Review of Integration Name: ____________________
Calculus AP Date: ____________________

1. Rocket A has positive velocity v(t) after being launched upward from an initial height of 0 feet at time t = 0 seconds. The velocity of the rocket is recorded for selected values of t over the interval [0, 80] seconds as shown in the table below. (2006 AB4/BC4)

t (sec)	0	10	20	30	40	50	60	70	80
v(t) (f/s)	5	`14	22	29	35	40	44	47	49

a) Using correct units, explain the meaning of $\int_{10}^{70} v(t)dt$in terms of the rocket's flight.

b) Use a midpoint Riemann sum with 3 subintervals of equal length to approximate $\int_{10}^{70} v(t)dt$

2. A metal wire of length 8 centimeters (cm) is heated at one end, The table below gives selected values of the Temperature T(x) in degrees Celsius, of the wire x cm from the heated end. The function T is decreasing and twice differentiable. (2005 AB3/BC3)

Distance, x (cm)	0	1	5	6	8
Temperature T(x) ^{0}C	100	93	70	62	55

a. Estimate T'(7). Show the work that leads to your answer. Indicate units of measure.
b. Write an integral expression in term of T(x) for the average temperature of the wire. Estimate the average temperature of the wire using a trapezoidal sum with four subintervals indicated by the data in the table. Indicate units of measure.

3. Use trapezoids to estimate the definite integral of $f(x) = -100x^2 + 90x + 14$ from x = 0.1 to x =1. Use 9 increments.

4. The velocity (in mph) of a Piper Club aircraft traveling due west is recorded every minute during the first 10 min after takeoff. Use the Trapezoidal Rule to estimate the distance traveled after 10 minutes.

t	0	1	2	3	4	5	6	7	8	9	10
v(t)	0	50	60	80	90	100	95	85	80	75	85

5. Approximate the area bounded by $f(x) = 4 - x^2$ and the x-axis using

a) Left-hand rectangles and four equal subdivisions
b) Right-hand rectangles and four equal subdivisions
c) Midpoint Rectangles and four equal subdivisions
d) Approximate this area using a Trapezoidal Rule and four equal subdivisions
e) Verify that that the Left-hand approximation and the Right hand approximation give the same result as the Trapezoidal rule

Review of Integration Name: ______________________

Calculus AP Date: ______________________

6. The table below shows the velocity of a remote-controlled toy car as it traveled down a hallway for 10 seconds.

t	0	1	2	3	4	5	6	7	8	9	10
v(t) in/sec	0	6	10	16	14	12	18	22	12	4	2

Estimate the distance traveled by the car using 10 subintervals of length 1 and the following methods

a) Left-hand rectangles
b) Right-hand rectangles

7. The table shows the rate in liters/minute at which water leaked out of a container.

Time (min)	0	1.2	2.3	3.8	5.4
Rate (liters/min)	5.6	4.3	3.1	2.2	1.5

A right hand Riemann sum is computed using the four subintervals indicated by the data in the table. This Riemann sum estimates the total amount of water that has leaked out of the container. What is the estimate?

A) 12.70 *l* B) 14.27 *l* C)16.7 *l* D) 16.95 *l* E) 19.62 *l*

8. The temperature, in degrees Celsius (^{0}C) of a turkey in an oven is a continuous function of time t. Some values of this function are given in the table.

Time (min)	0	5	10	15	20	25
Temperature ^{o}C	24	76	106	124	135	141

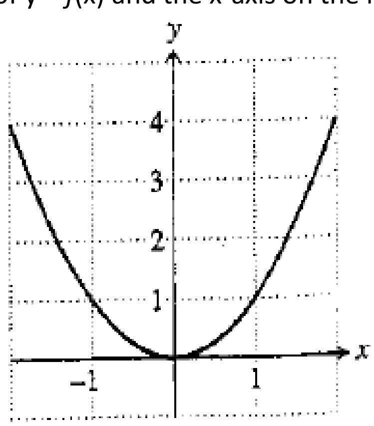
Approximate the average temperature (in degrees Celsius) of the turkey over the interval [0, 25] using a left-hand Riemann sum with subintervals of length 5 minutes.

9. The table below shows the velocity of a remote-controlled toy car as it traveled down a hallway for 10 seconds.

Time (sec)	0	1	2	3	4	5	6	7	8	9	10
Velocity (in/sec)	0	6	10	16	14	12	18	22	12	4	2

Using the Trapezoidal Rule, estimate the distance traveled by the car. Use 10 subintervals of length 1.

10. The graph of y = *f*(x) is shown. Use the Trapezoidal Rule with n = 4 to estimate the area bounded by the graph of y = *f*(x) and the x-axis on the intervals [-2, 2].



