You must turn in this portion of the test to retrieve your calculator.
You may not come back to this portion of the test ... once it is turned in it is in.

1. Evaluate each integral. For each integral your work must be presented in a manner consistent with that illustrated in class or you will not receive full credit for the problem. This problem continues on pages 2 and 3. (The point values range from 3 points to 10 points; the total possible points are 34.)

   a. Evaluate \( \int_0^2 \frac{4x^3}{\sqrt{100 - 4x^4}} \, dx \).

   b. Find \( \int e^x e^{2x} + 1 \, dx \).
c. Determine the value of \( \int_0^1 \frac{e^x}{e^x + 1} \, dx \).

d. Give me \( \int 16xe^{4x} \, dx \).
e. Evaluate \( \int_0^{\ln(\frac{1}{2})} e^x \cos(\pi e^x) \, dx \).

2. Write each derivative, antiderivative, or integral value in its provided blank. No other work should be shown. (15 points total – the blanks are not of equal weight.)

a. \( \int \sin\left(\frac{x}{5}\right) \, dx = \) ________________

b. \( \int \sec^2(x) \, dx = \) ________________

c. \( \int \frac{x^3 - 3}{x^4} \, dx = \) ________________

d. \( \int_{\pi/8}^{17\pi/8} \sin(t) \, dt = \) ________________

e. \( \int \frac{d}{dx} \left( f(x) \right) \, dx = \) ________________

f. \( \int \left( 2\sqrt{x} \right)^2 \, dx = \) ________________

g. \( \int \sec(x) \tan(x) \, dx = \) ________________

h. \( \frac{d}{dx} \left( \int f(x) \, dx \right) = \) ________________
3. A function \( f \) is shown in Figure 1 of your formula sheet. The right-most \( x \)-intercept on \( f \) is \((2 \pi, 0)\) and the left-most is \((-2 \pi, 0)\). The “areas” of the four shaded regions are, from left to right, 3.8, 10.5, 5.5, and 11.2. Answer each question on this page in reference to \( f \). (2 points each)

a. Write the value of each integral into its provided blank.

\[
\int_{-2}^{0} f(x) \, dx = \underline{\phantom{0}} \\
\int_{0}^{2 \pi} f(x) \, dx = \underline{\phantom{0}} \\
\int_{0}^{3} f(x) \, dx = \underline{\phantom{0}} \\
\int_{2 \pi}^{3} f(x) \, dx = \underline{\phantom{0}} \\
\]

b. Suppose that \( F \) is an antiderivative of \( f \) with the property that \( F(0) = 12.5 \). Write each of the other values \( F \) into the provided blanks.

\[
F(3) = \underline{\phantom{0}} \\
F(2 \pi) = \underline{\phantom{0}} \\
F(-4) = \underline{\phantom{0}} \\
F(-2 \pi) = \underline{\phantom{0}} \\
\]

c. Use the key in Table 1 to answer each of the following questions.

\[
The \text{ statement that correctly applies to } \int_{2}^{5} f'(x) \, dx \text{ is } \underline{\phantom{0}}.
\]

\[
\text{Table 1: Answer Key}
\]

a. The value is positive.

b. The value is negative.

c. The value is zero.

d. There’s no way to know anything about the value.

\[
The \text{ statement that correctly applies to } \int_{2}^{5} f''(x) \, dx \text{ is } \underline{\phantom{0}}.
\]

\[
The \text{ statement that correctly applies to } \int_{2}^{5} f'''(x) \, dx \text{ is } \underline{\phantom{0}}.
\]

\[
The \text{ statement that correctly applies to } \int_{2}^{5} (2x - f(x)) \, dx \text{ is } \underline{\phantom{0}}.
\]
You may use your calculator in any way you find useful on this portion of the test.

1. Suppose that $V(t)$ is the balance ($) of Sharam’s Visa card $t$ days after August 2, 1997. What would you know if $\int_{10}^{20} V'(t) \, dt = -420$? (5 points)

2. Suppose that $f(x)$ is the slope of a trail (ft/mile) $x$ miles from the starting point of the trail. What would you know if $\int_{0}^{2} f(x) \, dx = 250$? (5 points)

3. Find the antiderivative of $g(x) = \frac{1}{x^2 + x}$ with the property that $G(1) = 0$. (4 points)
4. Showing work that develops your Riemann Sum, find the $M_{50}$ estimate for $\int_{0}^{1} \sin(x) \, dx$. Round your estimate to the nearest thousandth. (12 points)

5. For a certain function, $f$, five estimates for the value of $\int_{-100}^{32} f(x) \, dx$ are $L_{40} = 10$, $M_{40} = 12$, $S_{20} = 10.5$, $S_{40} = 11$, and $S_{80} = 11$. Determine the $R_{40}$ estimate for this integral value. Show work that supports your conclusion. (5 points)
Figure 1: $y = f(x)$