The materials included in these files are intended for non-commercial use by AP teachers for course and exam preparation; permission for any other use must be sought from the Advanced Placement Program. Teachers may reproduce them, in whole or in part, in limited quantities, for face-to-face teaching purposes but may not mass distribute the materials, electronically or otherwise. These materials and any copies made of them may not be resold, and the copyright notices must be retained as they appear here. This permission does not apply to any third-party copyrights contained herein.
CALCULUS AB
SECTION II, Part A
Time—45 minutes
Number of problems—3

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

![Graph of intersecting functions]

Work for problem 1(a)

Area of \( R \):

\[
\int_{\text{bottom}}^{\text{top}} \left[ \text{right}(y) - \text{left}(y) \right] \, dy
\]

\[
\int_{0}^{1.266} \left[ 3\sqrt{2-y} - \tan^{-1} y \right] \, dy
\]

Area of \( R \) = 0.729

\[
\tan x + x^3 = 2
\]

\[x = 0.902\]
Work for problem 1(b)

Area of $S$: \[ \int_{\pi/4}^{\pi/2} \left[ \text{top}(x) - \text{bottom}(x) \right] \, dx \]
\[ \int_{\pi/6}^{\pi/2} \left[ (2-x^3) - \tan x \right] \, dx \]

Area of $S = 1.611$

---

Work for problem 1(c)

Volume of $S$ about the $x$-axis:

\[ \pi \int R(x)^2 \, dx \]
\[ \pi \int_{\pi/6}^{\pi/2} \left[ (2-x^3)^2 - \tan^2 x \right] \, dx \]

Volume of $S$ about the $x$-axis = 8.332
A graphing calculator is required for some problems or parts of problems.

Work for problem 1(a)

\[ A_c = \int_0^{0.902} \tan x \, dx + \int_{0.902}^{1.260} \left(\frac{2}{2-x^3}\right) \, dx = \]

\[ 0.478 + 0.251 = 0.729 \]
Work for problem 1(b)

\[ A_s = \int_0^{0.902} (2-x^3) - \tan x \, dx \]

\[ A_s = 1.160 \]

Work for problem 1(c)

\[ V = \int_0^{0.902} \pi ((2-x^3) - \tan x)^2 \, dx \]

\[ V = 5.555 \]