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.

$$\int_0^1 f(t)\,dt \qquad \int_0^x f(t)\,dt + \int_1^0 f(t)\,dt \qquad \int_0^x f(t)\,dt$$

$$\int_2^{2x} f(t/2)\,dt \qquad \frac{1}{2}\int_2^{2x} f(t/2)\,dt$$

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?

$$\frac{\sqrt{3}}{4}V \qquad \frac{2\sqrt{3}}{\pi}V \qquad \frac{4\sqrt{3}}{\pi}V \qquad 2\pi V \qquad \frac{2\pi}{\sqrt{3}}V$$

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

$$\int_0^{\sqrt{\pi}} \sqrt{1 + 2x^2\sin^2(x^2)}\,dx \qquad \int_0^{\sqrt{\pi}} \sqrt{1 + \sin^2(x^2)}\,dx \qquad \int_0^{\pi} \sqrt{1 + 4x^2\cos(x^2)}\,dx$$

$$\int_0^{\sqrt{\pi}} \sqrt{1 + \cos^2(x^2)}\,dx \qquad \int_0^{\sqrt{\pi}} \sqrt{1 + 4x^2\cos^2(x^2)}\,dx$$

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 $[0, 5]$?

$$2A + 3B \qquad \frac{2A + 3B}{5} \qquad \frac{A + B}{2} \qquad \frac{3A + 2B}{5} \qquad \frac{A + B}{5}$$