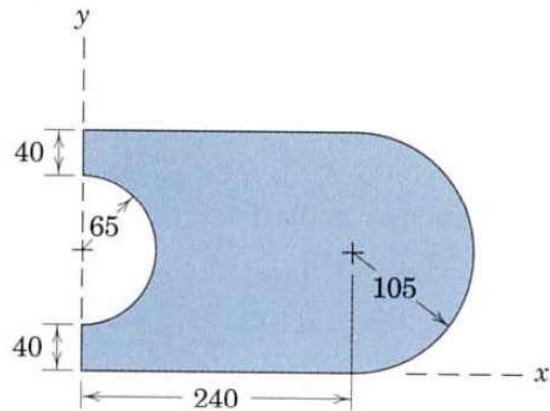


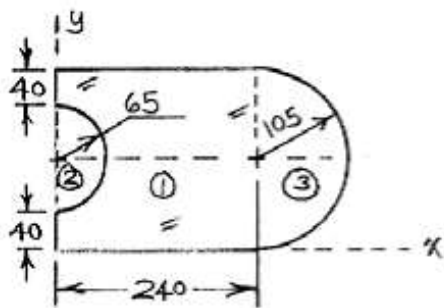
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Problem 5

Determine the coordinates of the centroid of the shaded area



Dimensions in millimeters



$$\bar{Y} = \frac{1}{2} (40 + 2(65) + 40) = 105 \text{ mm}$$

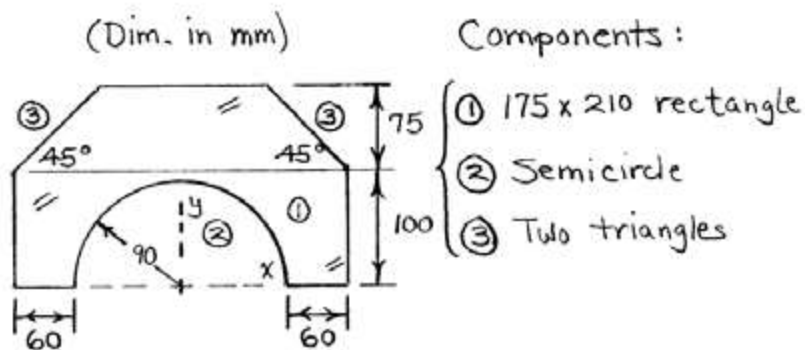
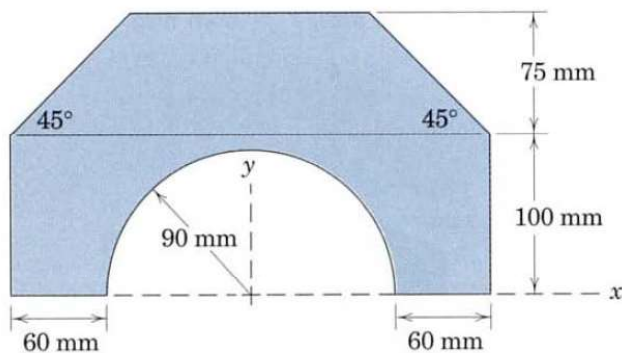
$$\bar{X} = \frac{210(240)\left(\frac{240}{2}\right) - \frac{\pi 65^2}{2} \cdot \frac{4(65)}{3\pi} + \frac{\pi 105^2}{2} \left(240 + \frac{4(105)}{3\pi}\right)}{(210)(240) - \frac{\pi 65^2}{2} + \frac{\pi 105^2}{2}}$$

