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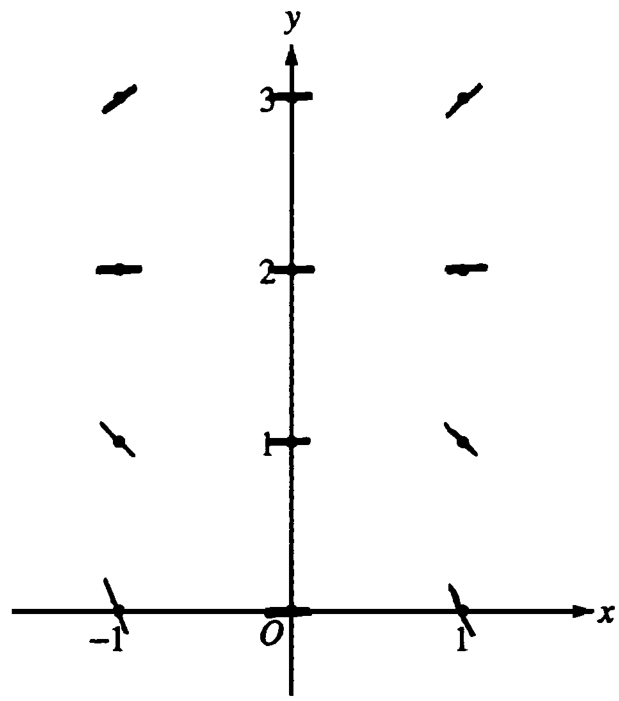
Advanced Placement Program

# AP® Calculus AB
# 2004 Sample Student Responses
# Form B

A

**NO CALCULATOR ALLOWED**

Work for problem 5(a)




Work for problem 5(b)

$x^4$ is always positive $\Rightarrow \frac{dy}{dx} < 0$ iff $y < 2 \wedge x \neq 0$

$\therefore$ the negative slope's where $y < 2$ and $x \neq 0$.

~~⇒ the negative slopes~~ become greater in magnitude as $|x|$ become greater and $|y-2|$ become greater

Continue problem 5 on page 13.

A2

**NO CALCULATOR ALLOWED**

Work for problem 5(c)

$$\frac{dy}{dx} = x^4(y-2) \Rightarrow \frac{dy}{(y-2)} = x^4\,dx \Rightarrow \int \frac{dy}{(y-2)} = \int x^4\,dx$$

$$\Rightarrow \ln|y-2| = \frac{x^5}{5} + c_1 \Rightarrow y-2 = e^{x^5/5 + c_1} \Rightarrow y = ce^{x^5/5} + 2$$

$$f(0) = 0 \Rightarrow 0 = ce^0 + 2 \Rightarrow c = -2$$

$$\therefore\ y = -2e^{x^5/5} + 2$$

**GO ON TO THE NEXT PAGE.**

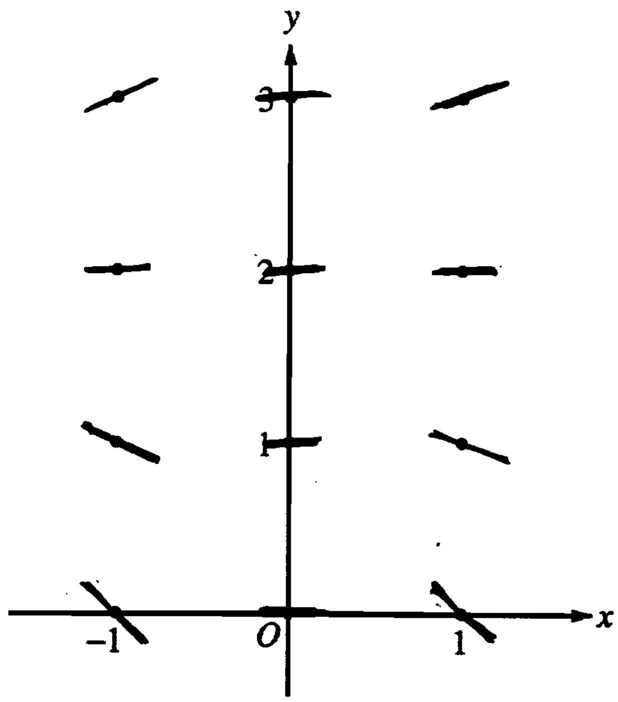
D1

**NO CALCULATOR ALLOWED**

Work for problem 5(a)

$\frac{dy}{dx} = x^4(y-2)$

| $(x,y)$ | $\frac{dy}{dx}$ |
|---|---|
| $(0,0)$ | $0$ |
| $(0,1)$ | $0$ |
| $(0,2)$ | $0$ |
| $(0,3)$ | $0$ |
| $(1,0)$ | $-2$ |
| $(1,1)$ | $-1$ |
| $(1,2)$ | $0$ |
| $(1,3)$ | $1$ |




| $(x,y)$ | $\frac{dy}{dx}$ |
|---|---|
| $(-1,0)$ | $-2$ |
| $(-1,1)$ | $-1$ |
| $(-1,2)$ | $0$ |
| $(-1,3)$ | $1$ |

Work for problem 5(b)

There are four points for which the slopes are negative in Part(a)

They are $(1,0)$ $(1,1)$ $(-1,0)$ and $(-1,1)$

If the slope $\left(\frac{dy}{dx}\right)$ is negative, that means the graph of $y$ is decreasing at these four points

Continue problem 5 on page 13.

D2

**NO CALCULATOR ALLOWED**

Work for problem 5(c)

$$\frac{dy}{dx} = x^4(y-2)$$

$$x^4\,dx = \frac{dy}{y-2}$$

$$\int x^4\,dx = \int \frac{dy}{y-2}$$

$$\frac{x^5}{5} + C_1 = \ln|y-2| + C_2.$$

$$\ln|y-2| = \frac{x^5}{5} + C$$

$$y-2 = e^{\frac{x^5}{5}+C} = e^{\frac{x^5}{5}} \cdot e^C$$

$$= Ae^{\frac{x^5}{5}}$$

$$f(x) = y = Ae^{\frac{x^5}{5}} + 2 \qquad f(0) = 0$$

$$f(0) = Ae^{\frac{0^5}{5}} + 2 = 0.$$

$$Ae^0 + 2 = 0$$

$$A + 2 = 0$$

$$A = -2$$

$$\therefore \boxed{y = -2e^{\frac{x^5}{5}}}$$

GO ON TO THE NEXT PAGE.