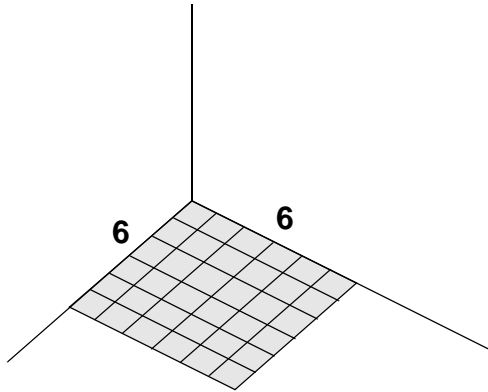


Section 12.4

Area

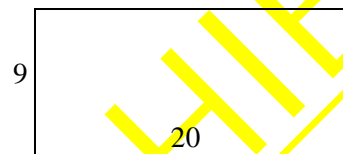
Area is the way *surface* is measured. Surface could be a floor, a yard, a wall, or the contact area of a tire against the road. Area is the product (multiplication) of quantities measured in TWO directions.



In the graph below, area is the plane that has been darkened and it accounts for every one of the smaller squares inside the area.

The graph has 36 square units, ($6 \times 6 = 36$).



Example: Find the area of the rectangle shown below.



$$\text{Area} = \text{LENGTH} \times \text{HEIGHT} = 20 \times 9 = 180$$

FORMULAS TO FIND THE AREA OF CERTAIN SHAPES

AREA FORMULAS

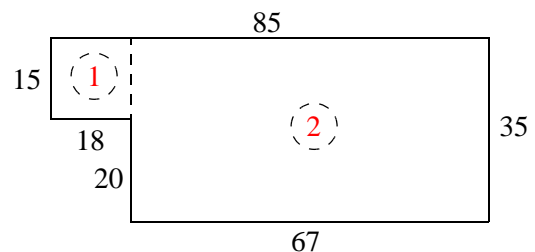
FIGURE	FORMULA	COMMENTS
Rectangle	bh	Base \times Height (Also for the square)
Triangle	$\frac{bh}{2}$	Splitting the rectangle in two 
Trapezoid	$\frac{h(B_1 + B_2)}{2}$	Two bases. Forms from a rectangle and 2 triangles 
Circle	πr^2	Where r is the radius and $\pi = 3.14$

Example:

Find the area, in square feet, of the floor plan shown. Areas of unusual shapes may be separated into familiar shaped areas that fit the equations known, then add them to find the answer.

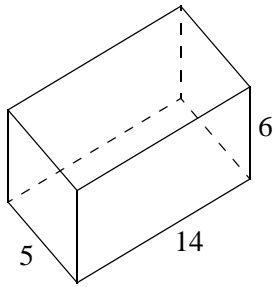
The floor plan shown consists of two rectangles:

1. (15×18) and 2. (67×35). See diagram.

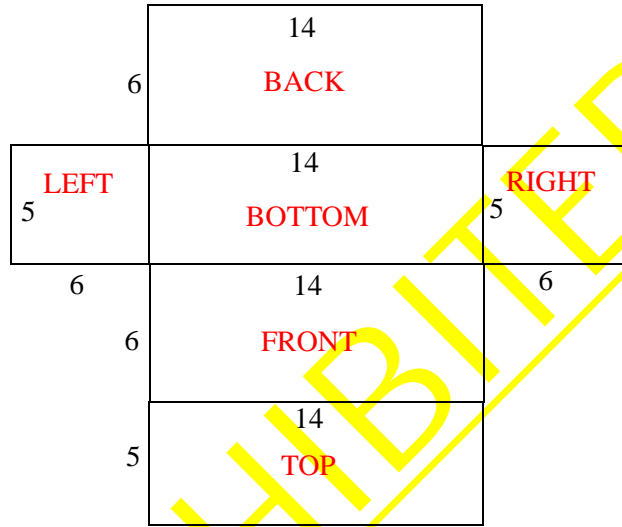


$$\text{Area}_{\text{rect.}} = \overset{1}{bh} + \overset{2}{bh} = \underset{1}{(15 \times 18)} + \underset{2}{(67 \times 35)} = 2615 \text{ ft}^2$$

Example: In the box shown below, the bottom has an area of 14×5 and the height is 6. If the outside of the box is to be painted, how much area will be covered with paint? (Units in inches)



Before any computation is performed, all surfaces must be laid out. The box is unfolded and all corresponding dimensions identified. The figure to the right shows this. Pairing the six sides of the box:

