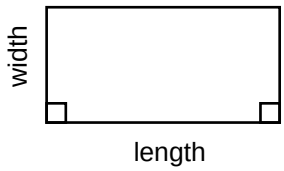
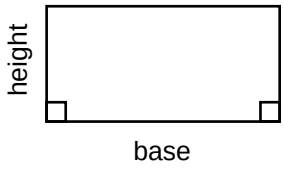
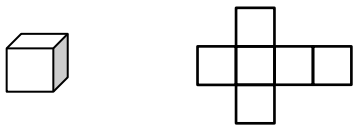
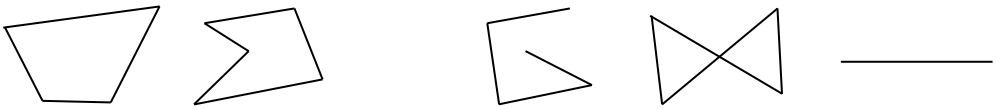
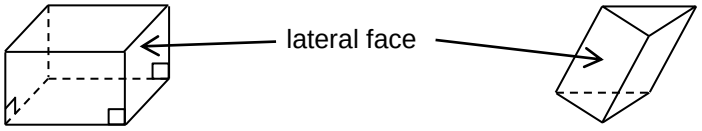
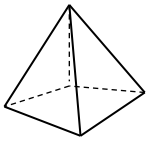
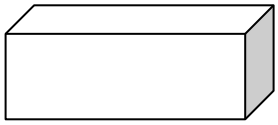
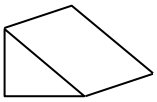
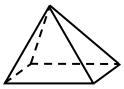
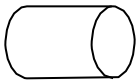
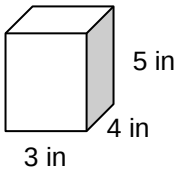
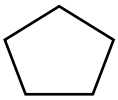
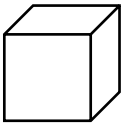
STUDENT RESOURCES

Word or Phrase	Definition
area	The <u>area</u> of a two-dimensional figure is a measure of the size of the figure, expressed in square units. The area of a rectangle is the product of its length and width (Area = length • width). or The area of a rectangle is the product of its base and height (Area = base • height). If this rectangle has a length of 12 inches and a width of 5 inches, then: $A = \ell w$ or $A = bh$ $A = (12)(5)$ or $A = (12)(5)$ $A = 60$ square inches $A = 60$ square inches  
net	A <u>net</u> for a three-dimensional figure is a two-dimensional pattern for the figure. If cut from a sheet of paper, for example, a net forms one connected piece which can be folded with the edges joined to form the given figure. cube net of a cube 
plane	A <u>plane</u> is a flat, two-dimensional surface without holes that extends to infinity in all directions.
polygon	A <u>polygon</u> is a special kind of figure in a plane made up of a chain of line segments laid end-to-end to enclose a region.  polygons not polygons

Word or Phrase	Definition
prism	*A <u>prism</u> is a solid figure in which two faces (the bases) are identical parallel polygons, and the other faces (referred to as the lateral faces) are parallelograms.* *If the lateral faces are perpendicular to the bases, the prism is a right prism. Otherwise, the prism is an oblique prism.*  A right rectangular prism is a right prism whose bases are rectangles and whose faces are rectangles. An oblique triangular prism is a prism whose bases are triangles and whose faces are parallelograms.
pyramid	A <u>pyramid</u> is a solid figure in which one face (the base) is a polygon, and the other faces (referred to as lateral faces) are triangles with a common vertex (referred to as the apex). The Egyptian pyramids are square pyramids since they have square bases. 
right rectangular prism	A <u>right rectangular prism</u> is a six-sided solid figure in which all the faces are rectangles. A rectangular box is a right rectangular prism. 
solid figure	A <u>solid figure</u> refers to a figure in three-dimensional space such as a prism or a cylinder.     cube triangular prism rectangular pyramid cylinder
surface area	The <u>surface area</u> of a three-dimensional figure is a measure of the size of the surface of the figure, expressed in square units. If the surface of the three-dimensional figure consists of two-dimensional polygons, the surface area is the sum of the areas of the polygons. If this rectangular box has a length of 3 inches, a width of 4 inches, and a height of 5 inches, then  $SA = 2(\ell w) + 2(\ell h) + (wh)$ $SA = 2(3 \bullet 4) + 2(3 \bullet 5) + 2(4 \bullet 5)$ $SA = 94$ square inches

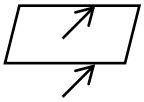
Word or Phrase	Definition
vertex	A vertex (plural of vertices) of a polygon or solid figure is a point where two edges meet. See polygon, solid figure. A pentagon has five vertices. 
volume	The volume of a three-dimensional figure is a measure of the size of the figure, expressed in cubic units. The volume of a right rectangular prism is the product of its length, width, and height. If this cube has a side length of 3 units, then  $V = \ell wh$ $V = 3 \bullet 3 \bullet 3$ $V = 27$ cubic inches

Base of a Polygon (*b*) Versus Base of a Solid Figure (*B*)

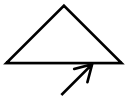
The base of a polygon is a predesignated side of the figure. It is typically denoted with a "*b*."

The base is usually regarded as the "bottom" of the polygon. The top is also a base, if it is parallel to the bottom.

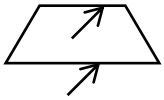
Any side of a parallelogram may be the base.



Any side of a triangle may be chosen as the base.



