Related Rates Cheat Sheet

- To find related rates of change, implicit differentiation is used and all of the variables in the equation are differentiated with respect to time. Therefore, all of the variables that are changing as time passes, need a "prime" after differentiation.

- Steps taken to solve related rates problems:
  - Step 0: Draw a picture, and put all numbers in the picture that are not changing.
  - Step 1: Try to come up with an equation that relates the two variables the problem is talking about [it could be 3 variables in some cases].
  - Step 2: Differentiate it and put the values and rates that are known. If some 'values' are still unknown you may have to use the formula you found in step 1 to solve for those unknown values.

- Position, velocity, and acceleration formula:

$\bar{v} = average\ velocity = \frac{\Delta x}{\Delta t}$ $\qquad$ $v = instantaneous\ velocity = \frac{dx}{dt}$

$\bar{a} = average\ acceleration = \frac{\Delta v}{\Delta t}$ $\qquad$ $a = instantaneous\ acceleration = \frac{dv}{dt}$

- Useful Volumes:

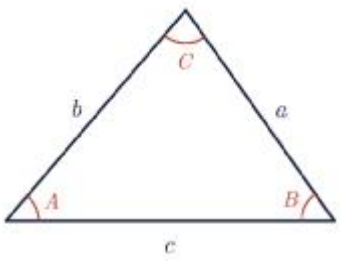
$V_{cylinder} = \pi r^2 h$ $\qquad$ $V_{cone} = \frac{1}{3}\pi r^2 h$ $\qquad$ $V_{pyramid} = \frac{1}{3}(Base\ Area)h$

$V_{rectangular\ prism} = l\ w\ h$ $\qquad$ $V_{sphere} = \frac{4}{3}\pi r^3$

- Sine and Cosine Laws:

$$c^2 = a^2 + b^2 - 2ab\cos C$$

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

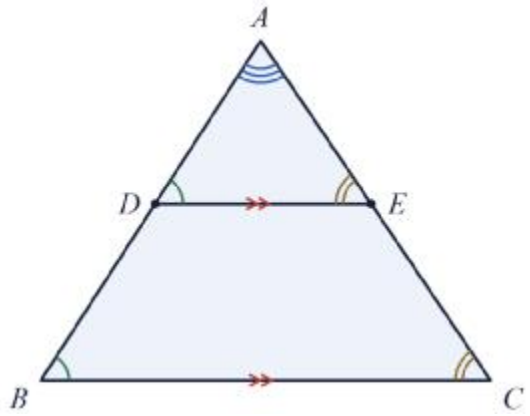


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- Pythagorean formula:
  $c^2 = a^2 + b^2$ where c is the hypotenuse

- Similarity of triangles (good for shadow problems):

$$\frac{AD}{AB} = \frac{AE}{AC} = \frac{DE}{BC}$$



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