1. Find the general antiderivative:

A.

$$\int \left(\frac{1}{x^3} - 2\sin(x) - \frac{1}{x} + y \right) dx$$

B.

$$\int \left(\frac{2}{\sqrt{1-u^2}} \right) du$$

C.

$$\int \left(\frac{t^4 + A}{t^2} \right) dt$$

D.

$$\int (5 \cdot e^t + 7)\, dt$$

2.

A. Calculate the derivative,

$$\frac{d}{dx} \int_2^{\cos(x)} \sin(t^2)\, dt$$

B. Given

$$H(x) = \int_{x^2}^{1} (z+1)^{100}\, dz$$

Determine $H'(x)$.

3. Find (without calculating the integral)

$$\int_{-a}^{a} x^5 \cos(x^2)\, dx.$$

4. Given the function

$$g(x) = 2.5\sin(x) + \frac{1}{x}.$$

Determine the average value of g over the interval $[\pi, \frac{3\pi}{2}]$.

5. Find the exact area between the graphs of $f(x) = \cos(x)$ and $g(x) = -\frac{1}{2}$ on the interval $[2\pi, \frac{5\pi}{2}]$.

6. Suppose that g is an odd function and suppose

$$\int_a^b g(x)\, dx = 4$$

and

$$\int_a^b h(x)\,dx = -5,$$

where a and b are postive constants. Find the values of

A.

$$\int_{-a}^{-b} g(x)\,dx.$$

B.

$$\int_b^a g(x)\,dx.$$

C.

$$\int_a^b (g(x) + 7\,h(x) + 3)\,dx.$$

7. Given the differential equation,

$$\frac{dW}{dx} = 2e^x + 1, \quad W(0) = 2$$

Find the solution for W.

8. Let $f'(x)$ be given by the graph in figure 5.61 in HGM calc on page 270. Suppose f is continuous and $f(0) = 2$.

A. Which is greater, $f(1)$ or $f(2)$?
B Find the x-values of the critical points of $f(x)$.
C. Determine the y-values of the critical points of $f(x)$.
D. Sketch a graph of $f(x)$.

9. Let $f''(x)$ be given by the graph in figure 5.64 in HGM calc on page 271. Suppose f' and f are continuous and $f'(0) = f(0) = 0$. Where is

A. $f'(x)$ the greatest?

B. $f'(x)$ the least?

C. $f(x)$ the greatest?

D $f(x)$ the least?

10. Given the table

t	$v(t)$
0	2
2	2.5
4	4
6	8
8	9
10	11

Estimate

$$\int_0^{10} v(t)\,dt.$$

11. A tomato is thrown upward from a bridge 40 m above the ground at 30 m/sec. How high does the tomato go, and when does it reach its highest point? Use

$$g = 9.8\text{m/sec}^2$$

and

$$\frac{dv}{dt} = -g.$$

12. Without computing the sums, find the difference between the right-hand and left-hand Riemann sums if we use $n = 100$ subintervals to approximate

$$\int_1^2 (x^3 + 2)\,dx.$$

13. Suppose water is pumped into a tank at a rate of

$$r(t) = 3e^{-t} + 1 \quad \text{liter/minute}$$

and suppose that the amount of water at time $t = 0$ is 100 liter. Find the exact amount of water in the tank in the first 3 hours.