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5/4/07

Answer the following 6 multiple choice and 2 open response problems. No work need be shown for multiple-choice problems. Clearly write the letters of your multiple-choice responses in the appropriate spaces provided on this page. Open response problems will be graded in the same manner as AP open response problems. The AP exam allows for two minutes per multiple-choice, 15 minutes per open response problem. You may want to allocate your time in the same manner.

1. _____

2. _____

3. _____

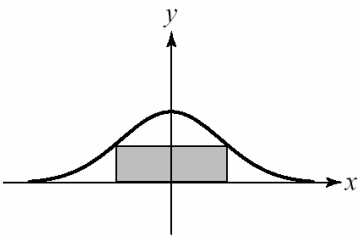
4. _____

5. _____

6. _____

1. A rectangle is inscribed under the curve $y = e^{-x^2}$ as shown below. Find the maximum possible area of the rectangle.

(A) 0.43
(B) 0.61
(C) 0.71
(D) 0.86
(E) 1.77



2. The base of a solid is the shape of a region between the *x*-axis and one arch of the curve $y = 2\sin(2x)$. Each cross section cut perpendicular to the *x*-axis is a semicircle whose diameter runs from the *x*-axis to the curve. Find the volume of the solid.

(A) 1.23 **(B)** 2.47 **(C)** 3.42 **(D)** 3.91 **(E)** 4.00

3. Let region *R* be the area bounded by the curves $y = \sqrt{x-2}$, $y = x - 4$, and the *x*-axis. Find the volume when *R* is revolved around the line $x = 1$.

(A) 80.425 **(B)** 18.933 **(C)** 59.481 **(D)** 20.106 **(E)** 3.333

4. The velocity of a particle moving along the x-axis is given by $v(t) = t\sin(t^2)$. Find the total distance traveled by the particle from $t = 0$ to $t = 3$ (round to the nearest 0.5).

(A) 1.0 **(B)** 1.5 **(C)** 2.0 **(D)** 2.5 **(E)** 3.0

5. Let $l(x)$ be the linear approximation to the function $f(x) = e^{-x}$ at $x = 1$. Evaluate $l(.5)$.

(A) 0.607 **(B)** 0.552 **(C)** 0.368 **(D)** 0.920 **(E)** 1.104

6. Let $g(x) = \int_0^x (t+2)(t-3)e^{-t}dt$. For what values of x is g decreasing?

(A) $(-\infty,-1.49)$ **(B)** $(.37,\infty)$ **(C)** $(-2,3)$ **(D)** $(-\infty,-2.72)\cup(0,\infty)$ **(E)** $(3,\infty)$

Open Response Problem 1

t (hours)	$R(t)$ (gallons per hour)
0	9.6
3	10.4
6	10.8
9	11.2
12	11.4
15	11.3
18	10.7
21	10.2
24	9.6

The rate at which water flows out of a pipe, in gallons per hour, is given by a differentiable function of time t. The table above shows the rate as measured every 3 hours for a 24 hour period.

a. Use a midpoint Riemann sum with 4 equal sub-divisions to approximate $\int_0^{24} R(t)dt$. Using correct units, explain the meaning of your answer in terms of water flow.

b. Is there some time t, $0 < t < 24$, such that $R'(t) = 0$? Justify your answer.

b. The rate of water flow $R(t)$ can be approximated by the quadratic function $Q(t) = \frac{1}{79}(768 + 23t - t^2)$. Use $Q(t)$ to approximate the average rate of water flow during the 24-hour time period. Indicate units of measure.

Open Response Problem 2

Consider region **R** bounded by the line $y = x - 1$, the parabola $y^2 = 2x + 6$, and the x-axis.

a. Draw a detailed sketch of region R.

b. Find the area of region **R**.

c. Find the volume of revolution if region **R** is rotated around the line $x = 5$.