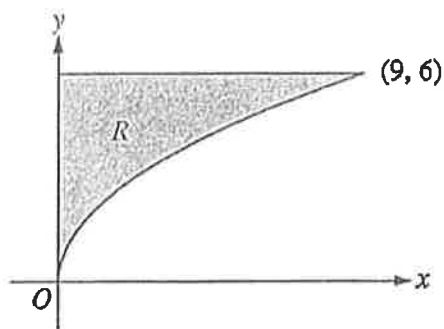


**AP<sup>®</sup> CALCULUS AB**  
**2010 SCORING GUIDELINES**

**Question 4**



Let  $R$  be the region in the first quadrant bounded by the graph of  $y = 2\sqrt{x}$ , the horizontal line  $y = 6$ , and the  $y$ -axis, as shown in the figure above.

- (a) Find the area of  $R$ .
- (b) Write, but do not evaluate, an integral expression that gives the volume of the solid generated when  $R$  is rotated about the horizontal line  $y = 7$ .
- (c) Region  $R$  is the base of a solid. For each  $y$ , where  $0 \leq y \leq 6$ , the cross section of the solid taken perpendicular to the  $y$ -axis is a rectangle whose height is 3 times the length of its base in region  $R$ . Write, but do not evaluate, an integral expression that gives the volume of the solid.

(a) Area =  $\int_0^9 (6 - 2\sqrt{x}) dx = \left(6x - \frac{4}{3}x^{3/2}\right) \Big|_{x=0}^{x=9} = 18$

3 :  $\begin{cases} 1 : \text{integrand} \\ 1 : \text{antiderivative} \\ 1 : \text{answer} \end{cases}$

(b) Volume =  $\pi \int_0^9 \left( (7 - 2\sqrt{x})^2 - (7 - 6)^2 \right) dx$

3 :  $\begin{cases} 2 : \text{integrand} \\ 1 : \text{limits and constant} \end{cases}$

(c) Solving  $y = 2\sqrt{x}$  for  $x$  yields  $x = \frac{y^2}{4}$ .

Each rectangular cross section has area  $\left(3\frac{y^2}{4}\right)\left(\frac{y^2}{4}\right) = \frac{3}{16}y^4$ .

Volume =  $\int_0^6 \frac{3}{16}y^4 dy$

3 :  $\begin{cases} 2 : \text{integrand} \\ 1 : \text{answer} \end{cases}$