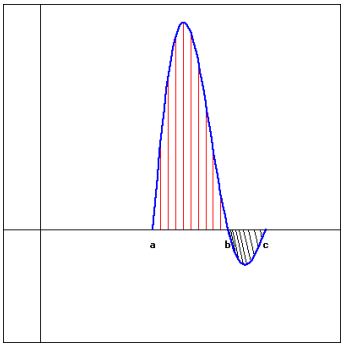
1. (2 pts) Use the following figure, which shows a graph of $f(x)$ to find each of the indicated integrals.



(Click on the graph for a larger version.)

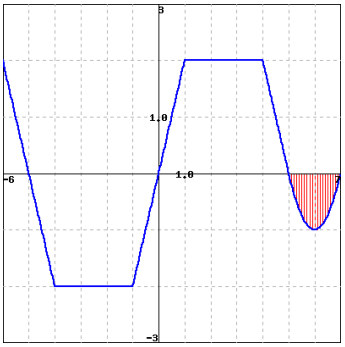
Note that the first area (with vertical, red shading) is 22 and the second (with oblique, black shading) is 2.

A. $\int_a^b f(x)dx =$ _____
B. $\int_b^c f(x)dx =$ _____
C. $\int_a^c f(x)dx =$ _____
D. $\int_a^c |f(x)|dx =$ _____
Answer(s) submitted:

-
-
-
-

(incorrect)

2. (2 pts) Use the graph of $f(x)$ shown below to find the following integrals.



(Click on the graph for a larger version.)

A. $\int_{-5}^0 f(x)dx =$ _____
B. If the vertical red shaded area in the graph has area A, estimate: $\int_{-5}^7 f(x)dx =$ _____
Answer(s) submitted:

-
-

(incorrect)

3. (2 pts) Using the graph of $5+\cos(4x)$, for $0 \le x \le \frac{3\pi}{4}$, list the following quantities in increasing order:

A. the value of the integral $\int_0^{\frac{3\pi}{4}} (5+\cos(4x))dx$,
B. the left sum with $n = 3$ subdivisions, and
C. the right sum with $n = 3$ subdivisions.
(Enter the letter of the value in each box.)

___ < ___ < ___

What is the value of the integral $\int_0^{\frac{3\pi}{4}} (5+\cos(4x))dx$?
value = _____
Answer(s) submitted:

-
-
-
-

(incorrect)

4. (1 pt) Find the average value of $f(x) = 4x+2$ over $[3,6]$
average value = _____
Answer(s) submitted:

-

(incorrect)

5. (2 pts) Coal gas is produced at a gasworks. Pollutants in the gas are removed by scrubbers, which become less and less efficient as time goes on. The following measurements, made at the start of each month, show the rate at which pollutants are escaping (in tons/month) in the gas:

Time (months)	0	1	2	3	4	5	6
Rate	4	6	11	17	23	31	42

A. Make an overestimate and an underestimate of the total quantity of pollutants that escape during the first month.
overestimate = _____ tons
underestimate = _____ tons

B. Make an overestimate and an underestimate of the total quantity of pollutants that escape for the whole six months for which we have data.
overestimate = _____
underestimate = _____

C. How often would measurements have to be made to find an overestimate and an underestimate (for the quantity of pollutants that escaped) during the first six months which differ by exactly 1 ton from each other?
_____ times a month.
Answer(s) submitted:

-
-
-
-

•

(incorrect)

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6. (2 pts) The following table gives the the approximate amount of emissions, E, of nitrogen oxides in millions of metric tons per year in the US. Let t be the number of years since 1940 and $E = f(t)$.

	1940	1950	1960	1970	1980	1990
t	0	10	20	30	40	50
E	6.6	9.8	13.3	18.1	20.6	19.9

Estimate the integral: $\int_0^{50} f(t)dt \approx$ _____

Be sure that you know what the units of your answer are, and what its meaning is!

(Original data from the Statistical Abstract of the US, 1992)

Answer(s) submitted:

•

(incorrect)

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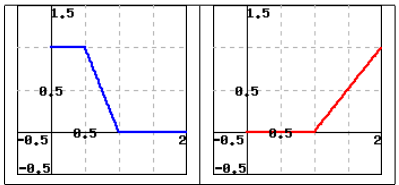
7. (2 pts) The figure below to the left is a graph of $f(x)$, and below to the right is $g(x)$.



$f(x)$ | $g(x)$

(a)

What is the average value of $f(x)$ on $0 \le x \le 2$?

avg value = _____

(b)

What is the average value of $g(x)$ on $0 \le x \le 2$?

avg value = _____

(c)

What is the average value of $f(x) \cdot g(x)$ on $0 \le x \le 2$?

avg value = _____

(d)

Is the following statement true?

$$\text{Average}(f) \cdot \text{Average(g)} = \text{Average}(f \cdot g)$$

- A. Yes
- B. No

Answer(s) submitted:

•
•
•
•

(incorrect)

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8. (2 pts) Graph $f(x) = x(x+5)(x-3)$. Then find the total area between the graph and the x-axis between $x = -5$ and $x = 3$.

area = _____

Next, find

$\int_{-5}^{3} f(x)\,dx =$ _____

Interpret the value of the integral in terms of areas. Be sure you can indicate how it is related to the answer you got for the total area between the graph and the x-axis between $x = -5$ and $x = 3$.

Answer(s) submitted:

•
•

(incorrect)

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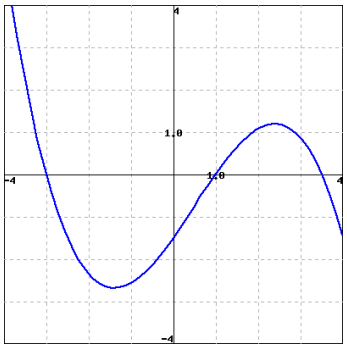
9. (2 pts) Use the figure below, which shows the graph of $y = f(x)$, to answer the following questions.



(Click on the graph to get a larger version.)

A. Estimate the integral: $\int_{-3}^{3} f(x)\,dx \approx$ _____

(You will certainly want to use an enlarged version of the graph to obtain your estimate.)

B. Which of the following average values of f is larger?

- A. Between $x = -3$ and $x = 3$
- B. Between $x = 0$ and $x = 3$

Answer(s) submitted:

•
•

(incorrect)

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10. (1 pt) Let $\int_{-4}^{-1} f(x)dx = 4$, $\int_{-4}^{-3} f(x)dx = 6$, $\int_{-2}^{-1} f(x)dx = 8$.

Find $\int_{-3}^{-2} f(x)dx =$ _____

and $\int_{-2}^{-3} (4f(x) - 6)dx =$ _____

Answer(s) submitted:

•
•

(incorrect)

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11. (1 pt) The value of $\int_0^{-1} (x-4)^2 dx$ is

_____

Answer(s) submitted:

•

(incorrect)

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12. (1 pt) The value of $\int_2^6 \frac{1}{x^2} dx$ is

_____

Answer(s) submitted:

•

(incorrect)

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13. (1 pt) The velocity function is $v(t) = t^2 - 6t + 8$ for a particle moving along a line. Find the displacement (net distance covered) of the particle during the time interval [-3,5].

displacement = _____

Answer(s) submitted:

•

(incorrect)

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14. (1 pt) Evaluate the definite integral

$$\int_4^9 \frac{7}{\sqrt{x}} dx$$

_____

Answer(s) submitted:

•

(incorrect)

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15. (1 pt) Evaluate the definite integral

$$\int_0^{\pi} 8\sin(x) dx$$

_____

Answer(s) submitted:

•

(incorrect)

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