

Day #54 Homework

1. Using a right Riemann sum over the given intervals,

estimate $\int_5^{35} F(t) dt$

<i>t</i>	5	13	22	27	35
<i>F(t)</i>	44	12	13	17	22

- A. 730
- B. 661
- C. 564
- D. 474
- E. 325

2. For the first six seconds of driving, a car accelerates at a rate of $a(t) = 10 \sin\left(1 + \frac{t^2}{10}\right)$ meters per second². Which one of the following expressions represents the velocity of the car when it first begins to decelerate?

- A. $\int_0^{0.775} a(t) dt$
- B. $\int_0^{2.389} a(t) dt$
- C. $\int_0^{1.715} a(t) dt$
- D. $\int_0^{4.627} a(t) dt$
- E. $\int_0^{3.830} a(t) dt$

3. The rate at which gas is flowing through a large pipeline is given in thousands of gallons per month in the chart below.

<i>t</i> (months)	0	3	6	9	12
<i>R(t)</i> (1000 gallons per month)	43	62	56	60	68

Use a midpoint Riemann sum with two equal subintervals to approximate the number of gallons that pass through the pipeline in a year.

- A. 594,000
- B. 672,000
- C. 732,000
- D. 744,000
- E. 1,068,000

4. Let f be a continuous function on the closed interval $[1, 11]$. If the values of f are given below at three points, use a trapezoidal approximation to find $\int_1^{11} f(x) dx$ using two subintervals.

- A. 165
 B. 172
 C. 190.5
 D. 40
 E. 80

x	1	9	11
$f(x)$	23	14	10

5. If $\int_a^b f(x) dx = 2a - 3b$, then $\int_a^b [f(x) + 3] dx =$

- A. $2a - 3b + 3$
 B. $3b - 3a$
 C. $-a$
 D. $5a - 6b$
 E. $a - 6b$

Use the table below to answer questions 6 and 7. Suppose the function $f(x)$ is a continuous function and f is the derivative of $F(x)$.

x	0	1	2	3
$f(x)$	-1	0	1	-2
$F(x)$	4	3	A	8

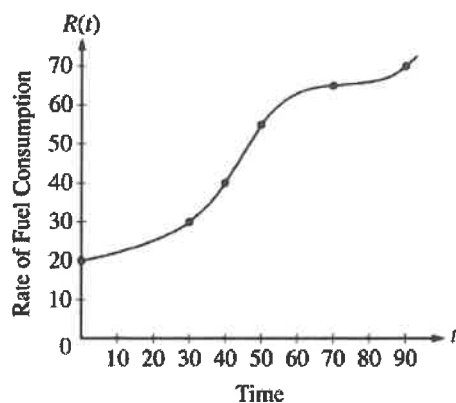
6. What is $\int_1^3 f(x) dx$?

- A. 5
 B. 8
 C. 4
 D. 19
 E. Cannot be determined

7. If the area under the curve of $f(x)$ on the interval $0 \leq x \leq 2$ is equal to the area under the curve $f(x)$ on the interval $2 \leq x \leq 3$, then what is the value of A ?

- A. 4
 B. 2
 C. 5.5
 D. 6
 E. Cannot be determined

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Problem #3



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

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 $0 \leq t \leq 90$ minutes, are shown above.

- (a) Use data from the table to find an approximation for $R'(45)$. Show the computations that lead to your answer. Indicate units of measure.
- (b) The rate of fuel consumption is increasing fastest at time $t = 45$ minutes. What is the value of $R''(45)$? Explain your reasoning.
- (c) Approximate the value of $\int_0^{90} R(t) dt$ using a left Riemann sum with the 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.
- (d) For $0 < b \leq 90$ minutes, explain the meaning of $\int_0^b R(t) dt$ in terms of fuel consumption for the plane. Explain the meaning of $\frac{1}{b} \int_0^b R(t) dt$ in terms of fuel consumption for the plane. Indicate units of measure in both answers.

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Problem #1

Traffic flow is defined as the rate at which cars pass through an intersection, measured in cars per minute. The traffic flow at a particular intersection is modeled by the function F defined by

$$F(t) = 82 + 4 \sin\left(\frac{t}{2}\right) \text{ for } 0 \leq t \leq 30,$$

where $F(t)$ is measured in cars per minute and t is measured in minutes.

- To the nearest whole number, how many cars pass through the intersection over the 30-minute period?
- Is the traffic flow increasing or decreasing at $t = 7$? Give a reason for your answer.
- What is the average value of the traffic flow over the time interval $10 \leq t \leq 15$? Indicate units of measure.
- What is the average rate of change of the traffic flow over the time interval $10 \leq t \leq 15$? Indicate units of measure.

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Problem #2

t (days)	$W(t)$ (°C)
0	20
3	31
6	28
9	24
12	22
15	21

The temperature, in degrees Celsius (°C), of the water in a pond is a differentiable function W of time t . The table above shows the water temperature as recorded every 3 days over a 15-day period.

- Use data from the table to find an approximation for $W'(12)$. Show the computations that lead to your answer. Indicate units of measure.
- Approximate the average temperature, in degrees Celsius, of the water over the time interval $0 \leq t \leq 15$ days by using a trapezoidal approximation with subintervals of length $\Delta t = 3$ days.
- A student proposes the function P , given by $P(t) = 20 + 10te^{(-t/3)}$, as a model for the temperature of the water in the pond at time t , where t is measured in days and $P(t)$ is measured in degrees Celsius. Find $P'(12)$. Using appropriate units, explain the meaning of your answer in terms of water temperature.
- Use the function P defined in part (c) to find the average value, in degrees Celsius, of $P(t)$ over the time interval $0 \leq t \leq 15$ days.

