

## Programming Competition sample problems

### General Things to Note

1. The format of your answer should match that of the sample output exactly! Not doing so may result in 0 points for the problem. The only exception is when you are asked to plot a graph. It is not required that your graph must look a certain way pixel for pixel.
2. The name of the source file for each problem should be what is in parentheses next to the bolded name of the problem.

### General Things about the competition

1. we will also have 1 or 2 plotting problems similar to the ones from the text book.
2. generally most of the problems are referenced from the text books.
3. problems may involve the use of some basic programming and logic flow. for example students should know how to use if statements, for loops, and while loops.
4. students should know how to read in input. a lot of the problems read in multiple inputs on one line.
5. student should know how to print outputs on the same line / on different lines

## 1. Rational Numbers (rational.c)

2 Points

A rational number can be expressed as the ratio of two integers. But the ratio is not unique because a rational number can be expressed with different ratios. For example,  $\frac{1}{2}$  is equal to  $\frac{5}{10}$ . Write a program that will determine if two fractions are the same.

**Input and Output Format** You will be given four integers  $a$ ,  $b$ ,  $c$ , and  $d$  in that order. They express two rational numbers in the forms  $\frac{a}{b}$  and  $\frac{c}{d}$ . All the inputs are read in a single line. the next line is your output. it will be either "True" if the fractions are equivalent., or "False" if the fractions are not equivalent.

### Assumptions

1.  $a$ ,  $b$ ,  $c$ , and  $d$  will all be positive, so none of them will be zero or negative.

### Sample Outputs

```
15 20 75 100
>True
```

```
17 21 18 29
>False
```

## 2. Math Problems (math\_problems.c)

2 Points

The little Martians also use C++ to help solve math in their schools. Help Billy solve these two problems.

a) Solve the following function without `pow()`.

$$\frac{3(5 - 2)^2 + 4 + 7^2}{5^2 - 3} \quad (1)$$

b) Solve the following function using the `pow()` function.

$$\frac{(32 - 12)^3 + (4 \times 5)}{5^4} \quad (2)$$

**Input and Output Format** your program will not take any inputs. It will use the values given. the first output will be the value for part a the second line of output will be the value for part b

**Sample Outputs** (Note: Numbers may not be the correct answers)

1.2500

4.560

### 3. Speed (speed.c)

5 Points

Sam the Martian drives a high-speed race car.  $t$  stands for time. At time  $t = 1$  hour he has passed the 294 mile mark. At time  $t = 2.5$  hours he has passed the 660 mile mark. find the speed Sam's race car is traveling at. Also calculate what mile mark he will pass at  $t = 4.6$  hours.

note: keep in mind that time  $t = 0$  does not necessarily mean Sam is at the 0 mile mark.

#### Input and Output Format

your program will not take any inputs. It will use the values given. the first output will be the speed of the car in miles/hour. the second line will be the mile mark passed when the car has traveled for 4.6 hours.

#### Sample Output

```
244
1172.4
```