

AP Exam Structure

- 27 MC Non Calculator 55 Minutes
- 18 MC Calculator Questions 50 Minutes
- 2 FRQ Calculator Questions 30 Minutes
- 4 FRQ Non-Calculator Questions 60 Minutes

What to Expect: Every year, or every other year you will see

- An Area, Volume, Volume—usually in the calculator
- A rate of change/accumulation application problem – usually in the calculator
- A position, velocity, acceleration, distance, displacement problem
- A Riemann Sum application problem
- A Slope Field/DEQ/Separation of Variables/Exponential Growth problem
- A graph of the derivative/ increasing/decreasing concave up/down problem
- A wild card conceptual problem- tangent line applications, FTC II, etc

Practice them all!

Calculator Skills

1. Graph a function in an appropriate window. 2 Graph its derivative. 3. Find the derivative. 4. Find the definite integral. 5. Find zeroes and intercepts. 6. Find the value of a function at a specific point.

The Following Questions are taken from the 2004 AP Tests version A and B. All questions, solutions and scoring for past exams are on the CollegeBoard website. Take as many tests as you can and learn from your mistakes

Question 1

Let R be the region enclosed by the graph of $y = \sqrt{x-1}$, the vertical line $x = 10$, and the x -axis.

- (a) Find the area of R .
- (b) Find the volume of the solid generated when R is revolved about the horizontal line $y = 3$.
- (c) Find the volume of the solid generated when R is revolved about the vertical line $x = 10$.

Question 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.

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

Question 3

A particle moves along the y -axis so that its velocity v at time $t \geq 0$ is given by $v(t) = 1 - \tan^{-1}(e^t)$.

At time $t = 0$, the particle is at $y = -1$. (Note: $\tan^{-1} x = \arctan x$)

- (a) Find the acceleration of the particle at time $t = 2$.
- (b) Is the speed of the particle increasing or decreasing at time $t = 2$? Give a reason for your answer.
- (c) Find the time $t \geq 0$ at which the particle reaches its highest point. Justify your answer.
- (d) Find the position of the particle at time $t = 2$. Is the particle moving toward the origin or away from the origin at time $t = 2$? Justify your answer.

Question 2

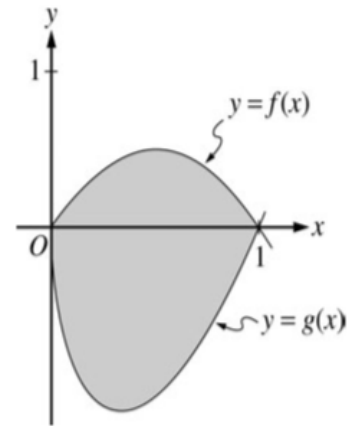
For $0 \leq t \leq 31$, the rate of change of the number of mosquitoes on Tropical Island at time t days is modeled by $R(t) = 5\sqrt{t} \cos\left(\frac{t}{5}\right)$ mosquitoes per day. There are 1000 mosquitoes on Tropical Island at time $t = 0$.

- (a) Show that the number of mosquitoes is increasing at time $t = 6$.
- (b) At time $t = 6$, is the number of mosquitoes increasing at an increasing rate, or is the number of mosquitoes increasing at a decreasing rate? Give a reason for your answer.
- (c) According to the model, how many mosquitoes will be on the island at time $t = 31$? Round your answer to the nearest whole number.
- (d) To the nearest whole number, what is the maximum number of mosquitoes for $0 \leq t \leq 31$? Show the analysis that leads to your conclusion.

Question 2

Let f and g be the functions given by $f(x) = 2x(1 - x)$ and $g(x) = 3(x - 1)\sqrt{x}$ for $0 \leq x \leq 1$. The graphs of f and g are shown in the figure above.

- (a) Find the area of the shaded region enclosed by the graphs of f and g .
- (b) Find the volume of the solid generated when the shaded region enclosed by the graphs of f and g is revolved about the horizontal line $y = 2$.
- (c) Let h be the function given by $h(x) = kx(1 - x)$ for $0 \leq x \leq 1$. For each $k > 0$, the region (not shown) enclosed by the graphs of h and g is the base of a solid with square cross sections perpendicular to the x -axis. There is a value of k for which the volume of this solid is equal to 15. Write, but do not solve, an equation involving an integral expression that could be used to find the value of k .



A particle moves along the x -axis so that its velocity v at time t , for $0 \leq t \leq 5$, is given by $v(t) = \ln(t^2 - 3t + 3)$. The particle is at position $x = 8$ at time $t = 0$.

- (a) Find the acceleration of the particle at time $t = 4$.
- (b) Find all times t in the open interval $0 < t < 5$ at which the particle changes direction. During which time intervals, for $0 \leq t \leq 5$, does the particle travel to the left?
- (c) Find the position of the particle at time $t = 2$.
- (d) Find the average speed of the particle over the interval $0 \leq t \leq 2$.