

Before you begin your work, please create a new file folder on your computer. The name of the folder should be YourLastName_YourFirstName. For example, if your name is John Smith your folder should be named Smith_John. Please store all your C files in that folder. Name your C files simply 1.c, 2.c, 3.c, 4.c, and 5.c. At the end of the exam you will have to copy that folder onto a USB memory stick. Also, you will have to upload your solutions to WebCT (just like a homework but this one is named "Midterm1 Lab").

Please DO NOT leave the room until you have copied your files onto the USB memory stick and also uploaded them on WebCT!!!

1. Check Please (10 points)

Write a complete C program that prints a receipt at a restaurant. The program must ask waiter to enter the amount (in \$) and then calculate the sales tax (assuming a tax rate of 7%). The program must then print a receipt similar to the one shown below and suggest three possible tips based on the amount before tax (15%, 20%, 25%).

SAMPLE RUN:

Enter amount: 45

Amount \$45.00

Tax \$ 3.15

Tip _____

TOTAL _____

15% tip = \$ 6.75

20% tip = \$ 9.00

25% tip = \$11.25

2. Painting Project (15 points)

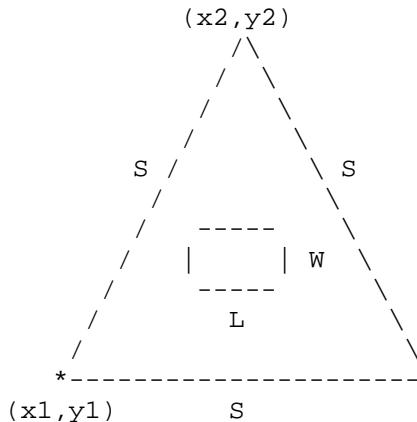
Write a complete C program that can help you calculate how much paint you need in order to paint a room. The program must do the following:

- * Ask the user to enter
 - the length (L), width (W), and height (H) of the room.
 - the number of doors that the room has.
 - the width and height of the door(s).
- * Print the area of the paintable surface (all 4 walls plus the ceiling minus the doors).
- * Print the gallons of paint required to paint the room
- * Print the number of 5 gallon buckets of paint that you must purchase

Assumptions: * the room has no windows; just doors of equal size.
* 1 gallon of paint can cover 20 square feet of wall area

3. Shape Properties (15 points)

Write a complete C program that calculates and prints on the screen the area and the outer perimeter of the figure shown below (an equilateral triangle with a rectangular cut out). The program must ask the user to enter the coordinates of the lower left corner (X1, Y1) and the upper corner of the triangle (X2, Y2) from which the side (S) can be calculated. The program must also ask for the length(L) and width(W) of the rectangle. You can assume that the user will enter the points in the right order (no error checking).



4. Trajectory Calculation (15 points)

From physics we know that the horizontal travel distance of a projectile is given by this formula:

$$d = \frac{v \cos(\theta)}{g} \left(v \sin(\theta) + \sqrt{(v \sin(\theta))^2 + 2gy_0} \right)$$

where

- * g: the gravitational constant (9.80 m/s²)
- * Q: launch angle for the projectile
- * v: launching velocity
- * y₀: starting elevation of the projectile
- * d: horizontal travel distance at the time of impact

Write a complete C program that reads Q, v, and y0 from the keyboard and calculates and prints d. The angle Q must be read in degrees. The launch speed v must be in m/s and y0 must be in meters. You can hardcode the gravitational constant and assume that the user will enter correct values (i.e., no error checking is required).

SAMPLE RUN #1:

```
Enter launch angle Q (in degrees): 45
Enter launching velocity v (in m/s): 20
Enter starting elevation y0 (in meters above 0): 0
The horizontal travel distance before the impact is 40.8163 meters
```

SAMPLE RUN #2:

```
Enter launch angle Q (in degrees): 70
Enter launching velocity v (in m/s): 50
Enter starting elevation y0 (in meters above 0): 10
The horizontal travel distance before the impact is 167.539 meters
```

5. Normal Curve (15 points)

The normal curve has a lot of applications in statistics. One application that many students are familiar with is "grading on a curve", where the mean scores get C's and the outliers get F's and A's.

The Normal probability density function is defined as follows:

$$f(x) = \frac{1}{\sqrt{2\pi\sigma^2}} \exp\left(-\frac{(x-\mu)^2}{2\sigma^2}\right)$$

where μ is the mean of the distribution and σ is the standard deviation. These are the only two parameters that are required to completely specify a normal curve.

Write a Complete C program that reads three values from the keyboard (x , μ , σ) and outputs the value $f(x)$ of the function for that x .

Your program must use a function to calculate $f(x)$.

SAMPLE RUN #1:

```
Please enter the mean mu : 0
Please enter the standard deviation (sigma): 1
Please enter a value for x: 4
The result is = 0.00013383
```

SAMPLE RUN #2:

```
Please enter the mean mu : 2
Please enter the standard deviation (sigma): 1
Please enter a value for x: 2
The result is = 0.398942
```