A trapezoid has two bases. They are the parallel sides.

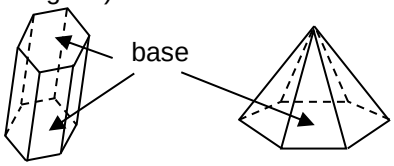


The base of a solid figure is a predesignated face of the figure. It is typically denoted with a *"B*."

The base is usually regarded as the "bottom" of the figure, on which it is standing. The "top" of a figure is sometimes also referred to as a base if it is identical and parallel to the "bottom."

This right prism has two parallel bases (hexagons).

This right pyramid has two one base (a hexagon).



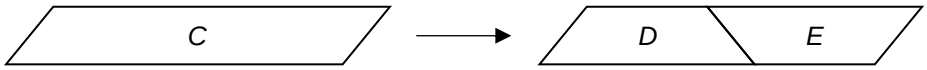
Composing and Decomposing Shapes: "Cut-Up Strategies"

Composing shapes refers to joining geometric shapes without overlaps to form other shapes.

Here are two identical triangles (*A* and *B*). When joining *A* and *B* (after rotating *B*), the result is a parallelogram with twice the area of each of the given triangles.

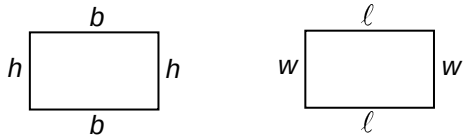
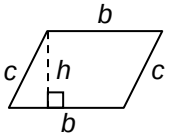
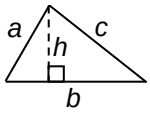
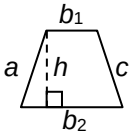
Decomposing shapes refers to taking a given geometric shape, and identifying geometric shapes that meet without overlap to form that given shape.

Given parallelogram *C*, we can identify a segment that creates two identical trapezoids *D* and *E*, each with one-half the area of *C*.



Composing and decomposing shapes are useful strategies for finding area formulas for common polygons derived from ones we already know. We refer to these methods collectively as "cut-up" strategies. For example, first we learn the formula for area of a rectangle. Then we can use a cut-up strategy to find the formula for area of a parallelogram. Then we can use other cut-up strategies to find the formulas for area of a triangle and area of a trapezoid.

Summary of Area Formulas

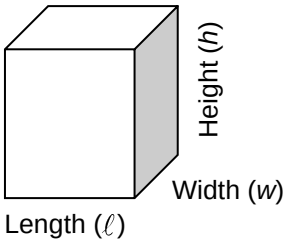
Shape/Definition	Diagram	Area
Rectangle a quadrilateral with 4 right angles		$A = bh$ or $A = \ell w$
Square a rectangle with 4 sides of equal length		$A = b^2$ or $A = s^2$
Parallelogram a quadrilateral with opposite sides parallel		$A = bh$
Triangle a polygon with three sides		$A = \frac{1}{2} bh$
Trapezoid a quadrilateral with at least one pair of parallel sides		$A = \frac{1}{2} (b_1 + b_2)h$

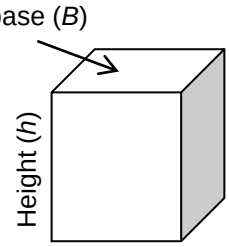
Volume and Surface Area of Right Rectangular Prisms

A right rectangular prism is identified by its length, width, and height.

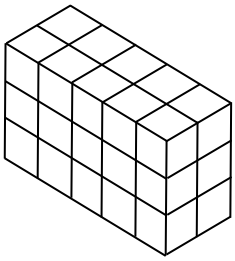
The area of the base is the product of the length and width ($B = \ell w$).

If the top and bottom rectangular faces are chosen as the bases, then the other rectangles are referred to as the lateral faces.

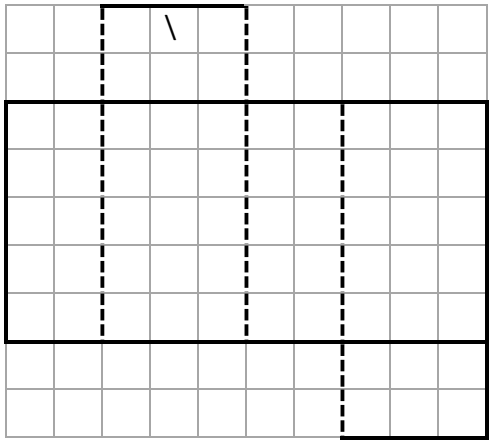




Right rectangular prism made with 30 cubes



Net of the same prism



Volume

The volume of a prism may be computed by counting layers of unit cubes. In the prism above, each layer has 10 cubes (5×2). There are 3 layers.

The volume is $(5 \times 2)(3) = 10(3) = 30$ cubic units.

In general, multiply the area of the base (B) by the height.

$V = \ell wh$ OR $V = Bh$

Surface Area

The surface area may be computed by creating a net that shows the areas of each face of the prism. In this prism there are two faces with dimensions 2×5, two faces with dimensions 3×2, and two faces with dimensions 3×5.

The surface area is
$2(2 \times 5) + 2(3 \times 2) + 2(3 \times 5)$
$= 20 + 12 + 30$
$= 62$ square units.

In general, find the area of each rectangular face.

$SA = \ell w + \ell w + wh + wh + \ell h + \ell h$ OR
$SA = 2\ell w + 2wh + 2\ell h$ OR
$SA = 2(\ell w + wh + \ell h)$