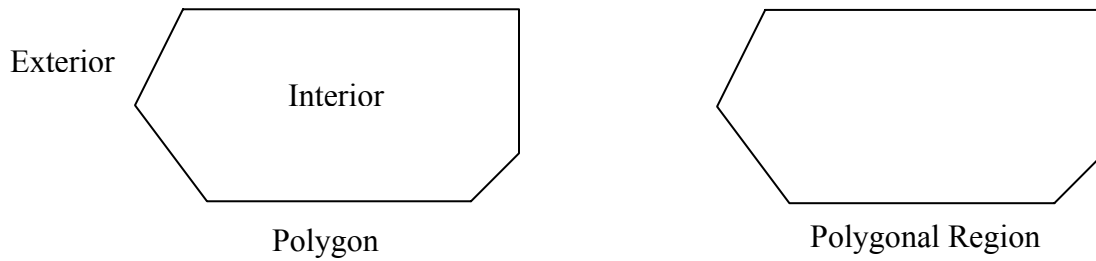


Geometry: Area of Composite Figures

An **area** is a measure of amount of surface enclosed by a polygon. A polygon separates the planes into **three parts: the polygon, the interior, and the exterior**. Together, a polygon and its interior are called **polygonal region**. Area can be used to describe the size of a garden, a rug, a swimming pool, or a national park. Area is measured in square units.



A **Composite Geometric figure** is a figure consisting of two or more geometric parts. Using the Postulates rule, it is possible to find the area of various regions.

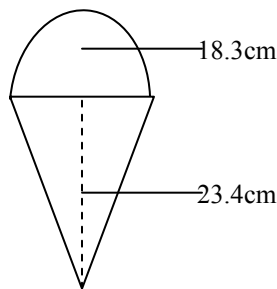
Area Addition Postulate 11-2.11-3

If two figures are congruent, then they have exactly the same area.

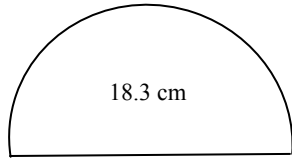
If a polygonal region is separated into **nonoverlapping** regions, then the **sum** of the area of these regions equals the area of the entire region.

Example 1 : Find the area of this figure, if the triangle has a base of 18.3 cm and height of 23.4 cm. The diameter of the semicircle (half of a circle) is 18.3 cm.

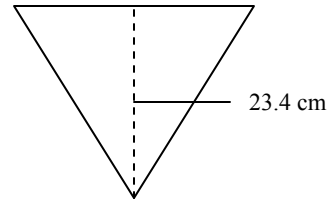
Solution:



First, remove the semicircle from the triangle. Use the Area Addition Postulate rule. Hint: This figure is a **nonoverlapping (sum)** region.



$$\frac{1}{2} \pi r^2$$



$$\frac{1}{2} bh$$

Second, the diameter of the semicircle is 18.3 cm. Find the radius by using the formula

$$\text{radius} = \frac{1}{2} \text{diameter}$$

$$r = \frac{18.3 \text{ cm}}{2}$$

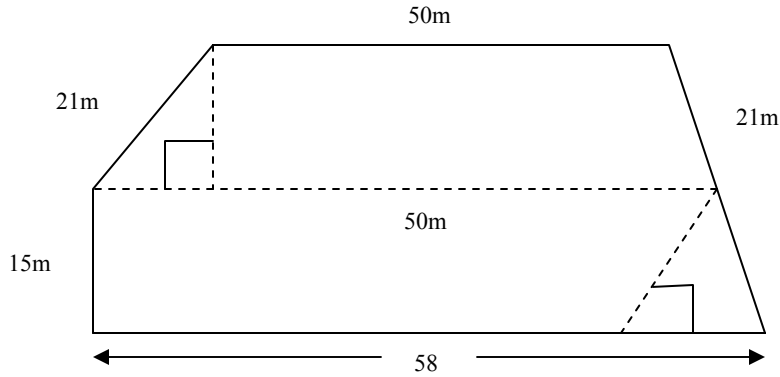
$$r = 9.15 \text{ cm}$$

Third, write formula for each of the figures and solve. Use 3.14 for π . Round to the nearest thousandths.

