AP Calculus BC
Chapter 7 Test – Review Outline (2013-14)

Section 7.1 – Integrals as Net Change

- Position, velocity and acceleration functions
  - Moving right/left or up/down – look at sign of $v(t)$
  - Speeding up/slowing down – compare sign of $v(t)$ and $a(t)$
- Displacement from a to b: $\int_a^b v(t)dt$; Total distance from a to b: $\int_a^b |v(t)| dt$
- $x(t_2) = x(t_1) + \int_{t_1}^{t_2} v(t)dt$
- Consumption over time: when you want to find the cumulative effect of a rate of change over time, integrate it (potato problem, amusement park problem)
- Net change from data: approximating the integral with rectangles, trapezoids

Section 7.2 – Areas in a Plane

- Areas between curves – with respect to x and y
- Use geometry or symmetry to save time, when possible

Section 7.3 – Volumes

- Slabs – integrate cross sectional area function $A(x)$ – circles, semicircles, squares, etc.
- Disks:
  - $V = \pi \int_{x_1}^{x_2} [f(x)]^2 \, dx$ (around x – axis)
  - $V = \pi \int_{y_1}^{y_2} [f(y)]^2 \, dy$ (around y – axis)
- Washers: $\pi \int R^2 - r^2$
  - $V = \pi \int_{x_1}^{x_2} [f(x)]^2 - [g(x)]^2 \, dx$ (around x – axis)
  - $V = \pi \int_{y_1}^{y_2} [f(y)]^2 - [g(y)]^2 \, dy$ (around y – axis)
- Cylindrical shells:
  - $V = 2\pi \int r(x)h(x)dx$ (around y – axis)
  - $V = 2\pi \int r(y)h(y)dy$ (around x – axis)

Section 7.4 – Arc Length and Surface Area

- Arc length:
  - $L = \int_{x_1}^{x_2} \sqrt{1 + [f'(x)]^2} \, dx$ (w/ respect to x)
  - $L = \int_{y_1}^{y_2} \sqrt{1 + [f'(y)]^2} \, dy$ (w/ respect to y)

1. Any unfinished problems from Chapter 7 AP Packet
2. p. 413 #1, 5, 13, 21, 24, 27, 31, 47

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Question 1

For $0 \le t \le 6$, a particle is moving along the x-axis. The particle's position, $x(t)$, is not explicitly given. The velocity of the particle is given by $v(t) = 2\sin\left(e^{t/4}\right) + 1$. The acceleration of the particle is given by $a(t) = \frac{1}{2}e^{t/4}\cos\left(e^{t/4}\right)$ and $x(0) = 2$.

(a) Is the speed of the particle increasing or decreasing at time $t = 5.5$? Give a reason for your answer.

(b) Find the average velocity of the particle for the time period $0 \le t \le 6$.

(c) Find the total distance traveled by the particle from time $t = 0$ to $t = 6$.

(d) For $0 \le t \le 6$, the particle changes direction exactly once. Find the position of the particle at that time.

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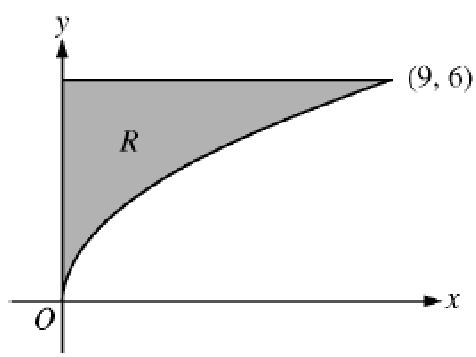
Question 4



Let R be the region in the first quadrant bounded by the graph of $y = 2\sqrt{x}$, the horizontal line $y = 6$, and the y-axis, as shown in the figure above.

(a) Find the area of R.

(b) Write, but do not evaluate, an integral expression that gives the volume of the solid generated when R is rotated about the horizontal line $y = 7$.

(c) Region R is the base of a solid. For each y, where $0 \le y \le 6$, the cross section of the solid taken perpendicular to the y-axis is a rectangle whose height is 3 times the length of its base in region R. Write, but do not evaluate, an integral expression that gives the volume of the solid.

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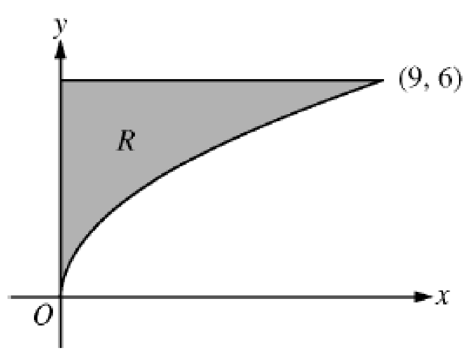

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