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 5.64 in HGM calc on page 288. 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 5.69 in HGM calc on page 289. 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. (Problem HGM,calc 5.1.16) Roger runs a marathon. His friend Jeff rides behind him on a bicycle and clocks his speed every 15 minutes. Roger starts out strong, but after an hour and a half he is so exhausted that he has to stop. Jeff's data follows.

Time since start (min)	speed (mph)
0	10
15	9
30	6
45	5
60	4
75	2
90	0

A. Give upper and lower estimates for the distance Roger ran in total during the entire hour and a half.
B. How often would Jeff have needed to measure Roger's speed in order to find lower and upper estimates within 0.2 mile of the actual distance he ran?

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.

14. Find the limit if the limit exists:

A

$$\lim_{x \to 0} \frac{\sinh(x)\cos(2x)}{\sin(3x)}$$

B

$$\lim_{x \to \infty} x^2 e^{-5x}$$

C

$$\lim_{x \to \infty} (2 - \cos(\tfrac{5}{x}))^x$$

D

$$\lim_{x \to \infty} \frac{3^x}{x^2}$$

E

$$\lim_{x \to \frac{\pi}{2}} \frac{\cos^2(t)}{t - \frac{\pi}{2}}$$

15. Exercise 4.6 number 30
16. Exercise 4.6 number 34
17. Exercise 4.6 number 35
18. Exercise Review chapter 5 number 41