GRE-2, Geometry

Types of polygons

Sides	Name	Degrees
3	Triangle	180
4	Quadrilateral	360
5	Pentagon	540
6	Hexagon	(Add 180 for each side)
7	Heptagon	
8	Octagon	
9	Nonagon	
10	Decagon	
n	n-gon	$180(n-2)$

The external angles always add up to 360

Types of triangles

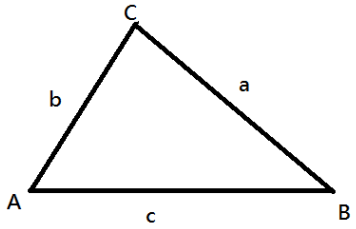
Equal angles open to equal sides
A larger angle opens to a longer side

All sides / angles different = Scalene
At least two sides / angles same = Isosceles
All three sides / angles equal = Equilateral or regular

Largest angle	Type
< 90	Acute
$= 90$	Right
> 90	Obtuse

The triangle inequality

"The shortest distance between two points is a straight line"



$$a < b + c$$
$$b < a + c$$
$$c < a + b$$

Alternatively: If a and b are known, then $|a-b| < c < a+b$

Types of quadrilaterals

Parallelograms

- Two pairs of parallel sides
- $A = bh$, where b and h have same requirements as triangle.
- Diagonals bisect each other
- Right angles = Rectangle
  - Diagonals are equal
- Equal sides = Rhombus ("Diamond")
  - Diagonals are perpendicular
  - Alt $A = \frac{1}{2} d_1 d_2$ (diagonals)
  - Square = Rectangular rhombus

Trapezoid

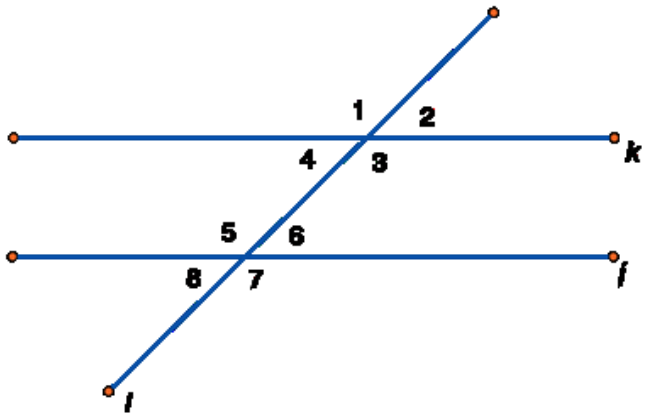
- One pair of parallel sides
- $A = \bar{b}\,h$, where $\bar{b}$ = average of bases

Optimizing rectangles

The more squarier, the more area.
The longer and skinnier, the more the perimeter.

Intersecting lines and angles

- Any two intersecting lines
  - Adjacent angles supplementary (add to 180)
  - "Opposite" (vertical) angles are equal
- Two parallel lines with transversal
  - The four acute angles are equal, and the four obtuse angles are equal
  - The acute and obtuse angles are supplementary
  - If the transversal is almost perpendicular, "slant" it for clarity
  - The same rules apply to parallel sides of a parallelogram / trapezoid



Three dimensions

Dimensionality

1D = "Linear". Length, width, height, diagonal, perimeter, circumference, etc. (string)
2D = Area (paint)
3D = Volume (space)

When you multiply measurements, you add their dimensions.
1D × 1D = 2D
1D × 2D = 3D

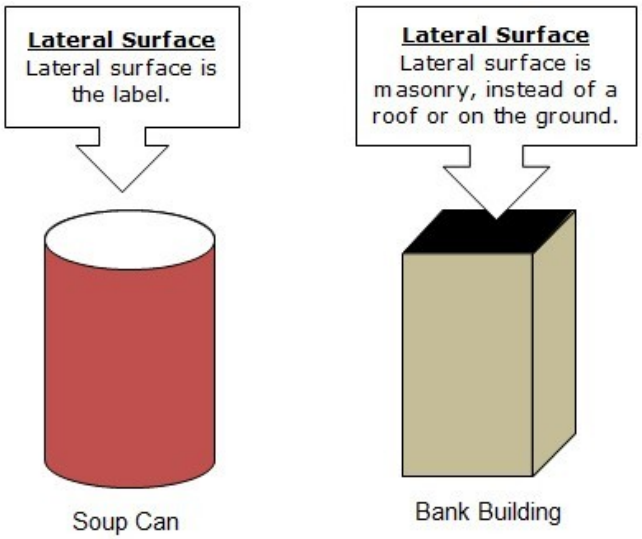
Box shapes

Base	× **height**	=
Perimeter / circumference (1D)	× height (1D)	= Lateral surface area (2D)
Area (2D)	× height (1D)	= Volume (3D)

The "height" must always, always, ALWAYS be perpendicular to the base!!!

