

Each problem is worth 10 points. For full credit provide good justification for your answers.

1. State the definition of the definite integral of a function $f(x)$ on the interval $[a, b]$.

2. Evaluate $\int_0^9 \sqrt{x} \, dx$ exactly.

3. The following table of values for $v(t)$ gives the position (in feet beyond the point where the car was at time 0) of a car t seconds after the driver hits the brakes because they saw a glowing purple giraffe.

t	$v(t)$
0.0	88
0.5	78
1.0	56
1.5	35
2.0	20
2.5	9
3.0	0

Find L_3 , R_3 , and M_3 , the left-hand, right-hand, and midpoint approximations for the distance travelled by the car over the three seconds it takes to come to a stop.

4. If $\int_0^7 f(x) dx = 12$, $\int_0^5 f(x) dx = 3$, and $\int_3^5 f(x) dx = 4$, what is $\int_3^7 3 \cdot f(x) dx$ and why?

5. A ball is thrown off a 100 ft cliff with an initial upward velocity of 96 ft/s. The acceleration due to gravity is -32 ft/s^2 . Find the ball's height above the bottom of the cliff after 5 seconds.

6. If a company's expected profits t years from now, in millions of dollars per year, are given by $p(t) = 40 + 5t$, what total profit can the company expect over the next five years?

7. The first edition of the *Cliff'sNotes Calculus Quick Review* says on page 116 that the area A of the region bounded by the graph of $f(x)$, the x axis, and the lines $x = a$ and $x = b$ is given by $A = \left| \int_a^b f(x) dx \right|$ when the function $f(x)$ is sometimes above and sometimes below the x axis.

Explain in at least a few sentences why the absolute value bars in this expression do or don't accurately express the actual area bounded by these curves.

8. Let $f(x) = \int_0^x \cos(t^2) dt$.

(a) What is $f(0)$?

(b) What is $f'(x)$?

9. Evaluate $\int \frac{3}{(2x-8)^4} dx$.

10. In Calc 2 you learn why $\int_0^r 2\pi x \left(h - \frac{hx}{r} \right) dx$ represents the volume of a cone with height h and base radius r . Evaluate this integral to find the volume. [Hint: you might want to do some algebra to simplify the function inside the integral before you try to find an antiderivative.]

Extra Credit (5 points possible):

Evaluate $\lim_{x \rightarrow 3} \frac{x}{x-3} \int_3^x \frac{\sin t}{t} dt$