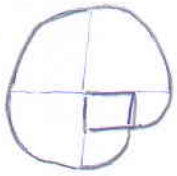
question 6) cow grazing

a) $10 \times 10\ m^2$ shed

$L = 20m$

∴ shape :



∴ Area $= \frac{3}{4}\pi(20)^2 + \frac{1}{2}\pi(10)^2$

$= 300\pi + 50\pi$

$= \boxed{350\pi \text{ units}}$

b) If $L > 20m$, then there will be intersection of areas. The cow will able to graze more but there would be redundancy in movements.

c) Spherical environment

∴ $r = 10km = 10{,}000\ m$

∴ Area $= \Omega r^2$

∴ $\Omega = 2\pi[1 - \cos\theta]$

∴ $\alpha = \frac{20}{10{,}000} = 0.002$ rad.

∴ $\beta = \frac{10}{10{,}000} = 0.001$ rad.

∴ $A_1 = \frac{3}{4} \cdot 2\pi r^2[1 - \cos\alpha]$

∴ $A_2 = \frac{2}{4} \cdot 2\pi r^2[1 - \cos\beta]$

∴ Area $= A_1 + A_2 = \frac{\pi r^2}{2}[5 - 3\cos\alpha - 2\cos\beta]$

$\simeq \boxed{349.999895835\pi \text{ units}}$

The answer in c) part is very close to a) part because the square and ropes dimensions are very less compared to sphere, so it can be approximated for a plane.