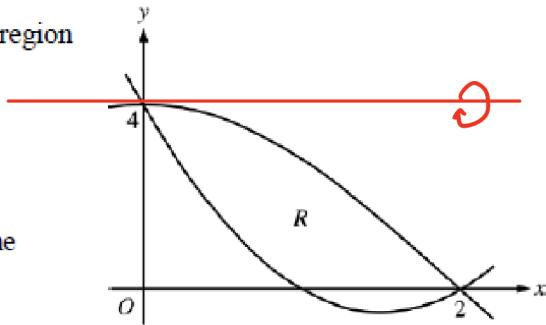


CALCULATOR NOT PERMITTED

2013 AP[®] CALCULUS AB

Question 5

Let $f(x) = 2x^2 - 6x + 4$ and $g(x) = 4\cos\left(\frac{1}{4}\pi x\right)$. Let R be the region bounded by the graphs of f and g , 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 $y = 4$.
- (c) The region R is the base of a solid. For this solid, each cross section perpendicular to the x -axis is a square. Write, but do not evaluate, an integral expression that gives the volume of the solid.

*After
7.8*

$$\begin{aligned}
 \text{(a) Area } R &= \int_0^2 [4\cos(\frac{1}{4}\pi x) - (2x^2 - 6x + 4)] dx \quad +1 \\
 &= 4 \int_0^2 \cos(\frac{1}{4}\pi x) dx - \int_0^2 (2x^2 - 6x + 4) dx \\
 u &= \frac{1}{4}\pi x \quad u=0 \quad u=\frac{1}{4}\pi(2) \\
 \frac{du}{dx} &= \frac{1}{4}\pi \quad dx = \frac{4}{\pi} du \\
 du &= \frac{1}{4}\pi dx \quad u=0 \quad u=\frac{1}{4}\pi(2) \\
 \frac{1}{\pi} du &= dx \\
 &= \frac{16}{\pi} \int_0^{\frac{\pi}{2}} \cos(u) du - \left[\left(\frac{2}{3}x^3 - 3x^2 + 4x \right) \Big|_0^2 \right] \quad +1 \\
 &= \frac{16}{\pi} [\sin(u)]_0^{\frac{\pi}{2}} - \left[\left(\frac{2}{3}(2)^3 - 3(2)^2 + 4(2) \right) - (0) \right] \\
 &= \frac{16}{\pi} [1 - 0] - \left[\frac{16}{3} - 12 + 8 \right] \\
 &= \frac{16}{\pi} - \left[\frac{16}{3} - 4 \right] \\
 &= \frac{16}{\pi} - \frac{4}{3} \quad +1
 \end{aligned}$$

$$\begin{aligned}
 \text{(c) } V &= \int_0^2 [g(x) - f(x)]^2 dx \\
 V &= \int_0^2 [4\cos(\frac{1}{4}\pi x) - (2x^2 - 6x + 4)]^2 dx \quad +1 \\
 &+1
 \end{aligned}$$

b)

$$R^2 = (4 - f(x))^2 = (4 - (2x^2 - 6x + 4))^2$$

$$r^2 = (4 - g(x))^2 = (4 - 4\cos(\frac{\pi}{4}x))^2$$

$$\begin{aligned}
 V &= \pi \int_0^2 (R^2 - r^2) dx \\
 V &= \pi \int_0^2 \left[(4 - (2x^2 - 6x + 4))^2 - (4 - 4\cos(\frac{\pi}{4}x))^2 \right] dx \quad +1 \\
 &+1
 \end{aligned}$$