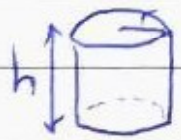
Start here for Question Number: 5

a) i)



$V = 10m^3$ $V = \pi r^2 \times h$ $\pi r^2 \times h = 10$

$A = SA$ $h = 10 - \pi r^2$

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

$A = 2\pi r^2 + 2\pi r(10 - \pi r^2)$

$= 2\pi r^2 + 20\pi r - 2\pi^2 r^3$

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

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

ii) $2\pi r^2 + \frac{20}{r}$ $u = 20$ $v = r$ $u' = 0$ $v' = 1$ $\frac{u'v - uv'}{v^2}$ $= \frac{-20}{r^2}$

$\frac{dA}{dr} = 4\pi r + \frac{-20}{r^2}$ $u = -20$ $v = r^2$ $u' = 0$ $v' = 2r$ $= \frac{40r}{r^4}$

$\frac{d^2A}{dr^2} = 4 + \frac{40r}{(r^2)^2}$

$\frac{40r}{(r^2)^2} = -4$

$\frac{40}{r^2} = -4$

$r^2 = -160$

$r = 12.65$ (2dps) > 0 > 0 = minimum

$\therefore r = 12.65$ minimum occurs

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

$\sec^2 x = \tan x$ $\tan x = \frac{\sin x}{\cos x}$

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

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

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

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

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

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

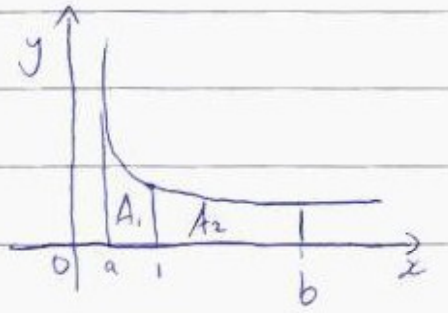
$= \int_0^{\frac{\pi}{4}} -\sin x\,dx$

$= (\cos x)_0^{\frac{\pi}{4}}$

$= \cos\frac{\pi}{4} - \cos 0$

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

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



A_1 and $A_2 = 1\,unit^2$

$\int_a^1 \frac{1}{x}$

$= (\log_e x)_a^1$

$= \log_e 1 - \log_e a$

$= 0 - \log_e a$

$a = \log_e$

$\int_1^b \frac{1}{x}$

$= (\log_e x)_1^b$

$= \log_e b - \log_e 1$

$= \log_e b - 0$

$b = -\log_e$

Additional writing space on back page.