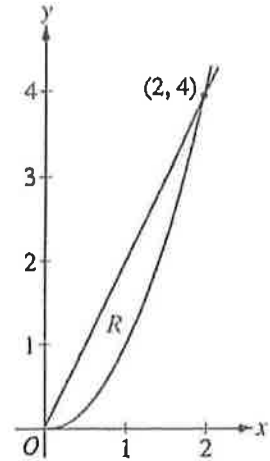


**AP[®] CALCULUS AB
2009 SCORING GUIDELINES**

Question 4

Let R be the region in the first quadrant enclosed by the graphs of $y = 2x$ and $y = x^2$, as shown in the figure above.

- (a) Find the area of R .
- (b) The region R is the base of a solid. For this solid, at each x the cross section perpendicular to the x -axis has area $A(x) = \sin\left(\frac{\pi}{2}x\right)$. Find the volume of the solid.
- (c) Another solid has the same base R . For this solid, the cross sections perpendicular to the y -axis are squares. Write, but do not evaluate, an integral expression for the volume of the solid.



$$\begin{aligned} \text{(a) Area} &= \int_0^2 (2x - x^2) dx \\ &= x^2 - \frac{1}{3}x^3 \Big|_{x=0}^{x=2} \\ &= \frac{4}{3} \end{aligned}$$

3 : { 1 : integrand
1 : antiderivative
1 : answer

$$\begin{aligned} \text{(b) Volume} &= \int_0^2 \sin\left(\frac{\pi}{2}x\right) dx \\ &= -\frac{2}{\pi} \cos\left(\frac{\pi}{2}x\right) \Big|_{x=0}^{x=2} \\ &= \frac{4}{\pi} \end{aligned}$$

3 : { 1 : integrand
1 : antiderivative
1 : answer

$$\text{(c) Volume} = \int_0^4 \left(\sqrt{y} - \frac{y}{2}\right)^2 dy$$

3 : { 2 : integrand
1 : limits