

Chapter 1: Polygons

Polygons and Interior Angles

The sum of interior angles is always 180 times 2 less than n

$$180 \times (n-2)$$

Polygons and Area

Always remember: The height always refers to a line drawn from the opposite of the vertex to the base, creating a 90 degree angle.

Area Formulas to Remember

Trapezoid	$\frac{1}{2} \times (\text{Base}_1 + \text{Base}_2) \times \text{Height}$	(avg of bases x height)
Parallelogram	Base x Height	Need to often drop line to calc height
Rhombus	$\frac{1}{2} \times (\text{Diagonal}_1 \times \text{Diagonal}_2)$	Diagonals are always perpendicular bi-sectors

Dimensions: Surface Area

-Rectangular solids and cubes have **six faces**

Cube: for DS, need just one side

Dimensions: Volume

Volume = Length x Width x Height

volume is measured in CUBIC units-

With a cube – you just need one side, since all sides are equal.

$$S^3$$

Common GMAT trick is to give volume then ask how many of that item can fit into another volume. Remember: Volume does not speak to surface area dimensions.

Chapter 2: Triangles & Diagonals

General rule:	Angles correspond to their opposite sides →	smallest angle is opposite shortest side Largest side is opposite largest angle
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Thus: If two sides are equal, so are their angles

Thus: If two angles are equal, so are their sides

If two sides or angles are equal: This is an isosceles triangle

Sides of a Triangle

The sum of any two sides of a triangle must be greater than the third side

It also must be greater than the difference between the length of other two sides

If you are given two sides of a triangle, the length of the third side must lie between the difference and the sum of the two given sides.

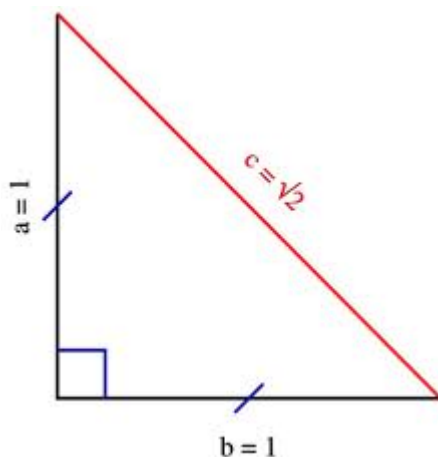
Common Right Triangles

Watch out for imposter non-right triangles! GMAT loves to throw these in to test-rushers

Common Combinations	Key Multiples
3-4-5	6-8-10 9-12-15 12-16-20
5-12-13	10-24-26
8-15-17	none

Isosceles Triangles & the 45-45-90

The most important isosceles triangle on the GMAT is the **isosceles right triangle**



45	45	90
leg	leg	hypoten
1:	1:	$\sqrt{2}$
x	x	\sqrt{x}

You must memorize how to find the length

If you are given the hypotenuse side $\sqrt{18}$ then make an equation: $x\sqrt{2} = \sqrt{18}$ to find x . (Divide both sides by **root 2** then get $x=3$ in this case.

If you are given diagonals of a square:

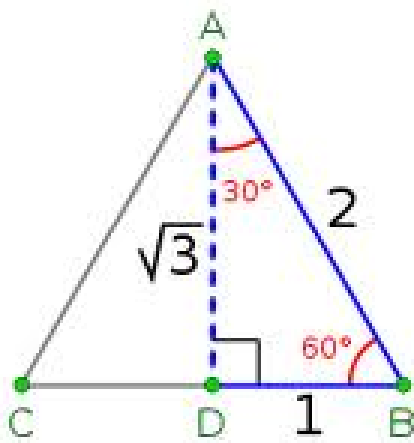
Then realize you can probably figure out measurements using rules of isosceles right triangles.

