



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

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B₁

Work for problem 3(a)

$$\frac{dx}{dt} = 3 + \cos(t^2)$$

$$\int dx = \int (3 + \cos(t^2)) dt$$

$$x = \int (3 + \cos(t^2)) dt$$

$$(a) \int_2^4 (3 + \cos(t^2)) dt \approx 6.1330$$

$$x(4) = x(2) + 6.1330 = 1 + 6.1330 = 7.1330$$

$$x(4) = 7.1330$$

Work for problem 3(b)

$$\left. \frac{dx}{dt} \right|_{t=2} = 3 + \cos(2^2) = 2.3464$$

$$\text{slope} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}} = \frac{-7}{2.3464} = -2.9833$$

$$8 = (-2.9833)(1) + b$$

$$b = 10.9833$$

$$y = -2.9833x + 10.9833$$

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B2

Work for problem 3(c)

$$\left. \frac{dx}{dt} \right|_{t=2} = 3 + \cos(2^2) = 2.3464$$

$$\left. \frac{dy}{dt} \right|_{t=2} = -7$$

$$\text{speed} = |v| = \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2} = \sqrt{(2.3464)^2 + (-7)^2} = \boxed{7.3828}$$

Work for problem 3(d)

$$\frac{\frac{dy}{dt}}{\frac{dx}{dt}} = -2t + 1 = \frac{dy}{3 + \cos(t^2)}$$

$$\frac{dy}{dt} = (2t + 1)(3 + \cos(t^2))$$

$$\left. \frac{d^2x}{dt^2} \right|_{t=4} = -2t \sin(t^2) \Big|_{t=4} = -2(4) \sin(4^2) = 2.3032$$

$$\begin{aligned} \left. \frac{d^2y}{dt^2} \right|_{t=4} &= (2t + 1)(-2t \sin t^2) + 2(3 + \cos(t^2)) \Big|_{t=4} \\ &= (2(4) + 1)(-2(4) \sin(4^2)) + 2(3 + \cos(4^2)) = 24.8137 \end{aligned}$$

$$\boxed{a = (2.3032, 24.8137)}$$

END OF PART A OF SECTION II

IF YOU FINISH BEFORE TIME IS CALLED, YOU MAY CHECK YOUR WORK ON

PART A ONLY. DO NOT GO ON TO PART B UNTIL YOU ARE TOLD TO DO SO.

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C1

Work for problem 3(a)

$$x(4) = 1 + \int_2^4 (3 + \cos(t^2))$$

$$x(4) = 7.133$$

Work for problem 3(b)

$$\text{at } t=2 \quad \frac{dx}{dt} = 3 + \cos(2^2)$$

$$\frac{dy}{dx} = \frac{7}{2.3464}$$

$$\frac{dy}{dx} = 2.9833$$

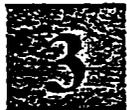
$$(y - 8) = 2.9833(x - 1)$$

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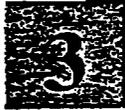
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Work for problem 3(c)

$$S = \sqrt{dy^2 + dx^2} \quad \text{at } t=2$$

$$S = 7.3827$$

Work for problem 3(d)

$$\frac{dy}{dx} = 2t + 1$$

$$dx = (3 + \cos(t^2)) dt$$

$$dy = (2t + 1)(3 + \cos(t^2)) dt$$

$$\frac{dy}{dt} = (2t + 1)(3 + \cos(t^2))$$

$$\text{at } t=4 \quad \frac{d^2y}{dt^2} = 24.814$$

$$\text{at } t=4 \quad \frac{d^2x}{dt^2} = 2.3032$$

$$A = \sqrt{2.3032^2 + 24.814^2}$$

$$A = 24.9207$$

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END OF PART A OF SECTION II

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