$$= \underline{176.7 \text{ mm}}$$

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Problem 6

Determine the y - coordinate of the centroid of the shaded area



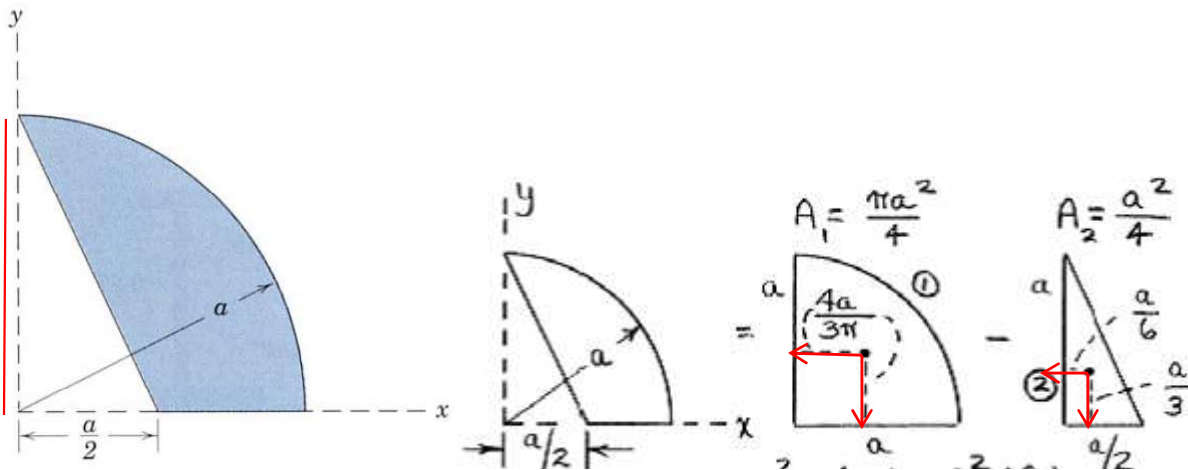
Comp.	A (mm ²)	\bar{y} (mm)	A \bar{y} (mm ³)
①	175(210)	$\frac{175}{2}$	3 215 625
②	$-\frac{\pi(90^2)}{2}$	$\frac{4(90)}{3\pi}$	- 486 000
③	$-2 \frac{1}{2} (75)(75)$	$(100 + \frac{2}{3} 75)$	- 843 750
$\Sigma A = 18 400$			$\Sigma A\bar{y} = 1 886 000$

$$\bar{Y} = \frac{\Sigma A\bar{y}}{\Sigma A} = \underline{102.5 \text{ mm}}$$

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Problem 7

Determine the x and y - coordinates of the centroid of the shaded area



Parts	A	\bar{x}	\bar{y}	$\sum \bar{x} A$	$\sum \bar{y} A$
1	$\frac{\pi a^2}{4}$	$\frac{4a}{3\pi}$	$\frac{4a}{3\pi}$	$\frac{a^3}{3}$	$\frac{a^3}{3}$
2	$-\frac{a^2}{4}$	$\frac{a}{6}$	$\frac{a}{3}$	$-\frac{a^3}{24}$	$-\frac{a^3}{12}$
Totals	$\frac{a^2}{4}(\pi - 1)$			$\frac{7a^3}{24}$	$\frac{a^3}{4}$

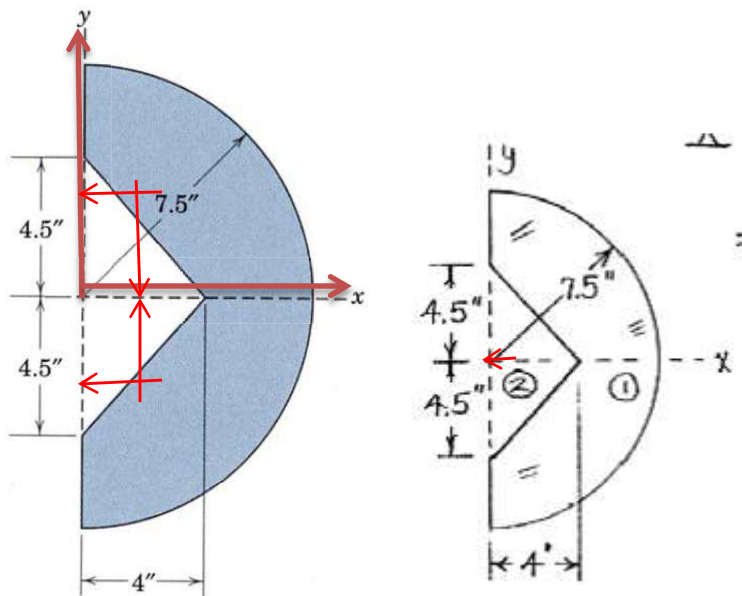
$$\bar{X} = \frac{\sum A \bar{x}}{\sum A} = \frac{\frac{7a^3}{24}}{\frac{a^2}{4}(\pi - 1)} = \frac{7a}{6(\pi - 1)}$$

