**Object Oriented Programming**

**C# – Console**

**Inheritance & Polymorphism**

We know that inheritance is a useful way to reuse code when our classes are related. We are going to adapt one of our previous programs so that we can make use of inheritance.

To calculate the volume of a cylinder we can use:

**V = Pi r2 \* h**

1. Create a new project
2. Copy in the Circle class from your previous work and change the visibility of the Radius from Private to Protected (this will make it possible to share this variable up and down the class hierarchy).
3. Create a new class called Cylinder
   1. To Inherit we define the class in the following way:

class Dog : Animal (this means that the Animal class is being inherited)

* 1. Create a new Protected Variable called **Height**
  2. Create a Mutator (Setter) method to set the Height with a Value received as a parameter
  3. Create an Accessor (Getter) method to Return Height
  4. Create a Constructor Method that contains the following code:

Height = 0

The use of Inheritance enables a derived class to share all the properties and methods of the base class.

If we were to want to use an inherited class, but the class had a constructor with parameters then we would need to use a method “Base” in the constructor.

e.g.

public Fox(int birthWeight)

: base(DefaultLifespan)

{

FoodUnitsNeeded = (int)(10 \* base.CalculateRandomValue(100, birthWeight) / 100);

}

1. Area of a Cylinder is (Radius ^ 2) \* Math.Pi \* Height – this is different to the area for a Circle. This is actually Volume – but for the purpose of Polymorphism we will use area.

Create a new Function Area in the Cylinder class that calculates the area (volume) of the Cylinder.

You will notice an error!

At the moment we have not implemented a way in which Area can be overridden with a new function (not implemented Polymorphism).

Look at the Circle class and alter the method definition:

public virtual double Area()

In the derived Cylinder class – alter the method definition:

public override double Area()

1. Create new Cylinders and Circles and make use of the Public methods to test the workings of these. Ensure you create a default Cylinder – set Height to 2. Create a default Circle. Compare Area’s. You will notice that the Cylinder Area overrides the Circle Area.