



AP[®] Calculus BC (Operational) 2004 Sample Student Responses

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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.

Work for problem 1(a)

$$\int_0^{30} [82 + 4\sin(\frac{t}{2})] dt \approx 2474 \text{ cars}$$

2474 cars pass through over the 30-minute period.

Work for problem 1(b)

$$F(t) = 82 + 4\sin(\frac{t}{2})$$

$$F'(t) = 4 \cdot \frac{1}{2} \cdot \cos(\frac{t}{2})$$

$$= 2\cos(\frac{t}{2})$$

$$F'(7) = 2\cos(\frac{7}{2}) = -1.8729$$

Since the derivative of $F(t)$ is negative,
the traffic flow is decreasing.

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Continue problem 1 on page 5.

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A₂

Work for problem 1(c)

Average value theo: $\frac{\int_a^b f(x) dx}{b-a}$

$$\frac{\int_{10}^{15} [82 + 4\sin(\frac{t}{2})] dt}{15-10} = \frac{409.4962}{5} = 81.8992 \approx 82 \text{ cars/min}$$

Work for problem 1(d)

$$\begin{aligned} & \frac{\int_{10}^{15} R'(t) dt}{15-10} \\ &= \frac{\int_{10}^{15} [2\cos(\frac{t}{2})] dt}{5} \\ &= \frac{7.587697}{5} \\ &= 1.5175 \\ &\approx 2 \text{ cars/min}^2 \end{aligned}$$

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D

CALCULUS AB
SECTION II, Part A

Time—45 minutes

Number of problems—3

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

Work for problem 1(a)

$$\int_0^{30} \left[82 + 4 \sin\left(\frac{t}{2}\right) \right] dt$$

2474 cars

Work for problem 1(b)

$$F(7) = 82 + 4 \sin\left(\frac{7}{2}\right)$$

$$F(7) = 83.403$$

Traffic flow is increasing
because $F(7)$ is positive.

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D₂

Work for problem 1(c)

$$\frac{1}{5} \int_{10}^{15} [82 + 4\sin(\frac{t}{5})] dt =$$

81.899 cars

Work for problem 1(d)

$$\frac{F(15) - F(10)}{15 - 10} = \frac{85.752 - 78.164}{5}$$

1.518 cars per minute

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