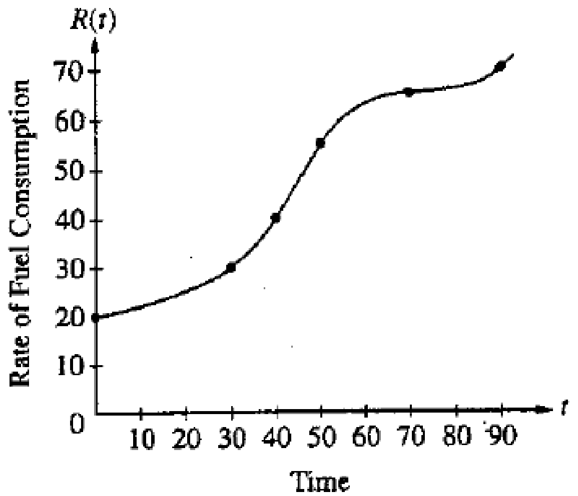
11. The function f is continuous on the closed interval [1, 7] and has the values given in the table.

x	1	4	6	7
f(x)	10	20	40	30

Using subintervals [1, 4], [4, 6], [6, 7], what is the trapezoidal approximation of $\int_a^b f(x)dx$?

a) 110 b) 120 c) 130 d) 140 e) 150

12. The rate of fuel consumption, in gallons per minute, recorded during an airplane flight is given by a twice-differentiable and strictly increasing function R of time t. The graph of R and a table of selected values of R(t) for the time interval [0, 90] minutes are shown below. (2003 AB3)



t (minutes)	$R(t)$ (gallons per minute)
0	20
30	30
40	40
50	55
70	65
90	70

a) Use the data from the table to find an approximation for R'(45). Show the computations that led to your answer. Indicate units of measure.

b) Approximate the value of $\int_0^{90} R(t)dt$ using a left Riemann sum with five subintervals indicated by the data in the table. Is this numerical approximation less than the value of $\int_0^{90} R(t)dt$? Explain your reasoning.

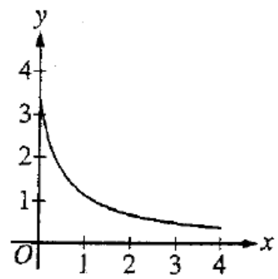
13. On a ship at sea, it is easier to measure how fast you are going than it is to measure how far you have gone. Suppose you are the navigator aboard a supertanker. The velocity of the ship is measured every 15 min and recorded in the table below. Estimate the distance the ship has gone between 7:30 pm and 9:15 pm

Time	mi/hr	Time	mi/hr
7:30	28	8:30	7
7:45	25	8:45	10
8:00	20	9:00	21
8:15	22	9:15	26

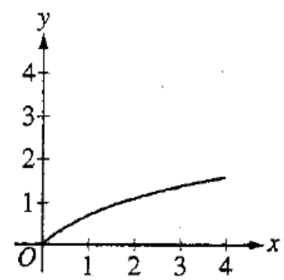
Review of Integration Name: ______________________
Calculus AP Date: ______________________

14. If a trapezoid sum over approximates $\int_0^4 f(x)dx$, and a right Riemann sum under approximates $\int_0^4 f(x)dx$, which of the following could be the graph of y = *f*(x)?

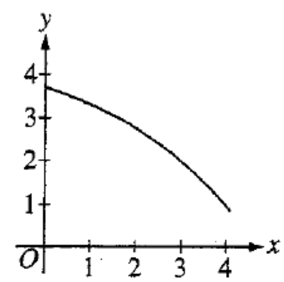
A



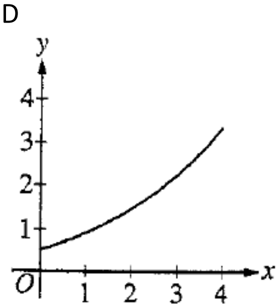
B



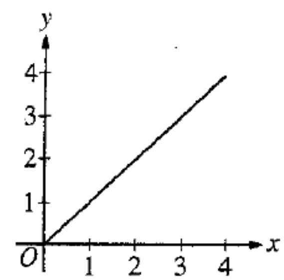
C



D



E



15. Given the following function: $y = 2x - x^2$ and the interval [1, 2], find the area using the following:
    a. 4 Inscribed rectangles
    b. 4 circumscribed rectangles
    c. Trapezoidal Rule with n = 4
    d. Midpoint Formula with n = 4
    e. Find the exact area under the curve

16. Evaluate the following
    a. $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} cosx dx$
    b. $\int_1^9 2x\sqrt{x}$
    c. $\int_0^1 (x^4 - 5x^3 + 3x^2 - 4x - 6)dx$
    d. $\int_{-4}^{4} |x| dx$
    e. $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} sinx dx$
    f. $\int_4^9 \frac{2+x}{2\sqrt{x}} dx$

17. Find the following
    a. $\int \left(x - \frac{1}{2x}\right)^2$
    b. $\int \frac{2x+1}{2x} dx$
    c. $\int \frac{x^3-x-1}{x^2} dx$
    d. $\int \sqrt{x}(\sqrt{x} - 1)dx$
    e. $\int \frac{e^{2x}+1}{e^x} dx$
    f. $\int |x+1| dx$