12.2 Surface Area of Prisms and Cylinders

prism – a polyhedron with 2 congruent faces, called ***bases***, that lie in parallel planes

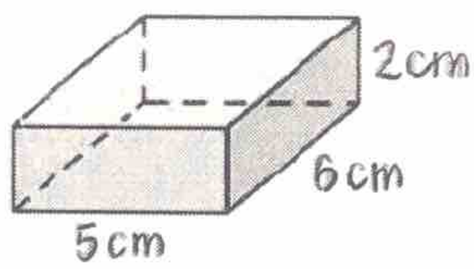
lateral faces – the faces of a prism that are not the bases, parallelogram formed by connecting the corresponding vertices of the bases

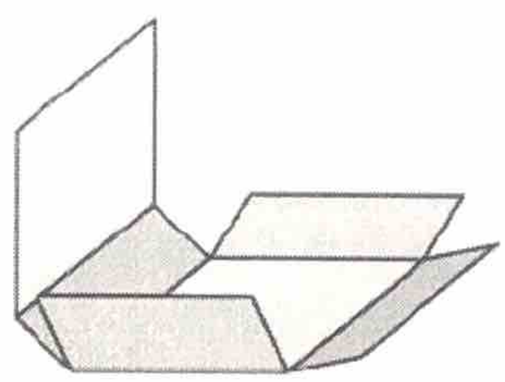
lateral edges – segments connecting the corresponding vertices of the bases

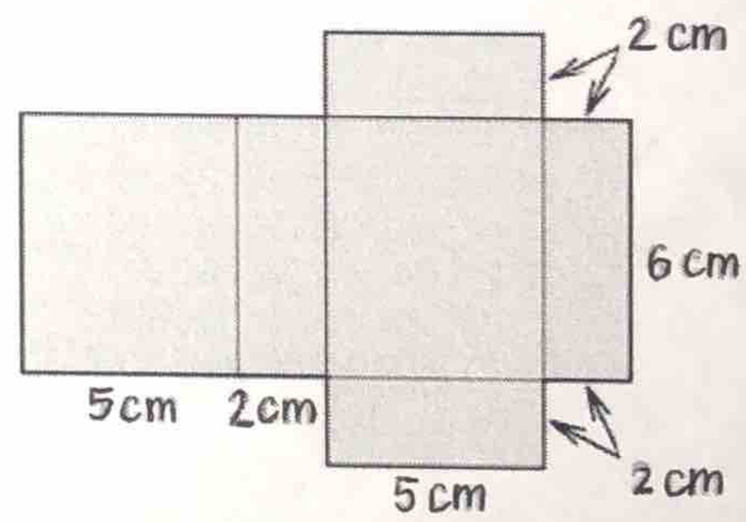
surface area – the sum of the areas of all faces of a polyhedron

lateral area – the sum of the areas of the lateral faces of a polyhedron

Ex 1: Find the surface area of a rectangular prism with height 2 cm, length 5 cm, and width 6 cm.