$$\begin{aligned} \text{Area} &= \text{area of semicircle} & + & \text{area of a triangle} \\ \text{Area} &= \frac{1}{2} \pi r^2 & + & \frac{1}{2} bh \\ &= \frac{1 \times 3.14(9.15 \text{ cm})^2}{2} & + & \frac{1(18.3 \text{ cm})(23.4 \text{ cm})}{2} \\ &= \frac{1 \times 3.14(83.7225 \text{ cm}^2)}{2} & + & \frac{428.2 \text{ cm}^2}{2} \\ &= 131.444 \text{ cm}^2 & + & 214.11 \text{ cm}^2 \\ &= 345.554 \text{ cm}^2 \end{aligned}$$

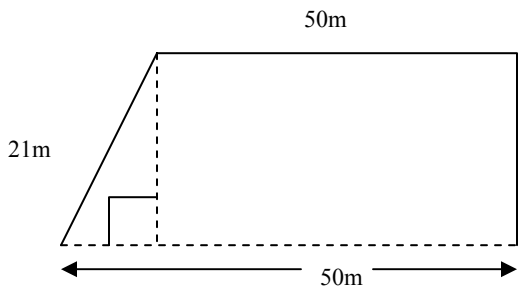
The area of this composite figure is 345.554 cm² or 345.554 square centimeters.

Example 2: Find the area of the composite figure if the parallelogram has a base of 50 m and a height of 20 m. If the trapezoid height is 15 m, the short base is 50 m and the long base is 58 m. Find the total area of these two figures.

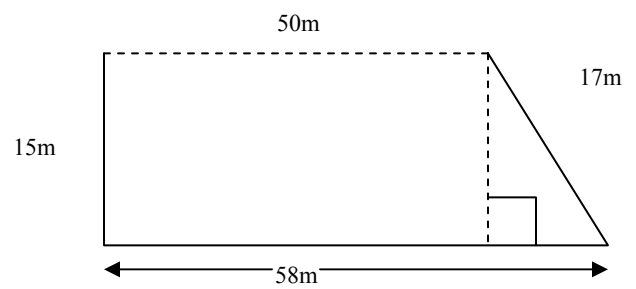


Solution:

First, remove the parallelogram from the trapezoid.



$$A = bh$$



$$\frac{1}{2} \times h (b + b)$$

Second, write the formula for each figure and solve. Use the Addition Postulate rule.

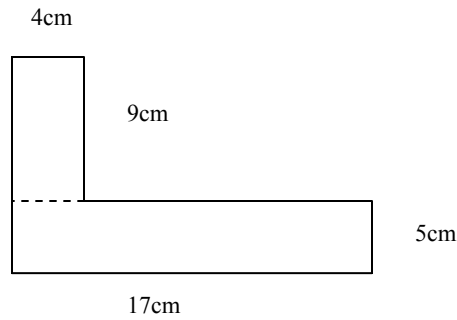
Hint: This figure is a **nonoverlapping (sum)** region.

$$\begin{aligned} \text{Area} &= \text{area of parallelogram} & + & \text{area of trapezoid} \\ \text{Area} &= (\text{base} \times \text{height}) & + & \frac{1}{2} \times \text{height}(\text{short base} + \text{long base}) \\ &= (50 \text{ m} \times 20 \text{ m}) & + & \frac{1}{2} \times 15 \text{ m} (50 \text{ m} + 58 \text{ m}) \end{aligned}$$

