

2013 AP[®] CALCULUS AB FREE-RESPONSE QUESTIONS

CALCULUS AB

SECTION II, Part A

Time—30 minutes

Number of problems—2

A graphing calculator is required for these problems.

1. On a certain workday, the rate, in tons per hour, at which unprocessed gravel arrives at a gravel processing plant is modeled by $G(t) = 90 + 45\cos\left(\frac{t^2}{18}\right)$, where t is measured in hours and $0 \leq t \leq 8$. At the beginning of the workday ($t = 0$), the plant has 500 tons of unprocessed gravel. During the hours of operation, $0 \leq t \leq 8$, the plant processes gravel at a constant rate of 100 tons per hour.
- (a) Find $G'(5)$. Using correct units, interpret your answer in the context of the problem.
 - (b) Find the total amount of unprocessed gravel that arrives at the plant during the hours of operation on this workday.
 - (c) Is the amount of unprocessed gravel at the plant increasing or decreasing at time $t = 5$ hours? Show the work that leads to your answer.
 - (d) What is the maximum amount of unprocessed gravel at the plant during the hours of operation on this workday? Justify your answer.
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2. A particle moves along a straight line. For $0 \leq t \leq 5$, the velocity of the particle is given by $v(t) = -2 + (t^2 + 3t)^{6/5} - t^3$, and the position of the particle is given by $s(t)$. It is known that $s(0) = 10$.
- (a) Find all values of t in the interval $2 \leq t \leq 4$ for which the speed of the particle is 2.
 - (b) Write an expression involving an integral that gives the position $s(t)$. Use this expression to find the position of the particle at time $t = 5$.
 - (c) Find all times t in the interval $0 \leq t \leq 5$ at which the particle changes direction. Justify your answer.
 - (d) Is the speed of the particle increasing or decreasing at time $t = 4$? Give a reason for your answer.
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END OF PART A OF SECTION II