

2010 AP<sup>®</sup> CALCULUS BC FREE-RESPONSE QUESTIONS

CALCULUS BC  
SECTION II, Part A

Time—45 minutes  
Number of problems—3

A graphing calculator is required for some problems or parts of problems.

1. There is no snow on Janet's driveway when snow begins to fall at midnight. From midnight to 9 A.M., snow accumulates on the driveway at a rate modeled by  $f(t) = 7te^{\cos t}$  cubic feet per hour, where  $t$  is measured in hours since midnight. Janet starts removing snow at 6 A.M. ( $t = 6$ ). The rate  $g(t)$ , in cubic feet per hour, at which Janet removes snow from the driveway at time  $t$  hours after midnight is modeled by

$$g(t) = \begin{cases} 0 & \text{for } 0 \leq t < 6 \\ 125 & \text{for } 6 \leq t < 7 \\ 108 & \text{for } 7 \leq t \leq 9. \end{cases}$$

- (a) How many cubic feet of snow have accumulated on the driveway by 6 A.M.?
- (b) Find the rate of change of the volume of snow on the driveway at 8 A.M.
- (c) Let  $h(t)$  represent the total amount of snow, in cubic feet, that Janet has removed from the driveway at time  $t$  hours after midnight. Express  $h$  as a piecewise-defined function with domain  $0 \leq t \leq 9$ .
- (d) How many cubic feet of snow are on the driveway at 9 A.M.?

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WRITE ALL WORK IN THE PINK EXAM BOOKLET.

**2013 AP<sup>®</sup> CALCULUS BC FREE-RESPONSE QUESTIONS**

**CALCULUS BC  
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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