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Teacher:
Period:
Due Date:

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HW 4.4

Objectives

- I will evaluate a definite integral and derivative using technology.
- Describe the meaning of a derivative or integral in a context.
- Determine the units of a derivative or integral.
- Determine net change, starting or final amounts in context.
- Determine the area between two curves.

1.) A test plane flights in a straight line with positive velocity $v(t)$, in miles per minute at time t minutes, where v is a differentiable function. What are the units of the following:

$$\int_0^{40} v(t)dt$$

a. $\text{mi} \cdot \text{min}$
b. mi
c. mi/min
d. mi/min^2

2.) Mosquitoes are reproducing on an island at a rate given by $R(\text{t})$. In order to determine if the number of mosquitoes is increasing at an increasing rate, which of the following operations is needed?

a. Integration
b. Substitution into the function
c. Differentiation
d. Finding the second derivative

3.) The number of gallons of a pollutant in a lake changes at the rate $P(t)$ gallons per day, where t is measured in days. In order to determine the day when the amount of gallons of pollutant are at a minimum, which of the following operations is needed?

a. Integration
b. Substitution into the function
c. Differentiation
d. Finding the second derivative

4.) The function $h(x)$ models the height of a skateboard ramp in meters after x horizontal meters. Which of the following operations would be needed to find the how much the slope is changing?

a. Integration
b. Substitution into the function
c. Differentiation
d. Finding the second derivative

5.) The rate, in calories per hour, at which a person using an exercise machine burns calories is modeled by the function f. What are the units of $f'(22)$?

a. $\text{Cal} \cdot \text{hr}$
b. Cal
c. Cal/hr
d. Cal/hr^2

6.) A car travels on a straight track. During the time interval $0 \leq t \leq 60$ seconds, the velocity, in feet per second, is given by $v(t)$. What are the units of the expression:

$$\frac{1}{30}\int_{30}^{60} v(t)dt$$

a. $\text{ft} \cdot \text{sec}$
b. ft
c. ft/ sec
d. ft/ sec^2

7.) The number people in an amusement park is modeled by the function $E(t)$ at hour t. In order to find when the number of people in the park is at a maximum, which of the following operations is needed?

a. Integration
b. Substitution into the function
c. Differentiation
d. Finding the second derivative

8.) Water is evaporating from a container at a rate given by the equation $W(t)$ measured in cubic centimeters per minute. What are the units of the following expression:

$$\frac{1}{50}\int_0^{50} W(t)dt$$

a. cm
b. cm^2
c. $\text{cm}^3\text{/min}$
d. $\text{cm}^3\text{/min}^2$

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9.) Determine $f'(1)$ given
$$f(x) = e^{-x}\sqrt{x+1}$$

10.) Determine $g'(-2)$ given
$$g(x) = \sin^3(\ln(4+x))$$

11.) Determine
$$\int_1^3 e^{-x}\sqrt{x+1}dx$$

12.) Determine
$$\int_{-2}^{1} \sin^3(\ln(4+x))\,dx$$

13.) For $h'(x) = x\tan(\sin^2 x)$ and $h\left(\frac{\pi}{4}\right) = 1$

a. $h''\left(\frac{\pi}{4}\right) = ?$

b. Determine $h\left(\frac{7\pi}{6}\right)$.

14.) The rate at which people enter an auditorium for a rock concert is modeled by the function R given by $R(t) = 1380t^2 - 675t^3$ for $0 \le t \le 2$ hours; $R(t)$ is measured in people per hour. No one is in the auditorium at time $t = 0$, when the doors open. The doors close and the concert begins at time $t = 2$.

a. How many people are in the auditorium when the concert begins?

b. The total wait time for all the people in the auditorium is found by adding the time each person waits, starting at the time the person enters the auditorium and ending when the concert begins. The function w models the total wait time for all people who enter the auditorium before time t. The derivative of w is given by $w'(t) = (2-t)R(t)$. Find $w(2) - w(1)$, the total wait time for those who enter the auditorium after time $t = 1$.