Equilateral Triangles and the 30-60-90 Triangle

An equilateral triangle is all three sides (and angles) are equal. (all three angles are 60 degrees)

A close relative of the equilateral is the 30-60-90

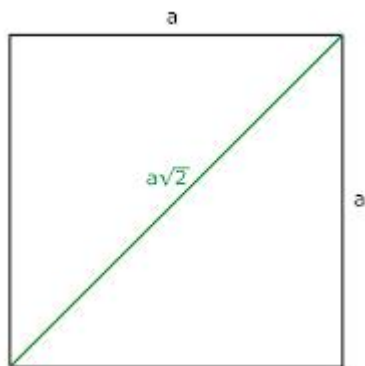
Notice two 30-60-90's can form an equilateral triangle



30	60	90
Short leg	Long leg	hypotn
1:	$\sqrt{3}$:	2
x	$x\sqrt{3}$	$2x$

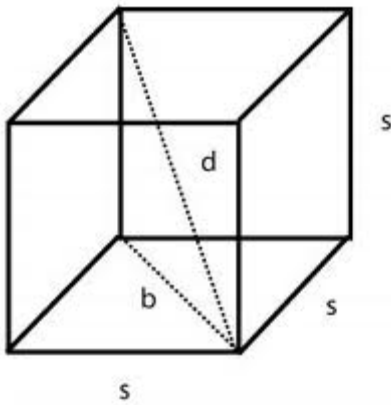
Diagonals of Other Polygons

Diagonal of a square: $x\sqrt{2}$



Main diagonal of a **cube**: $s\sqrt{3}$

Diagonal of Rectangular Solid



- 1) Find diagonal of bottom face
- 2) Use side or other given length
- 3) Calculate using Pythagorean theorem

Alternatively, the Deluxe Pythagorean Theorem: $d^2 = x^2 + y^2 + z^2$ where d is the diagonal.

Similar Triangles

Triangles are defined as similar if all their corresponding angles and their corresponding sides are in proportion.

- If you find that 2 triangles have 2 pairs of equal angles, you know they are similar.
- You know the third angle is congruent

If two similar triangles have corresponding **side lengths** in ratio $a:b$, then their **areas** will be in the ratio $a^2:b^2$

For similar **solids** with **sides** in ratio $a:b$ their **volumes** will be $a^3:b^3$ (note, cubed, not squares)

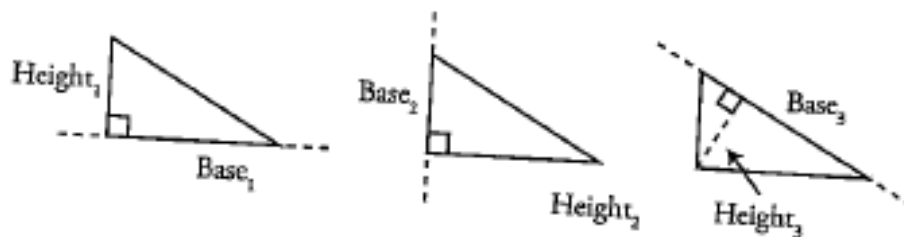
Area of Right Triangle

$$A = \frac{1}{2} \times (\text{One Leg}) \times (\text{Other Leg})$$

or

$$\frac{1}{2} \times (\text{hypotenuse}) \times (\text{height from hypotenuse})$$

Area of Equilateral Triangle



Thus, the area of a right triangle is given by the following formulas:

$$A = \frac{1}{2} \times (\text{One leg}) \times (\text{Other leg}) = \frac{1}{2} \text{ Hypotenuse} \times \text{Height from hypotenuse}$$

Because an **equilateral triangle** can be split into two 30–60–90 triangles, a useful formula can be derived for its area. If the side length of the equilateral triangle is S , then S is also the hypotenuse of each of the 30–60–90 triangles, so their sides are as shown in the diagram.



The equilateral triangle has base of length S and a height of length $\frac{S\sqrt{3}}{2}$. Therefore, the area of an equilateral triangle with a side of length S is equal to $\frac{1}{2}(S)\left(\frac{S\sqrt{3}}{2}\right) = \frac{S^2\sqrt{3}}{4}$.

Knowing this formula can save you significant time on a problem involving the area of an equilateral triangle, although you can always solve for the area without this formula.

Chapter 3: Circles & Cylinders

Circumference	$C = \pi d$	$C = \pi 2 r$
Diameter	$d = 2 r$	
Area	$A = \pi r^2$	

If you know **any** one of these values, you can determine the rest.