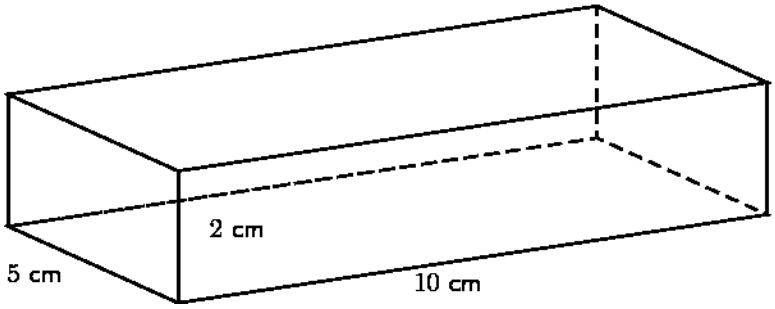
Not tested

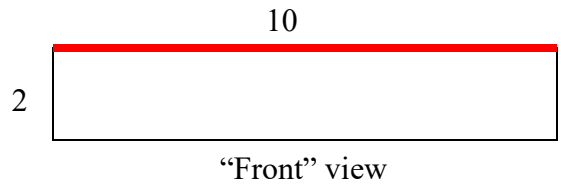
- Pyramids
- Cones
- Spheres
- Yaaayyyyyy!



Visualizing

Draw shapes "straight on"
If shape is complex, draw from two or three directions
Identify measurements in common between views.





"Front" view

"Top" view

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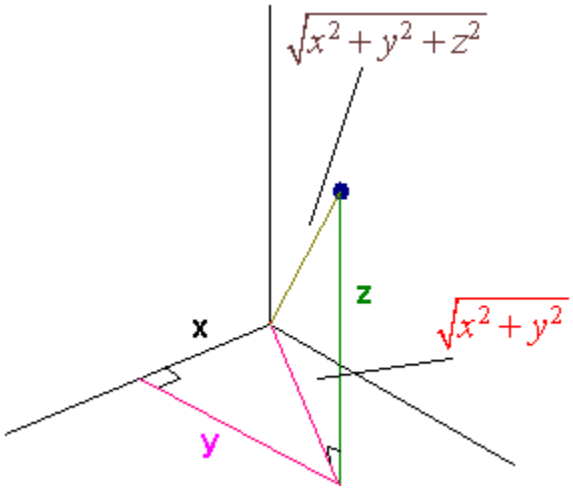
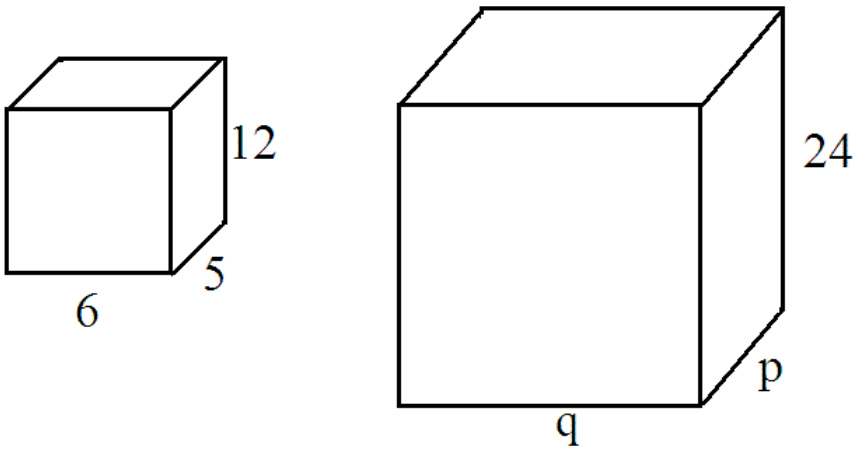
The 3D Pythagorean Theorem



$$x^2 + y^2 + z^2 = d^2$$

Scaling

Similar figures:
Let d = linear distance, A = Area, V = Volume



If $\frac{d_2}{d_1} = r$, then

$\frac{A_2}{A_1} = r^2$, and

$\frac{V_2}{V_1} = r^3$

Regardless of shape.