Left & Right Faces: $A = (6)(2) = 12\text{cm}^2$ each

Front & Back Faces: $A = (5)(2) = 10\text{cm}^2$ each

Top & Bottom Faces: $A = (6)(5) = 30\text{ cm}^2$ each

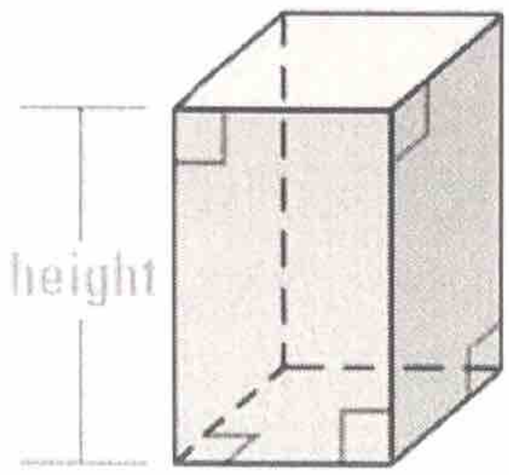
$SA = (12 + 10 + 30)2$

$\boxed{SA = 104\text{ cm}^2}$

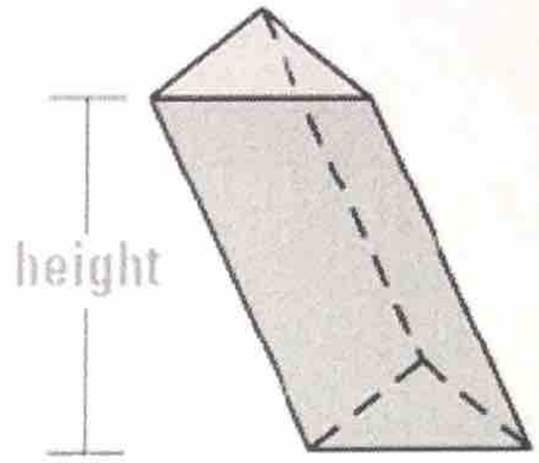
height of a prism – perpendicular distance between bases

right prism – a prism in which each lateral edge is perpendicular to both bases

oblique prism – a prism with lateral edges that are not perpendicular to the bases



Right rectangular prism



Oblique triangular prism

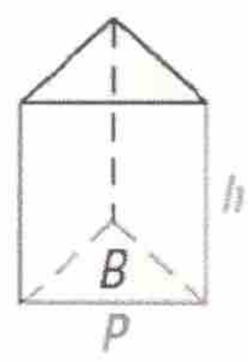
THEOREM *For Your Notebook*

THEOREM 12.2 Surface Area of a Right Prism

The surface area S of a right prism is

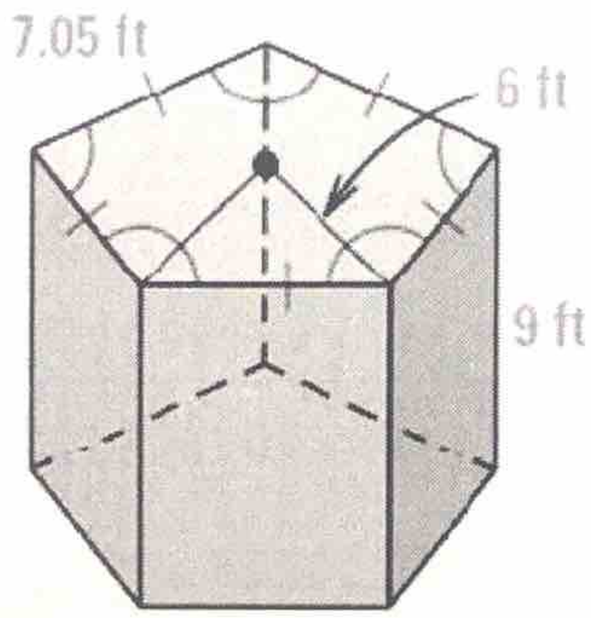
$$S = 2B + Ph = aP + Ph,$$

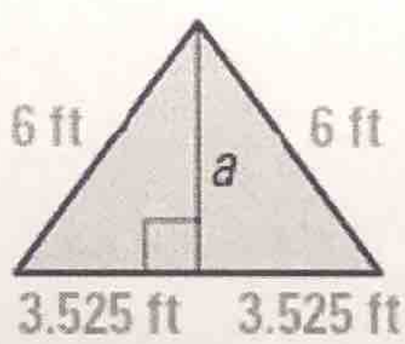
where a is the apothem of the base, B is the area of a base, P is the perimeter of a base, and h is the height.



$S = 2B + Ph = aP + Ph$

Ex 2: Find the surface area of the right pentagonal prism.