Circumference and Arc Length

Use central angel over 360 to find portion of circle, and then use circumference and multiple together

Area of a Sector

- 1) find area of circle
- 2) Use central angel to determine fraction of entire circle
- 3) Multiply

Inscribed Triangles

An inscribed angle is equal to half of the arc it intercepts

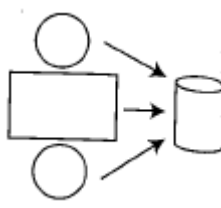
Inscribed Triangles

Important: If one of the sides of an inscribed triangle is the diameter of the circle, then tie triangle **must** be a right triangle. → If any right triangle inscribed in a circle must have the diameter as one of its side (also splitting circle in half)

Cylinders and Surface Area

Need two pieces of information to find surface area of cylinder: (1) radius (2) height

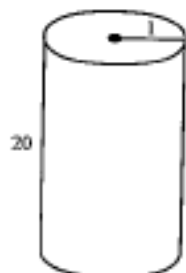
$$SA = 2 \text{ circles} + \text{rectangle} = 2(\pi r^2) + 2\pi rh$$



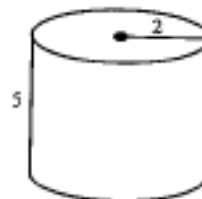
Cylinders and Volume

$$V = \pi r^2 h$$

Need two pieces of information to find volume of cylinder: (1) radius (2) height



$$\begin{aligned} V &= \pi r^2 h \\ &= \pi(1)^2 20 \\ &= 20\pi \end{aligned}$$



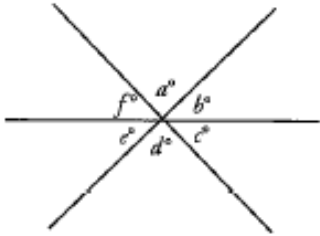
$$\begin{aligned} V &= \pi r^2 h \\ &= \pi(2)^2 5 \\ &= 20\pi \end{aligned}$$

Notice that they can have same volume, different shapes

Chapter 4: Lines & Angles

Intersecting Lines

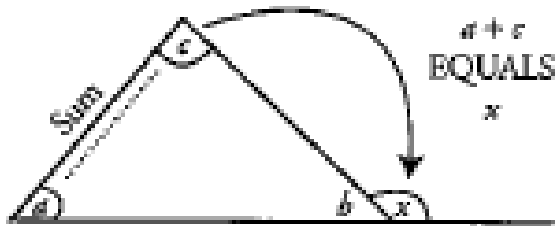
Sum to 360 to form a circle... also supplementary lines are interior angles that form a line and sum to 180



Don't forget, opposite angles are equal ($f=c$, $d=a$, so on).

Exterior Angles of a Triangle

This is frequently tested on the GMAT. Oftentimes must remove or draw more lines to see it when re-drawing



$a + b + c = 180$ (sum of angles in a triangle).

$b + x = 180$ (supplementary angles).

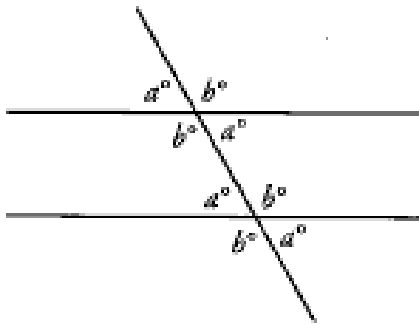
Therefore, $x = a + c$.

You know this because, b and x must sum to 180, which means $a+c$ is equal to x .

Parallel Lines Cut by a Transversal

Often tested on the GMAT

Strategy: always fill in the acute and obtuse angles – also extend lines if needed.



Chapter 5: Coordinate Plane

Intercepts of a Line

X intercept	$(x,0)$	point at which $y = 0$	To find: plug 0 in for y
y intercept	$(0,y)$	point which $x = 0$	To find: plug 0 in for x

Slope Intercept Form: $y=mx+b$

Is a linear equation (linear equations don't use roots or "xy")

Distance between two points

- 1) Draw a triangle
- 2) Find lengths of two legs (by calculating the rise, then calculating the run)
- 3) Use Pythagorean Theorem to find length of diagonal

And Always Remember

NEVER TRUST THE DIAGRAMS, INCLUDING IF LINES LOOK PARRALLEL UNLESS IT IS STATED!

ALWAYS REDRAW!!!!!!!!!!!!!!!!!!!!!!

More

Volume of a Sphere

$$\frac{4}{3} \pi r^3$$