

5.3 The Fundamental Theorem of Calculus

Name:

Date:

P 4. Explain in words what the integral represents and give units.

$$\int_1^3 v(t) dt,$$

where $v(t)$ is velocity in meters/sec and t is time in seconds.

P 5. Explain in words what the integral represents and give units.

$$\int_0^6 a(t) dt,$$

where $a(t)$ is acceleration in km/hr² and t is time in seconds.

P 9. Let $f(t) = F'(t)$. Write the integral $\int_a^b f(t) dt$ and evaluate it using the Fundamental Theorem of Calculus.

$$F(t) = t^2; a = 1, b = 3$$

P 15.

(a) Differentiate $x^3 + x$

(b) Use the Fundamental Theorem of Calculus to find

$$\int_0^2 (3x^2 + 1) dx.$$

P 19. Pollution is removed from a lake on day t at a rate of $f(t)$ kg/day.

(a) Explain the meaning of the statement $f(12) = 500$.

(b) If $\int_5^{15} f(t) dt = 4000$, give the units of the 5, the 15, and the 4000.

(c) Give the meaning of $\int_5^{15} f(t) dt = 4000$.

P 26. Annual coal production in the US (in billion tons per year) is given in the table. Estimate the total amount of coal produced in the US between 1997 and 2009. If $r = f(t)$ is the rate of coal production t years since 1997, write an integral to represent the 1997-2009 coal production.

Year	1997	1999	2001	2003	2005	2007	2009
Rate	1.090	1.094	1.121	1.072	1.132	1.147	1.073

P 39. A car speeds up at a constant rate from 10 to 70 mph over a period of half an hour. Its fuel efficiency (in miles per gallon) increases with speed); values are in the table. Make lower and upper estimates of the quantity of fuel used during the half hour.

Speed (mph)	10	20	30	40	50	60	70
Fuel efficiency (mpg)	15	18	21	23	24	25	26