**Continuity Equation**

***Terms to know:***

**Streamline (Laminar)**

* Every particle that passes a point moves along the same path
* Streamlines don’t cross each other

**Turbulent**

* Flow is irregular

**Viscosity**

* Degree of internal friction in the fluid

**Ideal fluid characteristics (what we’re assuming)**

1. Fluid is nonviscous
2. Fluid is incompressible (no change in volume)
3. Fluid motion is steady
4. No turbulence

***Equation of Continuity***

* Fluid in pipe will move some distance in a time interval
* X = v \* t
* Mass is conserved so the masses must be the same
* Mass is density \* volume



What the equation says:

* The product of the cross-sectional area of a pipe and the fluid speed at that cross section is constant
* A\* v = flow rate
* Same amount of fluid entering the tube is equal to the amount of fluid leaving the tube

**Example - Equation of Continuity**

*10 m3/h* of water flows through a pipe with *100 mm* inside diameter. The pipe is reduced to an inside dimension of *80 mm*.

the velocity in the 100 mm pipe can be calculated as



*(10 m3/h)(1 / 3600 h/s) = v100 (3.14 (0.1 m)2 / 4)*



*or*



*v100 = (10 m3/h)(1 / 3600 h/s) / (3.14 (0.1 m)2 / 4)*



*= 0.35 m/s*



Using equation (2) the velocity in the 80 mm pipe can be calculated



*(10 m3/h)(1 / 3600 h/s) = v80 (3.14 (0.08 m)2 / 4)*

*or*

*v80 = (10 m3/h)(1 / 3600 h/s) / (3.14 (0.08 m)2 / 4)*

*= 0.55 m/s*

**Example 2**

An ideal fluid flows through a long horizontal circular pipe. In one region of the pipe, it has radius R. The pipe then widens to radius 2R. What is the ratio of the fluids speed in the region of radius R to the speed of the fluid in region with radius 2R?

Using fluid continuity. A1v1 = A2v2 πR2v1 = π(2R)2v2 v1 = 4 v2