Selected hints

1 a.

$$
\begin{aligned}
V &= \int_{-\pi/3}^{\pi/3} \frac{\pi}{4}(\sec x - \tan x)^2 dx \\
&= \frac{\pi}{4}\int_{-\pi/3}^{\pi/3} (2\sec x^2 - 1 - 2\frac{\sin x}{\cos x^2}) dx \\
&= \frac{\pi}{4}(2\tan x - x + 2(-\frac{1}{\cos x}))\ |_{-\pi/3}^{\pi/3} \\
&= \frac{\pi}{4}(4\sqrt{3} - \frac{2\pi}{3})
\end{aligned}
$$

b. $V = \int_{-\pi/3}^{\pi/3} (\sec x - \tan x)^2 dx$
2 b. Disk method $\int_0^4 \pi(2-\sqrt{x})^2 dx = ... = \frac{8\pi}{3}$
c. Shell or washer method. For example, for the shell method, $r = 4 - x$, $h = 2 - \sqrt{x}$
$\int_0^4 2\pi(4-x)(2-\sqrt{x})dx = ... = \frac{224\pi}{15}$

4. The cross section of a solid right cyclinder with a cone removed is a disk with radius from which a disk of radius h has been removed. Thus the area of the cross section at level h is $A_1(h) = \pi(R^2 - \pi h^2)$.
The cross section of a hemisphere at that same level h is a disk of radius $\sqrt{R^2 - h^2}$. Therefore, its area is also $A_2(h) = \pi(R^2 - \pi h^2)$
Then, by the Cavalieri's principle, these two solids have the same volume.