$$\bar{Y} = \frac{\sum A \bar{y}}{\sum A} = \frac{\frac{a^3}{4}}{\frac{a^2}{4}(\pi - 1)} = \frac{a}{(\pi - 1)}$$

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Problem 8

Determine the x - coordinate of the centroid of the shaded area



Parts	A (in ²)	\bar{x} (in)	\bar{y} (in)	$\sum \bar{x} A$ (in ³)	$\sum \bar{y} A$ (in ³)
1	88.32	3.184	0	281.21	0
2	-18	1.3333	0	-24	0
Totals	70.32			257.21	0

$$A_{\text{circle}} = r^2 \pi / 2 = 7.5^2 * 3.14 / 2 = 88.32 \text{ in}^2 \quad , \quad \bar{x} = \frac{4r}{3\pi} = \frac{4*7.5}{3*3.14} = 3.184$$

$$A_{\text{triangle}} = \frac{1}{2} * 9 * 4 = 18 \text{ ,}$$

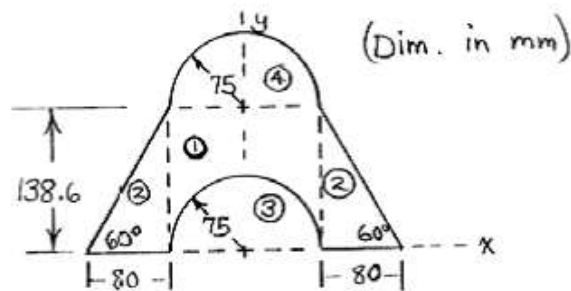
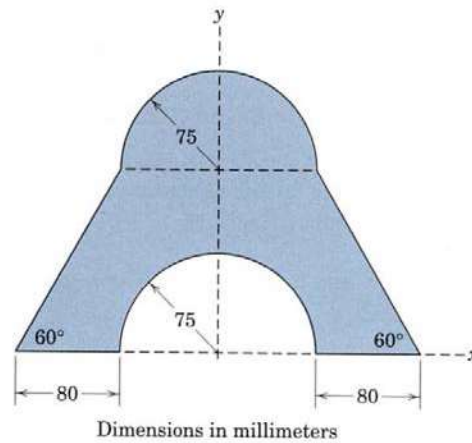
$$\bar{X} = \frac{\sum A \bar{x}}{\sum A} = \frac{257.21}{70.32} = 3.66 \text{ in}$$

$$\bar{Y} = \frac{\sum A \bar{y}}{\sum A} = 0$$

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Problem 9

Determine the y - coordinate of the centroid of the shaded area



Comp.	A (mm^2)	\bar{y} (mm)	$A\bar{y}$ (mm^3)
①	$150(138.6)$	$138.6/2$	1 440 000
②	$2 \frac{1}{2}(80)(138.6)$	$\frac{1}{3}(138.6)$	512 000
③	$-\pi \frac{75^2}{2}$	$\frac{4(75)}{3\pi}$	- 281 250
④	$\pi \frac{75^2}{2}$	$(138.6 + \frac{4(75)}{3\pi})$	1 505 565
	$\Sigma A = 31\ 870$		$\Sigma A\bar{y} = 3.18(10^6)$

$$\bar{Y} = \frac{\Sigma A\bar{y}}{\Sigma A} = \underline{99.7 \text{ mm}}$$