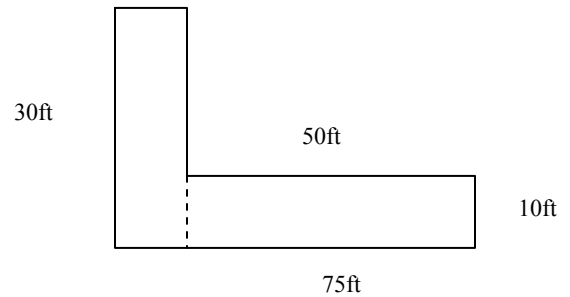
$$\begin{aligned}
 &= 1000 \text{ m}^2 && + && \frac{15\text{m}(108\text{m}^2)}{2} \\
 &= 1000 \text{ m}^2 && + && \frac{1620\text{m}^2}{2} \\
 &= 1000 \text{ m}^2 && + && 810 \text{ m}^2 \\
 &= 1810 \text{ m}^2
 \end{aligned}$$

The area of this figure is 1810 m^2 or 1810 square meters.

Example 3: Find the area of this L-shaped figure. Layout I is partitioned vertically, whereas Layout II is partitioned horizontally.



Layout I Vertically Partitioned

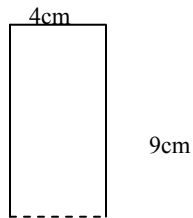


Layout II Horizontally Partitioned

Solution:

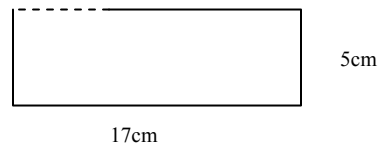
First, in Layout I, remove the short rectangle from the long rectangle. Use the Addition Postulate rule. This figure is a **nonoverlapping (sum)** region.

Short rectangle



$$A = lw$$

Long rectangle



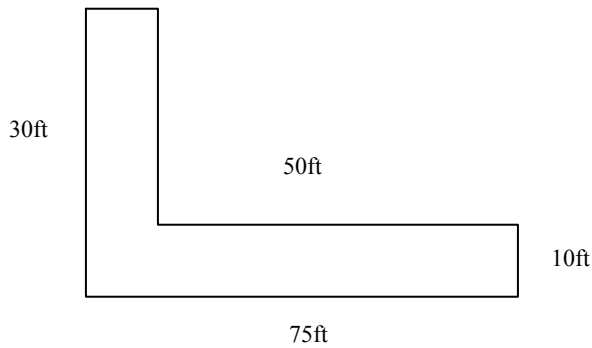
$$A = lw$$

Second, write the formula for each of the figures and solve.

$$\begin{aligned}
 \text{Area of figure} &= \text{area of short rectangle} & + & \text{area of long rectangle} \\
 \text{Area} &= (\text{length} \times \text{width}) & + & (\text{length} \times \text{width}) \\
 &= (9 \text{ cm} \times 4 \text{ cm}) & + & (17 \text{ cm} \times 5 \text{ cm}) \\
 &= 36 \text{ cm}^2 & + & 85 \text{ cm}^2 \\
 &= 121 \text{ cm}^2
 \end{aligned}$$

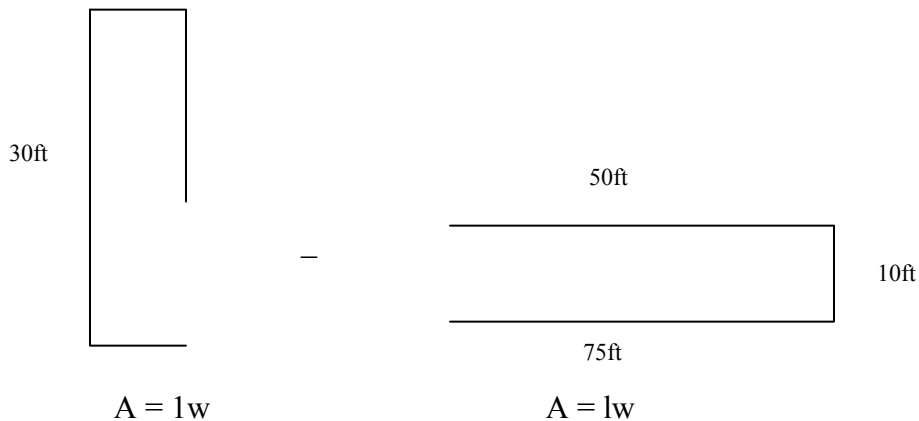
The area of Layout I is 121 cm^2 or 121 square centimeters.