15.) Mighty Cable Company manufactures cable that sells for \$120 per meter. For a cable of fixed length, the cost of producing a portion of the cable varies with its distance from the beginning of the cable. Mighty reports that the cost to produce a portion of a cable that is x meters from the beginning of the cable is $6\sqrt{x}$ dollars per meter. (Note: Profit is defined to be the difference between the amount of money received by the company for selling the cable and the company's cost of produing the cable.)

a. Find Mighty's profit on the sale of a 25-meter cable.

b. Using correct units, explain the meaning of $\int_{25}^{30} 6\sqrt{x}dx$ in the context of this problem.

c. Write an expression, involving an integral, that represents Mighty's profit on the sale of a cable that is k meters long.

16.) When a certain grocery store opens, it has 50 pounds of bananas on a display table. Customers remove bananas from the display table at a rate modeled by
$$f(t) = 10 + (0.8t)\sin\left(\frac{t^3}{100}\right) \text{ for } 0 < t \le 12$$
Where $f(t)$ is measured in pounds per hour and t is the number of hours after the store opened.

a. How many pounds of bananas are removed from the display table during the first 2 hours the store is open?

b. Find $f'(7)$. Using correct units, explain the meaning of $f'(7)$ in the context of the problem.

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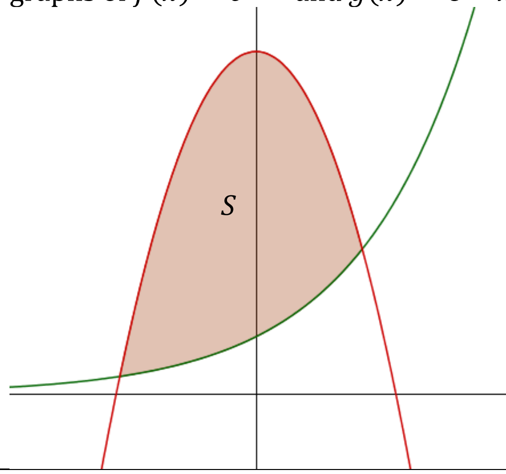
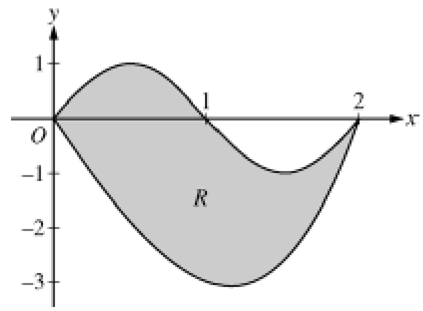
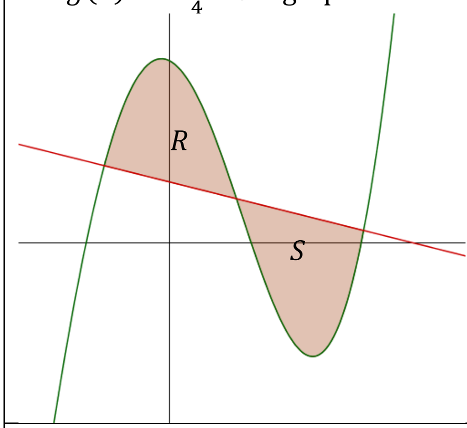
17.) Find area of the region S below enclosed by the graphs of $f(x) = e^{0.5x}$ and $g(x) = 6 - x^2$.

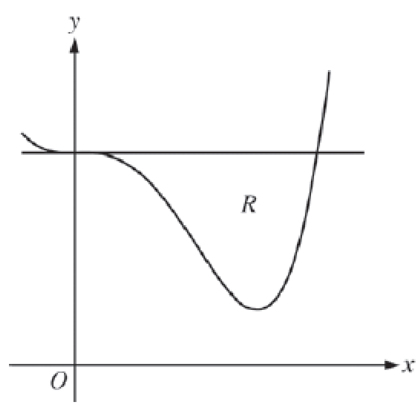




18.) Let R be the region bounded by the graphs of $y = \sin(\pi x)$ and $y = x^3 - 4x$, as shown in the figure above.

19.) Determine the area of the regions R and S bounded by the functions $f(x) = \frac{x^3}{4} - \frac{x^2}{3} - \frac{x}{2} + 3\cos x$ and $g(x) = -\frac{1}{4}x + 1$ graphed below.





20.) Let R be the region enclosed by the graph of $f(x) = x^4 - 2x^3 + 4$ and the horizontal line $y = 4$, as shown in the figure above.

a. What is the area of R?

b. The vertical line $x = k$ divides R into two regions with equal areas. Write, but do not solve, an equation involving integral expressions whose solution gives the value k.

c. Okay, now solve…