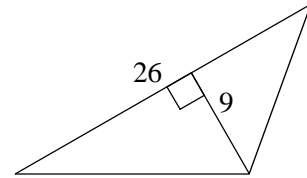
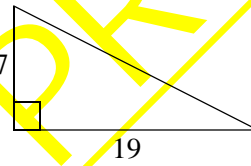
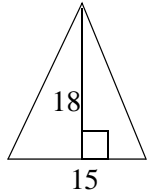


$\xrightarrow{\text{top \& bottom}}$ $\xrightarrow{\text{front \& back}}$ $\xrightarrow{\text{left \& right}}$
 $\text{Area}_{\text{rect.}} = 2(bh) + 2(bh) + 2(bh)$

$$= 2(5 \times 14) + 2(6 \times 14) + 2(5 \times 6)$$

$$= 140 + 168 + 60 = 368 \text{ in}^2$$

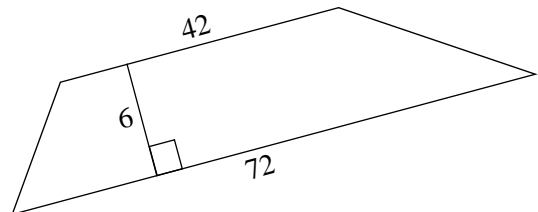
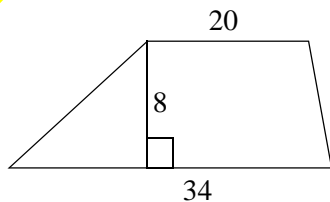
Example: Find the area of the triangles shown.



$$\text{Area}_T = \frac{bh}{2} \quad \text{Area} = \frac{15 \times 18}{2} = 135 \quad \text{Area} = \frac{19 \times 7}{2} = 66.5 \quad \text{Area} = \frac{26 \times 9}{2} = 117$$

Notice that each triangle has three bases and three heights. Which one to use is optional. However, base and height must form a right (90°) angle.

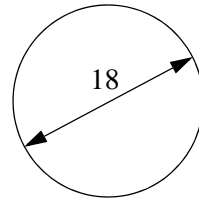
Example: Find the area of the trapezoids shown.



$$\text{Area}_{\text{trap.}} = \frac{h(B_1 + B_2)}{2} \quad \text{Area} = \frac{8(20 + 34)}{2} = 216 \quad \text{Area} = \frac{6(42 + 72)}{2} = 342$$

Example: Find the area, in square meters, of the circle shown.

Because the measure given in the diagram is the diameter and the radius is needed, divide diameter by 2 and calculate the answer.

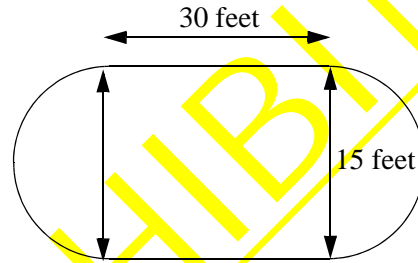


$$\text{Area}_C = \pi r^2 = (3.14)(9^2) = (3.14)(81) = 254.34 \text{ m}^2$$

Example: Find the area, in square feet, of the compound figure shown.

The figure consists of two half-circles and a rectangle. Find the areas of half circles and rectangle separately, then combine.

Because the half circles are the same size, they'll be joined to make one complete circle with a diameter of 15 and a radius (half) of 7.5.



$$\text{Area} = bh + \pi r^2$$

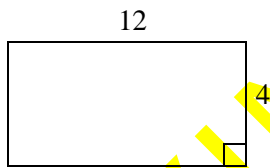
$$\text{Area} = (30)(15) + (3.14)(7.5)^2$$

$$\text{Area} = 450 + 176.625 = 626.6 \text{ ft}^2 \text{ (rounded)}$$

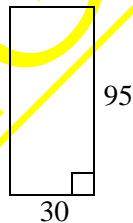
Practice:

Find the area.

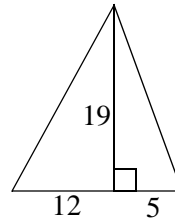
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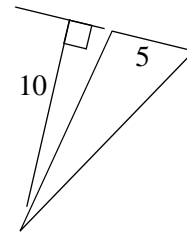
2.



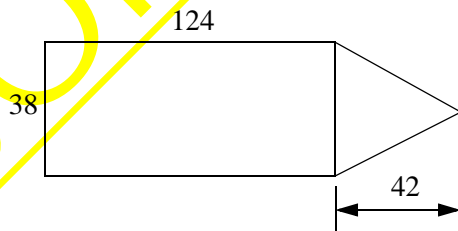
3.



