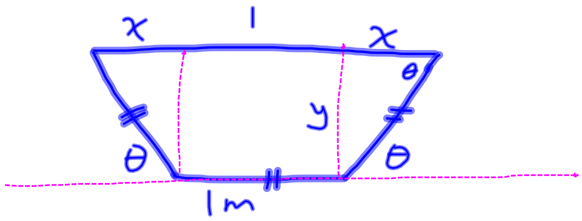
Q12



$\cos\theta = \frac{x}{1}$ $\sin\theta = \frac{y}{1}$

$x = \cos\theta$ $y = \sin\theta$

$A = \frac{(a+b)h}{2}$

$= \frac{[1 + (1+2x)]y}{2}$

$= (1+x)y$

$2y^2 + y - 1$

$= \frac{(2y-2)(2y+1)}{2}$

$= (2y-1)(2y+1)$

$A = (1+\cos\theta)(\sin\theta)$

$\frac{dA}{d\theta} = (-\sin\theta)(\sin\theta) + (1+\cos\theta)(\cos\theta)$

$= -\sin^2\theta + \cos\theta + \cos^2\theta$

$= -(1-\cos^2\theta) + \cos\theta + \cos^2\theta$

$= 2\cos^2\theta + \cos\theta - 1$

$= (2\cos\theta - 1)(\cos\theta + 1)$

$\frac{dA}{d\theta} = 0 \quad \therefore \cos\theta = \frac{1}{2}, \quad \cos\theta = -1$

$\theta = 60^\circ \qquad \theta = 180^\circ$

Thus max area occurs when $\theta = 60^\circ$.

Q14

$$y = A\cos kt + B\sin kt$$

$\boxed{\text{Show: } y'' + k^2 y = 0}$

$$y' = -Ak\sin kt + Bk\cos kt$$

$$y'' = -Ak^2\cos kt - Bk^2\sin kt$$

$$\begin{aligned} y'' + k^2 y &= -Ak^2\cos kt - Bk^2\sin kt \\ &\quad + Ak^2\cos kt + Bk^2\sin kt \\ &= 0 \end{aligned}$$