Example 4: Find the area of **Layout II**. This figure is partitioned horizontally.



Solution:

First, remove the first rectangle from the second rectangle. Use the Addition of Postulate rule. Hint: This is an **overlapping (subtract)** region.

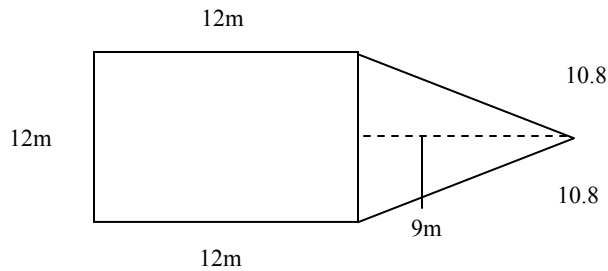


Second, write the formula for the figures and solve.

Area	=	area of rectangle	–	area of rectangle
	=	(length x width)	–	(length x width)
	=	(75 ft x 30 ft)	–	(50 ft x 20ft)
	=	2250 ft ²	–	500 ft ²
	=	1250 ft ²		

The area of this figure is 1250 ft² or 1250 square feet.

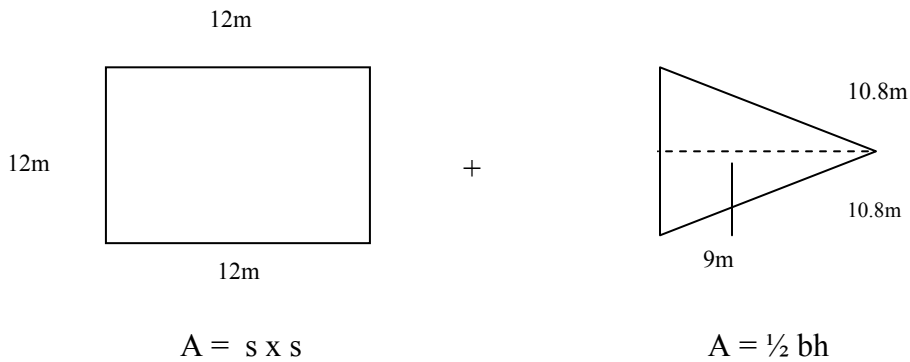
Example 5: Find the area of the triangle with a base of 12m and height of 9m, if the square is 12 m.



Solution:

First, remove the triangle from the square. Use the Area Addition Postulate rule.

Hint: This figure is a **nonoverlapping (sum)** region.

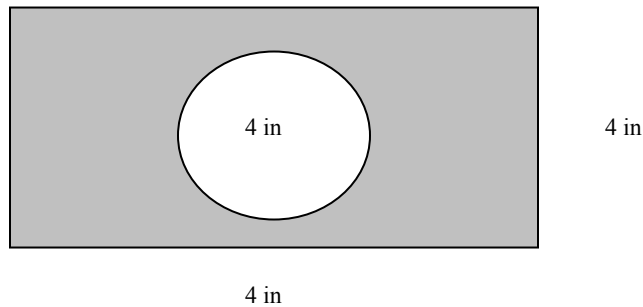


Second, write the formula for each of the figures and solve.

