt \quad \frac{1}{2} \int_2^{2x} f(t/2) \, dt
\]

b. [3 points] Let \( R \) be the region between the \( x \)-axis and the graph of some positive, continuous function from \( x = a \) to \( x = b \). If \( V \) is the volume of the solid whose base is \( R \) and whose cross-sections parallel to the \( y \)-axis are semicircles, what is the volume of the solid whose base is \( R \) and whose cross-sections parallel to the \( y \)-axis are equilateral triangles?

\[
\frac{\sqrt{3}}{4} V \quad \frac{2\sqrt{3}}{\pi} V \quad \frac{4\sqrt{3}}{\pi} V \quad 2\pi V \quad \frac{2\pi}{\sqrt{3}} V
\]

c. [3 points] Which of the following expressions gives the arclength of the graph of \( y = \sin(x^2) \) from \( x = 0 \) to \( x = \sqrt{\pi} \)?

\[
\int_0^{\sqrt{\pi}} \sqrt{1 + 2x^2 \sin^2(x^2)} \, dx \quad \int_0^{\sqrt{\pi}} \sqrt{1 + \sin^2(x^2)} \, dx \quad \int_0^{\pi} \sqrt{1 + 4x^2 \cos^2(x^2)} \, dx \\
\int_0^{\sqrt{\pi}} \sqrt{1 + \cos^2(x^2)} \, dx \quad \int_0^{\sqrt{\pi}} \sqrt{1 + 4x^2 \cos^2(x^2)} \, dx
\]

d. [3 points] If the average value of a continuous function is \( A \) on \([0, 3]\) and \( B \) on \([3, 5]\), what is its average value on \([0, 5]\)?

\[
2A + 3B \quad \frac{2A + 3B}{5} \quad \frac{A + B}{2} \quad \frac{3A + 2B}{5} \quad \frac{A + B}{5}
\]