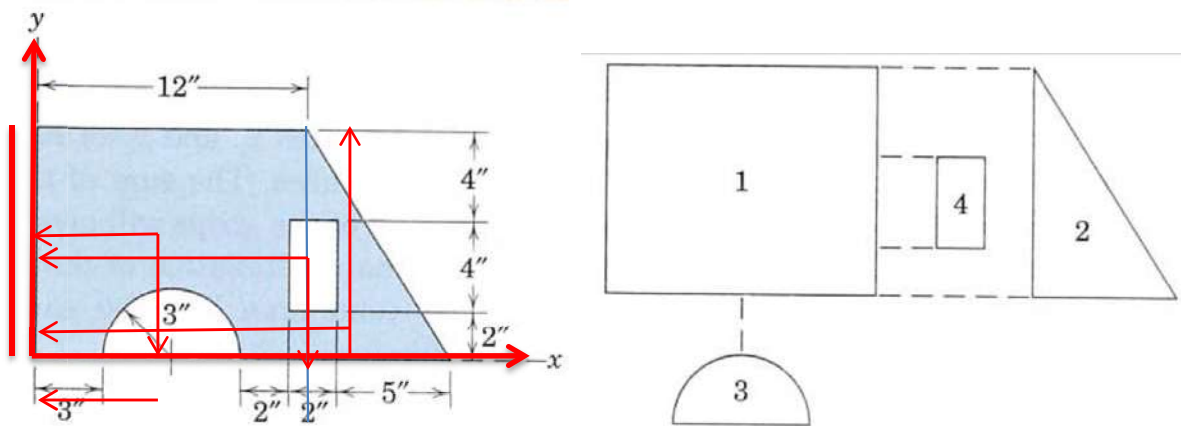


Centroid

Composite area

Problem 1

Locate the centroid 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	120	6	5	720	600
2	30	14	10/3	420	100
3	-14.14	6	1.273	-84.8	-18
4	-8	12	4	-96	-32
Totals	127.9			959	650

$$A_{\text{لنصف الدائره}} = 1/2 r^2 * 3.14 = 1/2 (3) * 3.14 = 14.14 \quad \bar{y} = \frac{4r}{3\pi} = \frac{4*3}{3*3.14} = 1.273$$

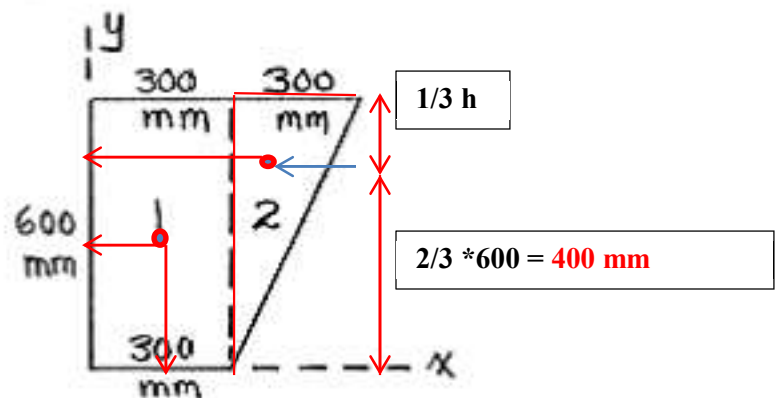
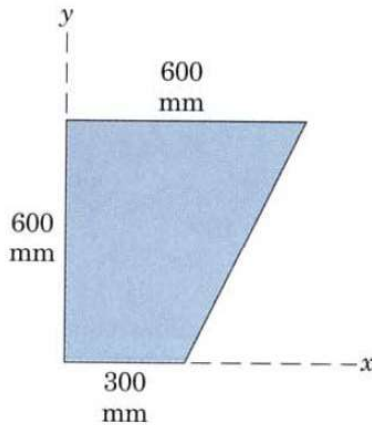
$$\bar{X} = \frac{\sum A \bar{x}}{\sum A} = \frac{959}{127.9} = 7.5 \text{ in}$$

$$\bar{Y} = \frac{\sum A \bar{y}}{\sum A} = \frac{650}{127.9} = 5.08 \text{ in}$$

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Problem 2

Determine the coordinates of the trapezoidal area shown



Parts	A (mm ²)	\bar{x} (mm)	\bar{y} (mm)	$\sum \bar{x} A$ (mm ³)	$\sum \bar{y} A$ (mm ³)
1	18(10 ⁴)	150	300	27(10 ⁶)	54(10 ⁶)
2	9(10 ⁴)	400	400	36(10 ⁶)	36(10 ⁶)
Totals	27(10⁴)			63(10⁶)	90(10⁶)

مساحة المثلث = $\frac{1}{2}$ * القاعدة * الارتفاع = $\frac{1}{2} * 300 * 600 = 9 (10^4) \text{ mm}^2$