$$\begin{aligned}
 \text{Area} &= \text{area of square} && + && \text{area of triangle} \\
 \text{Area} &= s^2 && && \frac{1}{2}bh \\
 &= (12\text{ m} \times 12\text{ m}) && + && \frac{1(12\text{m} \times 9\text{m})}{2} \\
 &= 144\text{ m}^2 && + && \frac{108\text{m}^2}{2} \\
 &= 144\text{ m}^2 && + && 54\text{ m}^2 \\
 &= 198\text{ m}^2
 \end{aligned}$$

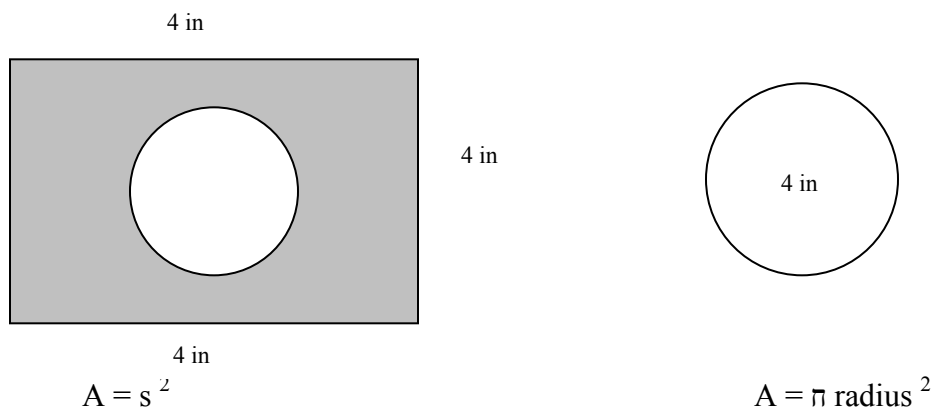
The area in this figure is 198 m^2 or 198 square meters.

Example 6: Find the area of the shaded portion of the figure. Use 3.14 for π .



Solution:

First, remove the circle from the square. Use the Addition of Postulate rule. This is an **overlapping (subtract)** region.



Second, to use the formula for finding the area of a circle, find the radius. In the circle, the diameter is 4 inches.

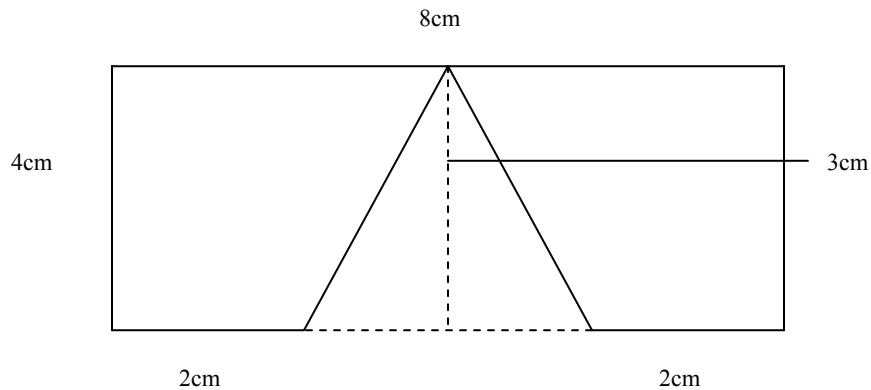
$$\begin{aligned}
 \text{Radius} &= \frac{1}{2} \times \text{diameter} & \text{or} & \quad \text{Radius} = \frac{\text{diameter}}{2} \\
 &= \frac{1}{2} \times \frac{4 \text{ in}}{1} & & \quad = \frac{4 \text{ in}}{2} \\
 &= \frac{4 \text{ in}}{2} & & \quad = 2 \text{ in} \\
 &= 2 \text{ in}
 \end{aligned}$$

Third, write the formula for each figure and solve.

