

2. A particle moving along a curve in the xy -plane has position $(x(t), y(t))$ at time t seconds, where $x(t)$ and $y(t)$ are measured in centimeters. It is known that $x'(t) = 8t - t^2$ and $y'(t) = -t + \sqrt{t^{1.2} + 20}$. At time $t = 2$ seconds, the particle is at the point $(3, 6)$.
- (a) Find the speed of the particle at time $t = 2$ seconds. Show the setup for your calculations.
 - (b) Find the total distance traveled by the particle over the time interval $0 \leq t \leq 2$. Show the setup for your calculations.
 - (c) Find the y -coordinate of the position of the particle at the time $t = 0$. Show the setup for your calculations.
 - (d) For $2 \leq t \leq 8$, the particle remains in the first quadrant. Find all times t in the interval $2 \leq t \leq 8$ when the particle is moving toward the x -axis. Give a reason for your answer.

Write your responses to this question only on the designated pages in the separate Free Response booklet. Write your solution to each part in the space provided for that part.

END OF PART A

Name:

AP Calculus BC: **2024**

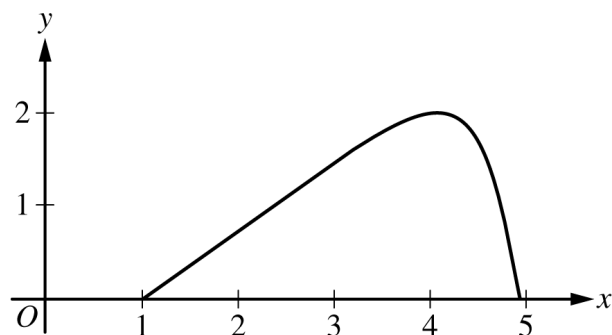
CALCULUS BC

SECTION II, Part B

Time—1 hour

4 Questions

NO CALCULATOR IS ALLOWED FOR THESE QUESTIONS.



2. For $0 \leq t \leq \pi$, a particle is moving along the curve shown so that its position at time t is $(x(t), y(t))$, where $x(t)$ is not explicitly given and $y(t) = 2 \sin t$. It is known that $\frac{dx}{dt} = e^{\cos t}$. At time $t = 0$, the particle is at position $(1, 0)$.
- (a) Find the acceleration vector of the particle at time $t = 1$. Show the setup for your calculations.
- (b) For $0 \leq t \leq \pi$, find the first time t at which the speed of the particle is 1.5. Show the work that leads to your answer.
- (c) Find the slope of the line tangent to the path of the particle at time $t = 1$. Find the x -coordinate of the position of the particle at time $t = 1$. Show the work that leads to your answers.
- (d) Find the total distance traveled by the particle over the time interval $0 \leq t \leq \pi$. Show the setup for your calculations.

Write your responses to this question only on the designated pages in the separate Free Response booklet. Write your solution to each part in the space provided for that part.

Name:

AP Calculus BC: **2023**

END OF PART A

CALCULUS BC

SECTION II, Part B

Time—1 hour

4 Questions

NO CALCULATOR IS ALLOWED FOR THESE QUESTIONS.

2. At time $t \geq 0$, a particle moving along a curve in the xy -plane has position $(x(t), y(t))$ with velocity vector $v(t) = (\cos(t^2), e^{0.5t})$. At $t = 1$, the particle is at the point $(3, 5)$.
- (a) Find the x -coordinate of the position of the particle at time $t = 2$.
 - (b) For $0 < t < 1$, there is a point on the curve at which the line tangent to the curve has a slope of 2.
At what time is the object at that point?
 - (c) Find the time at which the speed of the particle is 3.
 - (d) Find the total distance traveled by the particle from time $t = 0$ to time $t = 1$.
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END OF PART A OF SECTION II