The Weekly Rigor

An Essential Skill for Calculus Students: Plane Geometry
(Part 1)

The geometry a calculus student needs falls into three categories: 1. Basic formulas; 2. Triangle principles; 3. Drawing figures.

1. The following table represents the maximum number of geometry formulas that the calculus student may be expected to have memorized.

A – Area C – Circumference V – Volume SA – Surface Area P – Perimeter
r – radius h – height b – base s – side l – length w – width

Circles:	$C = 2\pi r$	$A = \pi r^2$
Cylinders:	$SA = 2\pi r^2 + 2\pi rh$	$V = \pi r^2 h$
Cones:	$V = \frac{1}{3}\pi r^2 h$	
Spheres:	$A = 4\pi r^2$	$V = \frac{4}{3}\pi r^3$
Triangles:	$A = \frac{1}{2}bh$	
Rectangles:	$P = 2l + 2w$	$A = lw$
Squares:	$P = 4s$	$A = s^2$
Rectangular Prisms:	$SA = 2wh + 2wl + 2hl$	$V = lwh$
Cubes:	$SA = 6s^2$	$V = s^3$

The above formulas for spheres are usually the most difficult for students to memorize. As an aid, when you learn about the differentiation formula called the Power Rule, note that the derivative of the volume of a sphere equals the area of the sphere. (Also, the derivative of a circle's area equals the circumference.)
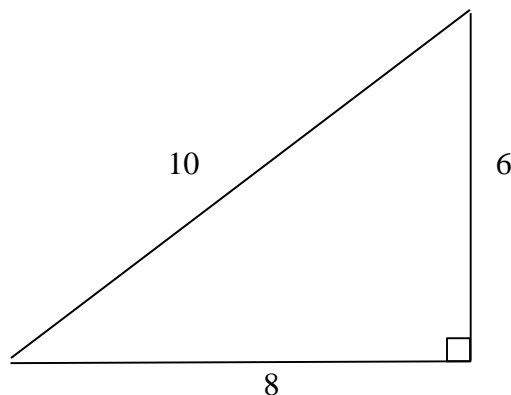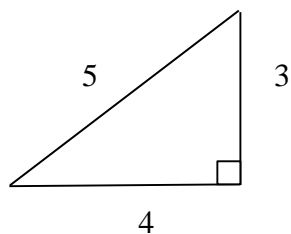
2. Three principles of triangles are of utmost importance in calculus: the Pythagorean Theorem, properties of similar triangles, and the construction of the two reference triangles.

The Pythagorean Theorem, e.g.,

<table>
<tr><td>5   3</td><td>$3^2 + 4^2 = 5^2$</td></tr>
<tr><td>4</td><td></td></tr>
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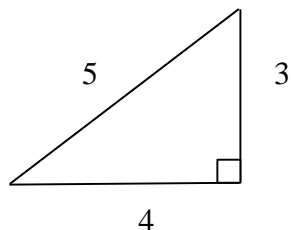
is so crucial, that anytime a right triangle comes up in a problem, it is very likely that the theorem is needed to solve it.

Similar triangles come up occasionally in calculus, especially in word problems. The salient property of similar triangles is that their corresponding sides are proportional. For example, note that the corresponding sides of the following two similar triangles equal the same ratio $\frac{1}{2}$.