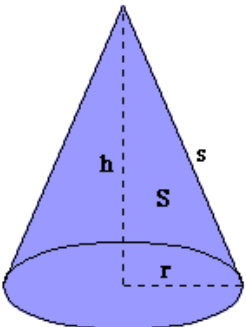


## C++ Programming Problems

### Assignment statements and Basic I/O

Turn in hardcopy of the source code (put comments in!!) and hardcopy of all requested output for each of the three programs. Turn in a packet with all programs together.

- Design and write a program to compute values for circles, spheres, and cones as described below. Ask the user for a radius in centimeters (cm), and then compute the circumference and area of a circle with that radius. Next, calculate volume and surface area for a sphere with that radius. Now, ask for the height, and then calculate volume and surface area for a right circular cone using the same given radius. Use the formulas in this table:

Circle	Sphere	Right Circular Cone
<b>area:</b> $A = \pi r^2$ <b>circumference:</b> $C = 2\pi r$	<b>volume:</b> $V = \frac{4}{3} \pi r^3$ <b>surface area:</b> $S = 4\pi r^2$	 <b>volume:</b> $V = \frac{1}{3} \pi r^2 h$ <b>slant height:</b> $s = \sqrt{r^2 + h^2}$ <b>surface area:</b> $S = \pi r^2 + \pi r s$

The answers should be given as doubles with 2 places after the decimal. Label all values correctly and indicate proper unit names. Put one calculation per line and right justify the values in a column on the screen.

Name a constant for PI, using 3.1416 as its value. Notice how many times the formulas use  $r^2$ . It would be more efficient to calculate this value once, store it into a variable and use that variable in your formulas! You will need to use the sqrt function to calculate slant height, so don't forget **#include <cmath>**. Use the following input sets (radius followed by height):

```
3.0  1.0
6.7  1.5
10.0 15.0
1.0  1.5
```

Until we learn about loops, you will need to run your program for each input set, a total of 4 times. Turn in a copy of your source and another page with all your output examples. (Just copy and paste to the same file while you run your program all 4 times and then print one output page.)

Check your answers, don't take for granted they are right just because a computer printed them. Remember who told the computer what to do! Be careful to avoid integer division for the fractions in the formulas! For example, in a C++ expression, 1/3 gives the result of 0.

**Part A.**

The wind chill factor in degrees Fahrenheit can be computed with the formula given below where V is the wind velocity in mph and T is the temperature in degrees Fahrenheit. Write a program that will ask the user for a velocity and temperature (be sure to explain which units to give these in!) and then calculates the wind chill factor. Give the answer with two places after the decimal.

$$wc = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Remember to put this formula (and others on this page) in proper C++ form with no assumed multiplication! You will need to use the pow function to raise V to the .16 power. This function requires you to put “#include <cmath>” at the top of your program.

Test your program with the following input. The output you turn in should show the answer for every input set.

Velocity in mph	Fahrenheit Temperature
16	20
35	20
5	32
15	0

(quick check: 16 mph and 20 degrees gives a wind chill of 5.78 degrees Fahrenheit.)

**Part B.** Rewrite your program for international use when the user gives wind velocity in kilometers per hour and temperatures in degrees Celsius. You only have the formula above that assumes mph and Fahrenheit as input and gives the answer in Fahrenheit. You can use this same formula, but now you must convert your input **BEFORE** you use it in the formula. Use the correct conversion formula from the formulas given below. Give the windchill answer in BOTH Fahrenheit and Celsius.

$$C = 5/9(F - 32)$$

$$F = (9/5)C + 32$$

$$1 \text{ km} = .621 \text{ mile}$$

Be careful to avoid integer division in the fractions in the formulas!!! Label your output so that it is clear what every number means. Turn in your new source with output for each of the following input sets.

Velocity in kph	Celsius Temperature
20	-5
50	-5
7	0
25	10

(quick check: 20 kph and -5 degrees Celsius gives a wind chill of 11.25 degrees Fahrenheit, -11.53 degrees Celsius.)