$P_{base} = 5(7.05) = 35.25$ feet

apothem: $(3.525)^2 + (a)^2 = 6^2$

$a = \sqrt{6^2 - 3.525^2}$

$a \approx 4.86$

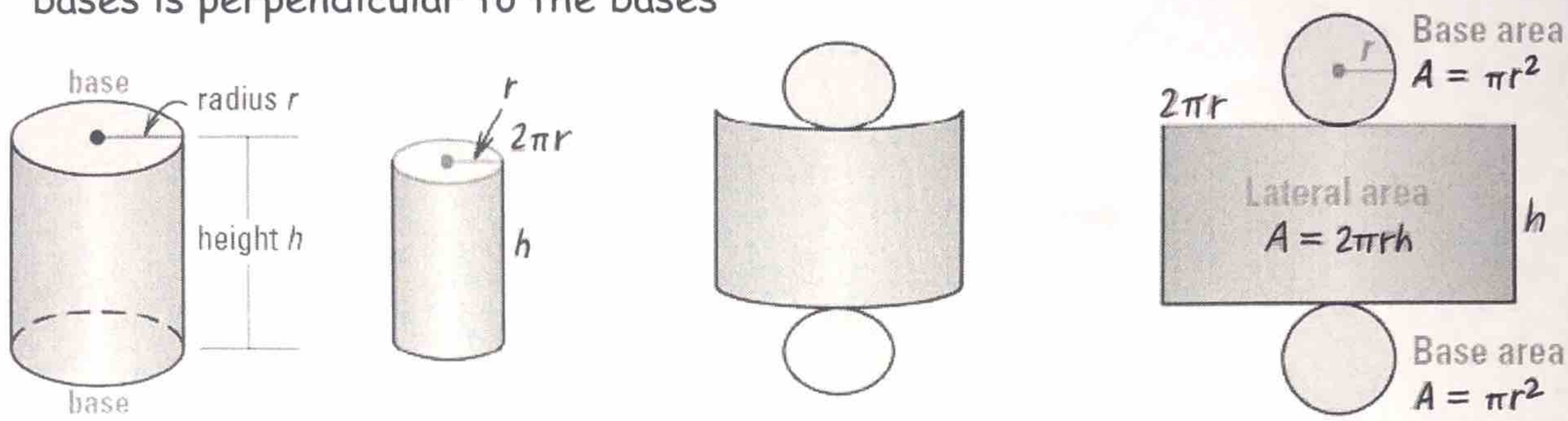
$SA = aP + Ph$

$SA \approx (4.86)(35.25) + (35.25)(9)$

$\boxed{SA \approx 488.57 \text{ ft}^2}$

cylinder - a solid with congruent circular bases that lie in parallel planes

right cylinder - a cylinder in which the segment joining the centers of the bases is perpendicular to the bases



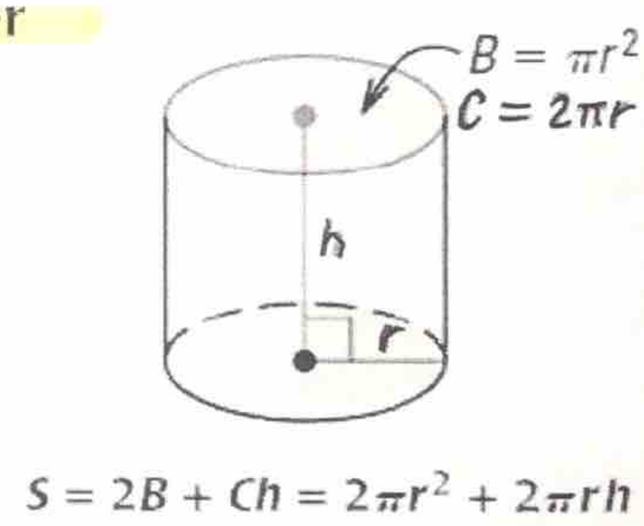
THEOREM *For Your Notebook*

THEOREM 12.3 Surface Area of a Right Cylinder

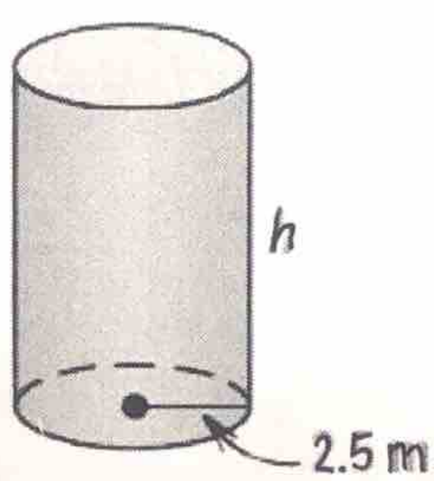
The surface area S of a right cylinder is

$$S = 2B + Ch = 2\pi r^2 + 2\pi rh,$$

where B is the area of a base, C is the circumference of a base, r is the radius of a base, and h is the height.



Ex 3: Find the height of the right cylinder, which has a surface area of 157.08 square meters.



$$SA = 2\pi r^2 + 2\pi rh$$

$$157.08 = 2\pi(2.5)^2 + 2\pi(2.5)h$$

$$157.08 = 12.5\pi + 5\pi h$$

$$157.08 - 12.5\pi = 5\pi h$$

$$117.81 \approx 5\pi h$$

$$\boxed{h \approx 7.5\text{ m}}$$