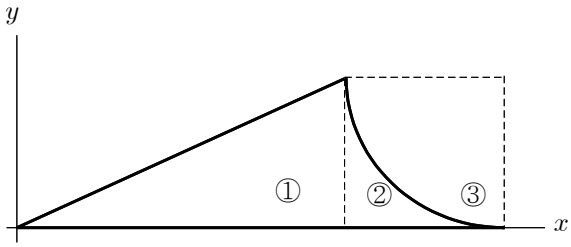
[5.1~5.5절]

5.6　① 삼각형



$A = \frac{1}{2}(120\ \text{mm})(75\ \text{mm}) = 4{,}500\ \text{mm}^2$

$\bar{x} = \frac{2}{3}(120\ \text{mm}) = 80\ \text{mm}$

$\bar{y} = \frac{1}{3}(75\ \text{mm}) = 25\ \text{mm}$

② 정사각형

$A = (75\ \text{mm})^2 = 5{,}625\ \text{mm}^2$

$\bar{x} = (120\ \text{mm}) + \frac{1}{2}(75\ \text{mm}) = 157.5\ \text{mm}$

$\bar{y} = \frac{1}{2}(75\ \text{mm}) = 37.5\ \text{mm}$

③ 1/4 원

$A = -\frac{1}{4}\pi(75\ \text{mm})^2 = -4{,}418\ \text{mm}^2$

$\bar{x} = (120+75\ \text{mm}) - \frac{4}{3\pi}(75\ \text{mm}) = 163.17\ \text{mm}$

$\bar{y} = (75\ \text{mm}) - \frac{4}{3\pi}(75\ \text{mm}) = 43.17\ \text{mm}$

$\Sigma A = (4{,}500\ \text{mm}^2) + (5{,}625\ \text{mm}^2) + (-4{,}418\ \text{mm}^2) = 5{,}707\ \text{mm}^2$

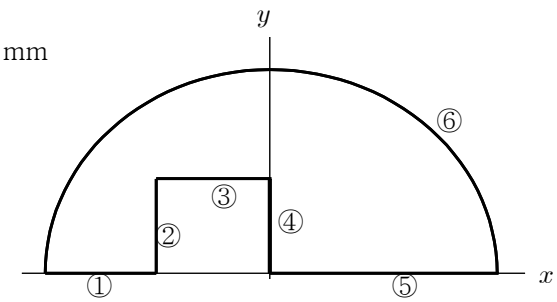
$\Sigma(\bar{x}A) = (80\ \text{mm})(4{,}500\ \text{mm}^2) + (157.5\ \text{mm})(5{,}625\ \text{mm}^2) + (163.17\ \text{mm})(-4{,}418\ \text{mm}^2)$
$= 525{,}052\ \text{mm}^3$

$\Sigma(\bar{y}A) = (25\ \text{mm})(4{,}500\ \text{mm}^2) + (37.5\ \text{mm})(5{,}625\ \text{mm}^2) + (43.17\ \text{mm})(-4{,}418\ \text{mm}^2)$
$= 132{,}712\ \text{mm}^3$

$\bar{X} = \frac{\Sigma(\bar{x}A)}{\Sigma A} = \frac{525{,}052\ \text{mm}^3}{5{,}707\ \text{mm}^2} = 92.00\ \text{mm}$

$\bar{Y} = \frac{\Sigma(\bar{y}A)}{\Sigma A} = \frac{132{,}712\ \text{mm}^3}{5{,}707\ \text{mm}^2} = 23.25\ \text{mm}$　　⇒　centroid = (92.0 mm, 23.3 mm)

5.27　① $L = (38\ \text{mm}) - (20\ \text{mm}) = 18\ \text{mm}$



$\bar{x} = -(20\ \text{mm}) - \frac{1}{2}(38-20\ \text{mm}) = -29\ \text{mm}$

$\bar{y} = 0$

② $L = 16\ \text{mm}$

$\bar{x} = -20\ \text{mm}$

$\bar{y} = \frac{1}{2}(16\ \text{mm}) = 8\ \text{mm}$

③ $L = 20\ \text{mm}$

$\bar{x} = \frac{1}{2}(-20\ \text{mm}) = -10\ \text{mm}$

$\bar{y} = 16\ \text{mm}$

④ $L = 16$ mm

$\bar{x} = 0$

$\bar{y} = 8$ mm

⑤ $L = 38$ mm

$\bar{x} = \frac{1}{2}(38 \text{ mm}) = 19$ mm

$\bar{y} = 0$

⑥ $L = \pi(38 \text{ mm}) = 119.38$ mm

$\bar{x} = 0$

$\bar{y} = \frac{2}{\pi}(38 \text{ mm}) = 24.19$ mm

$\Sigma L = 18 + 16 + 20 + 16 + 38 + 119.38 \text{ mm} = 227.38 \text{ mm}$

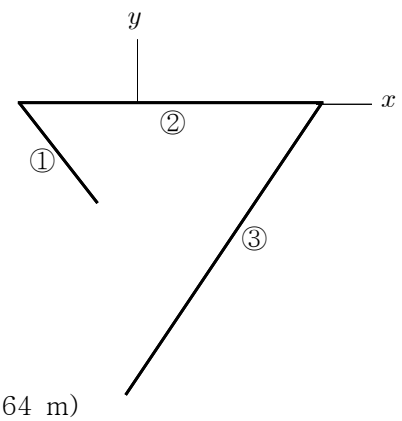
$\Sigma(\bar{x}L) = (-29)(18) + (-20)(16) + (-10)(20) + (0)(16) + (19)(38) + (0)(119.38) \text{ mm}^2$
$= -320.0 \text{ mm}^2$

$\Sigma(\bar{y}L) = (0)(18) + (8)(16) + (16)(20) + (8)(16) + (0)(38) + (24.19)(119.38) \text{ mm}^2$
$= 3{,}464 \text{ mm}^2$

$\bar{X} = \frac{\Sigma(\bar{x}L)}{\Sigma L} = \frac{-320.0 \text{ mm}^2}{227.38 \text{ mm}} = -1.407$ mm

$\bar{Y} = \frac{\Sigma(\bar{y}L)}{\Sigma L} = \frac{3{,}464 \text{ mm}^2}{227.38 \text{ mm}} = 15.23$ mm $\Rightarrow$ centroid = (−1.407 mm, 15.23 mm)

5.29 $\bar{X} = 0 \Rightarrow \bar{X}L = \Sigma(\bar{x}L) = 0$



① $L = 0.75$ m

$\bar{x} = -d + \frac{1}{2}(0.75 \text{ m})\cos 55°$

$= -d + (0.2151 \text{ m})$

② $L = 1.50$ m

$\bar{x} = -d + \frac{1}{2}(1.50 \text{ m}) = -d + (0.75 \text{ m})$

③ $L = 2$ m

$\bar{x} = -d + (1.50 \text{ m}) - \frac{1}{2}(2 \text{ m})\cos 55° = -d + (0.9264 \text{ m})$

$\Sigma(\bar{x}L) = [-d + (0.2151 \text{ m})](0.75 \text{ m}) + [-d + (0.75 \text{ m})](1.50 \text{ m})$
$+ [-d + (0.9264 \text{ m})](2 \text{ m}) = 0$

$\Rightarrow (0.75 + 1.50 + 2 \text{ m})\, d$
$= (0.2151 \text{ m})(0.75 \text{ m}) + (0.75 \text{ m})(1.50 \text{ m}) + (0.9264 \text{ m})(2 \text{ m})$

$\Rightarrow d = 0.739$ m