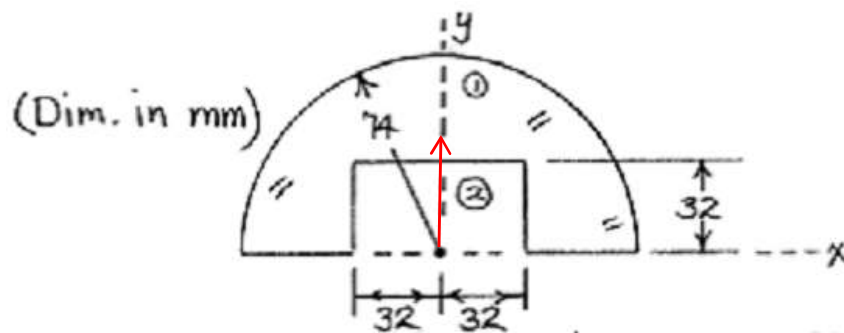
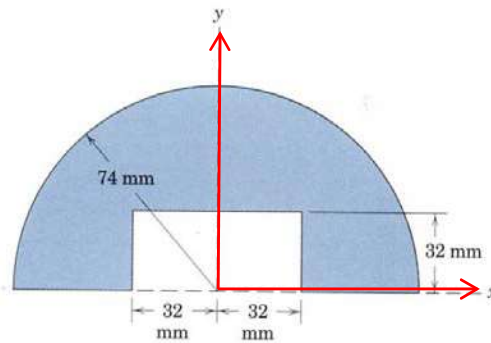
$$\bar{X} = \frac{\sum A \bar{x}}{\sum A} = \frac{63(10^6)}{27(10^4)} = 233 \text{ mm}$$

$$\bar{Y} = \frac{\sum A \bar{y}}{\sum A} = \frac{90(10^6)}{27(10^4)} = 333 \text{ mm}$$

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Problem 3

Calculate the y – coordinate of the centroid of the shaded area



Parts	A (mm ²)	\bar{x} (mm)	\bar{y} (mm)	$\sum \bar{x} A$ (mm ³)	$\sum \bar{y} A$ (mm ³)
1	8597.32	0	31.42	0	270149.3
2	-2048	0	16	0	-32768
Totals	6549.32			0	237381

Area دائرة = $r^2 \cdot 3.14/2 = 74 \cdot 74 \cdot 3.14/2 = 8597.32$

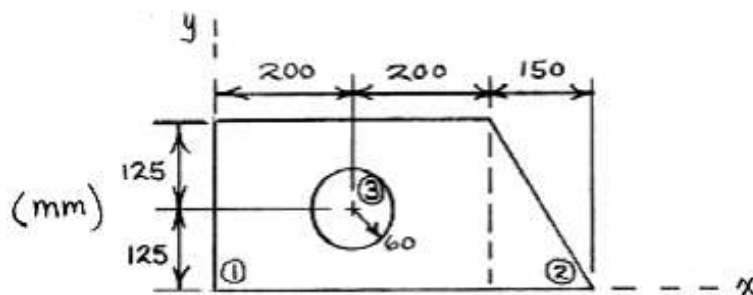
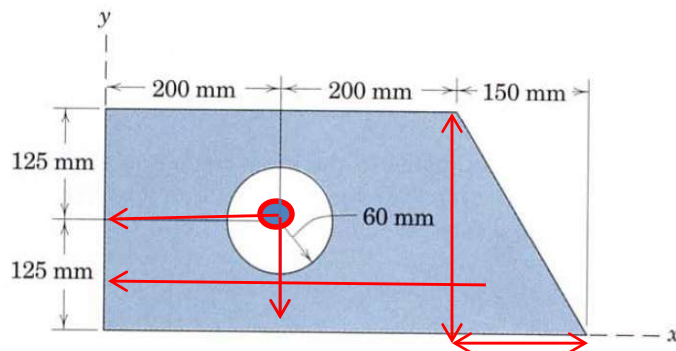
$$\bar{y} = \frac{4r}{3\pi} = \frac{4 \cdot 74}{3 \cdot 3.14} = 31.42$$

$$\bar{Y} = \frac{\sum A \bar{y}}{\sum A} = \frac{237381}{6549.32} = 36.2 \text{ mm}$$

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Problem 4

Determine the coordinates of the centroid of the shaded area



Parts	A (mm ²)	\bar{x} (mm)	\bar{y} (mm)	$\sum \bar{x} A$ (mm ³)	$\sum \bar{y} A$ (mm ³)
1	100(10 ³)	200	125	20(10 ⁶)	12.5(10 ⁶)
2	18.75(10 ³)	450	250/3	8.44(10 ⁶)	1.563(10 ⁶)
3	-11.31(10 ³)	200	125	-2.26(10 ⁶)	-1.414(10 ⁶)
Totals	107.4(10³)			26.18(10⁶)	12.65(10⁶)

$150/3=50+400=450$ $\bar{y} = \frac{250}{3}$, $A = r^2\pi = 60 * 60 * 3.14 = 11.31(10^3)$

$$\bar{X} = \frac{\sum A \bar{x}}{\sum A} = \frac{26.18(10^6)}{107.4(10^3)} = 244 \text{ mm}$$

$$\bar{Y} = \frac{\sum A \bar{y}}{\sum A} = \frac{12.65(10^6)}{107.4(10^3)} = 117.7 \text{ mm}$$