AP® Calculus BC
2001 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)

$\frac{dy}{dt} = \frac{dy/dt}{dx/dt} = \frac{3\sin(t^2)}{\cos(t^3)}$ @ $t=2$, $\frac{dy}{dt} = 15.604$

$(y-5) = 15.604(x-4)$

Work for problem 1(b)

speed $= \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2} = \sqrt{\cos^2(t^3) + 9\sin^2(t^2)}$

@ $t=2$, speed $= 2.275$

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B_2

Work for problem 1(c)

$$\int_0^1 \sqrt{\left(\frac{dx}{dt}\right)^2+\left(\frac{dy}{dt}\right)^2}\,dt = \int_0^1 \sqrt{\cos^2(t^3)+9\sin^2(t^2)}\,dt$$

using calc $=$ **1.458**

Work for problem 1(d)

$x'(t) = \cos(t^3)$

$x(t) = F(t) = \int \cos(t^3)\,dt$

$$\int_2^3 \cos(t^3)\,dt = F(3) - F(2)$$

using calc $= .0465 = F(3) - 4$ (given)

$x(3) = F(3) = 3.954$

$y'(t) = 3\sin(t^2)$

$y(t) = F(t) = \int 3\sin(t^2)$

$$\int_2^3 3\sin(t^2)\,dt = F(3) - F(2)$$

$-.0936 = F(3) - 5$

$y(t) = F(3) = 4.906$

Position at time $t=3$: $(3.954, 4.906)$

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D1

CALCULUS BC

SECTION II, Part A

10:70

Time—45 minutes

Number of problems—3

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

Work for problem 1(a)

$$\frac{\frac{dy}{dt}}{\frac{dx}{dt}} = \frac{dy}{dx} \qquad \frac{3\sin(t^2)}{\cos(t^3)} \qquad \frac{dy}{dx} = \frac{3\sin(2)^2}{\cos(2)^3}$$

slope = 15.604

$$y - 5 = 15.604(x - 4)$$

$$\boxed{y = 15.604x - 57.417}$$

Work for problem 1(b)

$$\frac{dx}{dt} = \cos t^3 = \cos 2^3 = -.146$$

$$\frac{dy}{dt} = 3\sin t^2 = 3\sin 2^2 = -2.270$$

$$(-.146)^2 + (-2.270)^2 = s^2$$

$$s = \sqrt{(\qquad\qquad 1}$$

$$\boxed{s = 2.275}$$

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D2

Work for problem 1(c)

$$\int_0^1 \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2}\, dt = \int_0^1 \sqrt{(\cos t^3)^2 + (3\sin t^2)^2}\, dt$$

$$= \int_0^1 \sqrt{\cos^2 t^3 + 9\sin^2 t^2}\, dt$$

Work for problem 1(d)

$$x = \int \cos t^3\, dt =$$

$$y = 3\int \sin t^2\, dt =$$

$$\frac{dx}{dt} = \cos t^3$$

$$\int dx = \int \cos t^3\, dt$$

at $t = 2$ $\quad x = 4$ $\quad y = 5$

$$4 + \int_2^3 \cos t^3\, dt = x \qquad x = 3.954$$

$$5 + \int_2^3 \sin t^2\, dt = y \qquad y = 4.969$$

$(3.954, 4.969)$