Start here for Question Number: 5

a) $V = 10$ cubic m

i- $A = 2\pi r^2 + 2\pi rh$

$= 2\pi r^2 + 2\pi r\, 10$

$= 2\pi r^2 + \pi r 20$

$= 2\pi r^2 + \frac{20}{r}$

ii- $f(x) = 2\pi r^2 + \frac{20}{r}$

$f'(x) = 4\pi r + (-\frac{1}{2} 20 r^{-\frac{3}{2}})$

minimum occurs when $f'(x) = 0$

$0 = 4\pi r + (-\frac{1}{2} 20 r^{-\frac{3}{2}})$

$= 4\pi r - 10 r^{-\frac{1}{2}}$

$= 4\pi r - \sqrt{10r}$

$= r(4\pi - \sqrt{10})$ $\therefore r = 0$

$\therefore$ minimum occurs when $r = 0$

b) Prove $\sec^2 x + \sec x \tan = \frac{1 + \sin x}{\cos^2 x}$

$\frac{1 + \sin x}{\cos^2 x} = \frac{1}{x} + \frac{\sin x}{\cos x}$

$\tan = \frac{\sin x}{\cos x}$

$\therefore \sec^2 x + \sec x \tan = \frac{1}{x} + \tan$

$= \sec x (\sec x + \tan)$

$= \sec^2 x + \sec x \tan$

ii - Prove $\sec^2 x + \sec x \tan x = \frac{1}{1-\sin x}$

$= \sec x (\sec x + \tan x)$

$= \frac{1}{\cos x} + \tan$

$= \frac{1}{1-\sin x}$

iii - $\int_0^{\frac{\pi}{4}} \frac{1}{1-\sin x}\, dx$

$= \int_0^{\frac{\pi}{4}} \frac{1}{1^2 - \cot^2 x}\, dx$

$= \left[1 \tan^{-1} \frac{\cot^2 x}{1}\right]$

$= \left[\tan^{-1} \cot x\right]$

$= \left[\sin x\right]_0^{\frac{\pi}{4}}$

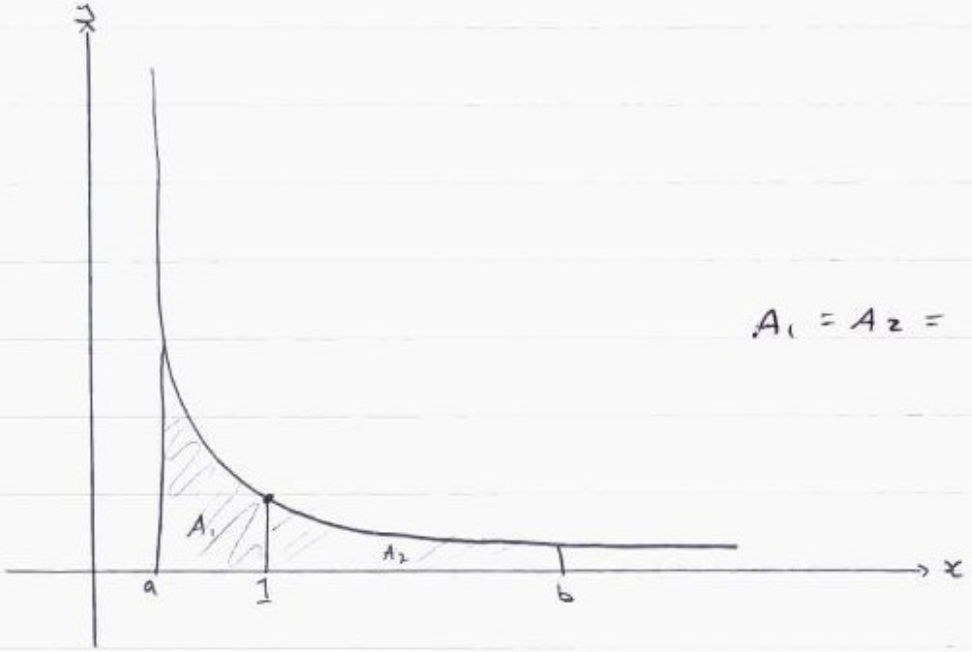
$= \left(\sin \frac{\pi}{4}\right) - (\sin 0)$

$= \sin \frac{\pi}{4}$

$= \frac{1}{\sqrt{2}}$

Additional writing space on back page.

c) $y = \frac{1}{x}$ $x > 0$



$A_1 = A_2 = 1 \text{ unit}^2$

$a = \frac{2}{5}$

$b = 2\frac{19}{5}$

You may ask for an extra Writing Booklet if you need more space to answer question 5.