Final Function and Final Class

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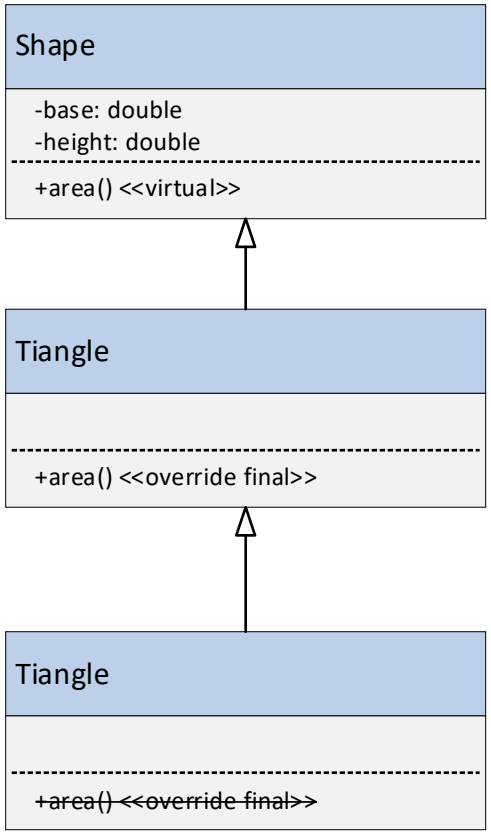
Final Function



Final Function

```
class Shape {
        protected:
          double _base;
          double _height;
        public:
          Shape():_base(0.0), _height(0.0) {}

          Shape(double base, double height): _base(base), _height(height) {}

          virtual double area() = 0;    //abstract or pure virtual function
};
```

```
class Triangle: public Shape {
  public:
          Triangle(): Shape() {}
          Triangle(double base, double height): Shape(base, height) {}

          //final can be used only to non-static virtual function
          double area() override final{
               return 0.5*_base*_height;
          }
};
```

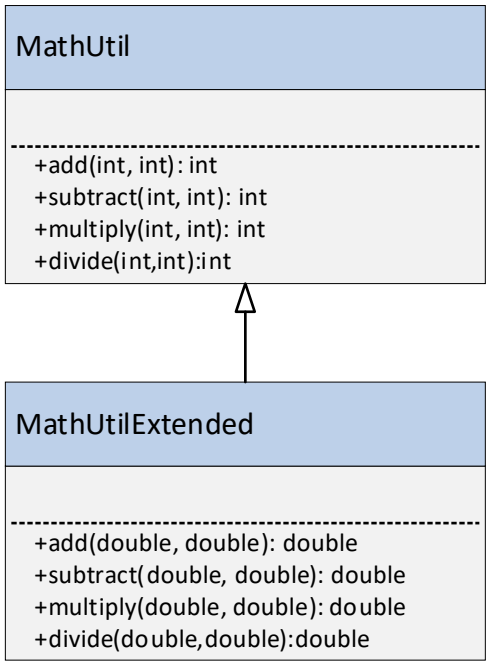
Final Function

```
class RightAngleTriangle: public Triangle {
public:
  RightAngleTriangle(): Triangle() {}
  RightAngleTriangle(double base, double height): Triangle(base, height) {}
  //virtual final method cannot be overriden
  // double area()override {
  //   return 0.5*_base*_height;
  // }
};
```

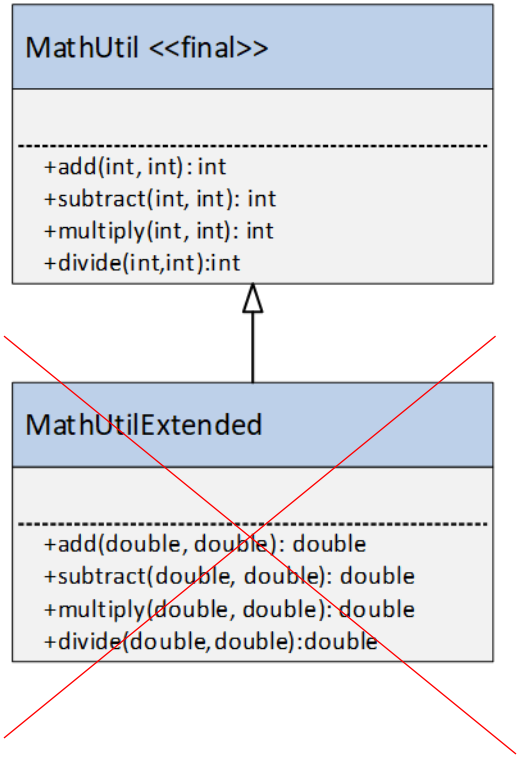
```
int main() {

  Triangle triangle(3,4);
  cout<<triangle.area()<<endl;
  RightAngleTriangle rightTriangle(3,4);
  cout<<rightTriangle.area()<<endl;

  Triangle& refTriangle1 = triangle;
  cout<<refTriangle1.area()<<endl;
  Triangle& refTriangle2 = rightTriangle;
  cout<<refTriangle2.area()<<endl;

  return 0;
}
```