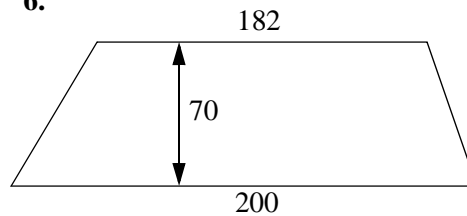
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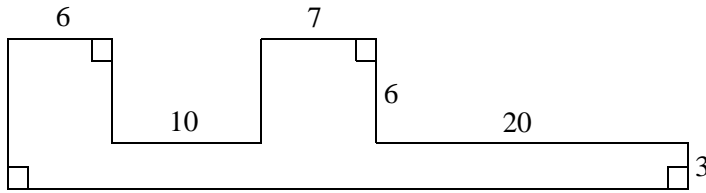
5.



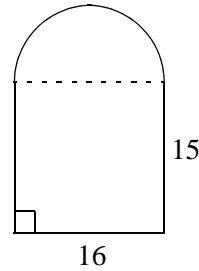
6.



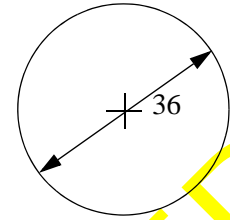
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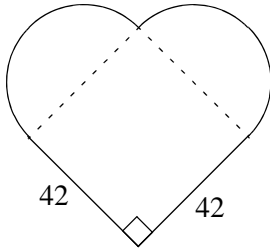
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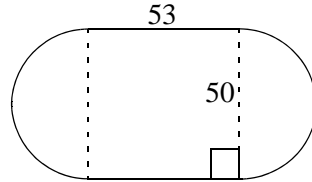
9.



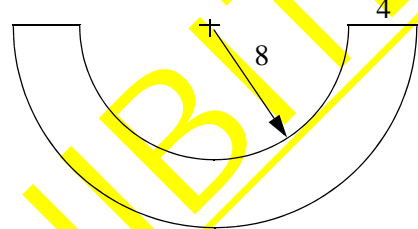
10.



11.



12.



Solve.

13. A display for fruit is shown in figure 1. How much area is available?
14. The water tanks of a certain city need paint. If the tanks are circular and 20 feet wide by 30 feet high, how much area needs to be covered in one tank? (The bottom does not need paint.)
15. Antonio's rectangular yard is 45 feet long and 27 feet wide. If he wants to cover it with sod and sod is sold by the square yard, how many square yards must he buy?
16. The four walls Flora wants to paint are each 250 centimeters high and 400 centimeters long. How many square meters of wall will she paint?
17. The surface area of a rectangular steel plate has 6 holes as shown in figure 2. Find the area of the plate after the holes were cut out.
18. The surface area of a cube is 486 square inches. Find the measure of one side of the cube.
19. The surface area of a cube is 384 square inches. Find the measure of one side of the cube.
20. The roof of a rectangular 30 feet by 40 feet house is made up of four sections as shown in figure 3. Find the area to install a new roof.
21. Ricky is cutting a piece of wood for his dog house and wood is sold by the square foot. If the piece is triangular in shape and is 36 inches high and 48 inches wide, how much should he buy?
22. Shantavia has to fill a triangular hole that has an area of 72 square inches. If the height of the hole is 12 inches, how wide is its base?
23. If the 20-inch high isosceles triangle shown in figure 4 is inscribed with a circle having a 7-inch diameter, how much area is left outside the circle?
24. A space alien dressed as a farmer is making crop circles in a corn farm in Kansas. If it wants to make the circles 28 "smuts" in diameter, how many square "smuts" of farmland will it destroy?
25. A Coast Guard airplane on a rescue mission covers a circular area of 700 square miles. To the nearest tenth, what is the diameter of the circular path?

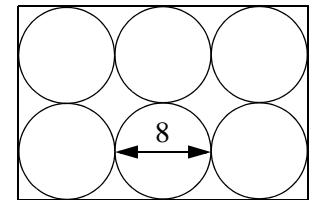
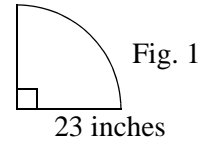


Fig. 2

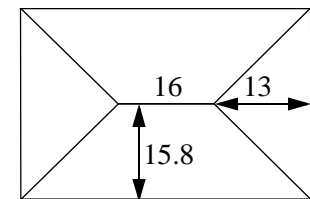


Fig. 3

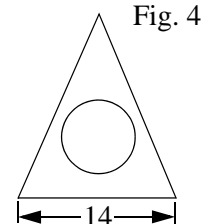


Fig. 4