$$\begin{aligned}
 \text{Area of shaded portion} &= \text{area of a square} & - & \quad \text{area of a circle} \\
 &= s \cdot s & - & \quad \pi (\text{radius})^2 \\
 &= s^2 & - & \quad \pi r^2 \\
 &= (4 \text{ in} \cdot 4 \text{ in}) & - & \quad 3.14 (2 \text{ in})^2 \\
 &= 16 \text{ in}^2 & - & \quad 3.14 (4 \text{ in}) \\
 &= 16 \text{ in}^2 & - & \quad 12.56 \text{ in}^2 \\
 &= 3.44 \text{ in}^2
 \end{aligned}$$

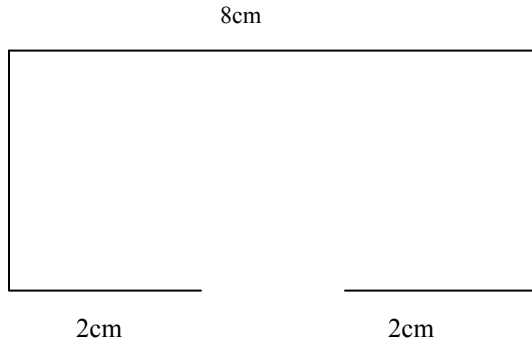
The area is 3.44 in^2 or 3.44 square inches.

Example 7: Find the area of a rectangle with a length of 8 cm and width of 4cm, if the triangle base is 4 cm and height is 3 cm.

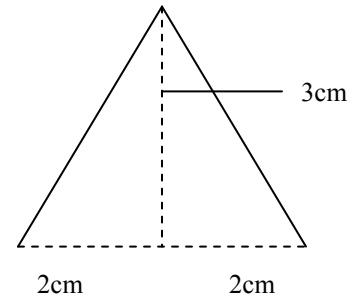


Solution:

First, remove the triangle from the rectangle. Use the Addition of Postulate rule.
 Hint: This is an **overlapping** (subtract) region.



$$A = lw$$



$$A = \frac{1}{2}bh$$

Second, use the formula for each figure and solve.

Area	=	area of rectangle	–	area of triangle
Area	=	(length x width)	–	$\frac{1}{2}$ (base x height)
	=	(8 cm x 4 cm)	–	$\frac{1}{2}$ (4 cm x 3 cm)
	=	32 cm ²	–	$\frac{12 \text{ cm}^2}{2}$
	=	32 cm ²	–	6 cm ²
	=	26 cm ²		

The area of the figure is 26 cm² or 26 square centimeters.

Example 8: Find the area of the shaded region. Use 3.14 for π.



Solution:

First, remove the second semicircle from the rectangle. Use the Addition of Postulate rule. This is an **overlapping (subtract)** region.



Second, to use the formula for finding the area of a circle, find the radius. In this circle, the diameter is 8 ft.

$$\begin{array}{lcl}
 \text{Radius} = & \frac{1}{2} \text{ diameter} & \text{or} & \text{Radius} & = & \frac{\text{diameter}}{2} \\
 & = & \frac{1}{2} \cdot \frac{8 \text{ ft}}{1} & & = & \frac{8 \text{ ft}}{2} \\
 & = & \frac{8 \text{ ft}}{2} & & = & 4 \text{ ft} \\
 & = & 4 \text{ ft} & & &
 \end{array}$$

Third, write the formula for each figure and solve.

$$\begin{array}{lcl}
 \text{Area of shaded portion} & = & \text{area of a rectangle} & - & \text{area of circle} \\
 \text{Area} & = & (\text{length} \times \text{width}) & - & \pi (\text{radius})^2 \\
 & = & (22 \text{ ft} \times 8 \text{ ft}) & - & 3.14 (4 \text{ ft})^2 \\
 & = & 176 \text{ ft}^2 & - & 3.14 (16 \text{ ft}^2) \\
 & = & 176 \text{ ft}^2 & - & 50.24 \text{ ft}^2 \\
 & = & 125.76 \text{ ft}^2 & &
 \end{array}$$

The area of this figure is 125.76 ft² or 125.76 square feet.