Final Class

Non-final Class



Final Class



Non Final Class

```
class MathUtil {
   public:
         static int add(int a, int b) { return a+b;}
         static int subtract(int a, int b) {return a-b;}
         static int multiply(int a, int b) { return a*b;}
         static int divide(int a, int b) { return a/b;}
};
```

```
class MathUtilExtended: public MathUtil {
   public:
         static double add(double a, double b) { return a+b;}
         static double subtract(double a, double b) {return a-b;}
         static double multiply(double a, double b) { return a*b;}
         static double divide(double a, double b) { return a/b;}
};
```

Non Final Class

```
int main() {
  cout<<"Using MathUtil......."<<endl;
  cout<<MathUtil::add(12, 5)<<endl;
  cout<<MathUtil::subtract(12, 5)<<endl;
  cout<<MathUtil::multiply(12, 5)<<endl;
  cout<<MathUtil::divide(12, 5)<<endl;
  cout<<MathUtil::add(12.5, 5.5)<<endl;
  cout<<MathUtil::subtract(12.5, 5.5)<<endl;
  cout<<MathUtil::multiply(12.5, 5.5)<<endl;
  cout<<MathUtil::divide(12.5, 5.5)<<endl;

  cout<<"Using MathUtilExtended......."<<endl;
  cout<<MathUtilExtended::add(12.5, 5.5)<<endl;
  cout<<MathUtilExtended::subtract(12.5, 5.5)<<endl;
  cout<<MathUtilExtended::multiply(12.5, 5.5)<<endl;
  cout<<MathUtilExtended::divide(12.5, 5.5)<<endl;
  return 0;
}
```

```
Using MathUtil.....
17
7
60
2
17
7
60
2


Using MathUtilExtended.....
18
7
68.75
2.27273
```

Final Class

```
class MathUtil final{
   public:
         static int add(int a, int b) { return a+b;}
         static int subtract(int a, int b) {return a-b;}
         static int multiply(int a, int b) { return a*b;}
         static int divide(int a, int b) { return a/b;}
};
```

```
// class MathUtilExtended: public MathUtil {
//    public:
//       static double add(double a, double b) { return a+b;}
//       static double subtract(double a, double b) {return a-b;}
//       static double multiply(double a, double b) { return a*b;}
//       static double divide(double a, double b) { return a/b;}
// };
```

Final Class

```
int main() {
  cout<<"Using MathUtil......."<<endl;
  cout<<MathUtil::add(12, 5)<<endl;
  cout<<MathUtil::subtract(12, 5)<<endl;
  cout<<MathUtil::multiply(12, 5)<<endl;
  cout<<MathUtil::divide(12, 5)<<endl;
  cout<<MathUtil::add(12.5, 5.5)<<endl;
  cout<<MathUtil::subtract(12.5, 5.5)<<endl;
  cout<<MathUtil::multiply(12.5, 5.5)<<endl;
  cout<<MathUtil::divide(12.5, 5.5)<<endl;

  // cout<<"Using MathUtilExtended......."<<endl;
  // cout<<MathUtilExtended::add(12.5, 5.5)<<endl;
  // cout<<MathUtilExtended::subtract(12.5, 5.5)<<endl;
  // cout<<MathUtilExtended::multiply(12.5, 5.5)<<endl;
  // cout<<MathUtilExtended::divide(12.5, 5.5)<<endl;
  return 0;
}
```

```
Using MathUtil.....
17
7
60
2
17
7
60
2
```