

## Review Questions and Exercises

### Short Answer

1. Assume that the following variables are defined:

```
int age;  
double pay;  
char section;
```

Write a single `cin` statement that will read input into each of these variables.

2. Assume a `string` object has been defined as follows:

```
string description;
```

A) Write a `cin` statement that reads in a one-word string.

B) Write a statement that reads in a string that can contain multiple words separated by blanks.

3. What header files must be included in the following program?

```
int main()  
{  
    double amount = 89.7;  
    cout << showpoint << fixed;  
    cout << setw(8) << amount << endl;  
    return 0;  
}
```

4. Complete the following table by writing the value of each expression in the Value column.

Expression	Value
$28 / 4 - 2$	
$6 + 12 * 2 - 8$	
$4 + 8 * 2$	
$6 + 17 \% 3 - 2$	
$2 + 22 * (9 - 7)$	
$(8 + 7) * 2$	
$(16 + 7) \% 2 - 1$	
$12 / (10 - 6)$	
$(19 - 3) * (2 + 2) / 4$	

5. Write C++ expressions for the following algebraic expressions:

$$a = 12x$$

$$z = 5x + 14y + 6k$$

$$y = x^4$$

$$g = \frac{h + 12}{4k}$$

$$c = \frac{a^3}{b^2k^4}$$

6. Assume a program has the following variable definitions:

```
int units;  
float mass;  
double weight;
```

and the following statement:

```
weight = mass * units;
```

Which automatic data type conversion will take place?

- A) `mass` is demoted to an `int`, `units` remains an `int`, and the result of `mass * units` is an `int`.
  - B) `units` is promoted to a `float`, `mass` remains a `float`, and the result of `mass * units` is a `float`.
  - C) `units` is promoted to a `float`, `mass` remains a `float`, and the result of `mass * units` is a `double`.
7. Assume a program has the following variable definitions:

```
int a, b = 2;  
float c = 4.2;
```

and the following statement:

```
a = b * c;
```

What value will be stored in `a`?

- A) 8.4
  - B) 8
  - C) 0
  - D) None of the above
8. Assume that `qty` and `salesReps` are both integers. Use a type cast expression to rewrite the following statement so it will no longer perform integer division.

```
unitsEach = qty / salesReps;
```

9. Rewrite the following variable definition so the variable is a named constant.

```
int rate;
```

10. Complete the following table by writing statements with combined assignment operators in the right-hand column. The statements should be equivalent to the statements in the left-hand column.

Statements with Assignment Operator	Statements with Combined Assignment Operator
<pre>x = x + 5; total = total + subtotal; dist = dist / rep; ppl = ppl * period; inv = inv - shrinkage; num = num % 2;</pre>	

11. Write a multiple assignment statement that can be used instead of the following group of assignment statements:

```
east = 1;  
west = 1;  
north = 1;  
south = 1;
```

12. Write a `cout` statement so the variable `divSales` is displayed in a field of 8 spaces, in fixed point notation, with a precision of 2 decimal places. The decimal point should always be displayed.
13. Write a `cout` statement so the variable `totalAge` is displayed in a field of 12 spaces, in fixed point notation, with a precision of 4 decimal places.
14. Write a `cout` statement so the variable `population` is displayed in a field of 12 spaces, left-justified, with a precision of 8 decimal places. The decimal point should always be displayed.

### Fill-in-the-Blank

15. The \_\_\_\_\_ library function returns the cosine of an angle.
16. The \_\_\_\_\_ library function returns the sine of an angle.
17. The \_\_\_\_\_ library function returns the tangent of an angle.
18. The \_\_\_\_\_ library function returns the exponential function of a number.
19. The \_\_\_\_\_ library function returns the remainder of a floating point division.
20. The \_\_\_\_\_ library function returns the natural logarithm of a number.
21. The \_\_\_\_\_ library function returns the base-10 logarithm of a number.
22. The \_\_\_\_\_ library function returns the value of a number raised to a power.
23. The \_\_\_\_\_ library function returns the square root of a number.
24. The \_\_\_\_\_ file must be included in a program that uses the mathematical functions.

### Algorithm Workbench

25. A retail store grants its customers a maximum amount of credit. Each customer's available credit is his or her maximum amount of credit minus the amount of credit used. Write a pseudocode algorithm for a program that asks for a customer's maximum amount of credit and amount of credit used. The program should then display the customer's available credit.

After you write the pseudocode algorithm, convert it to a complete C++ program.

26. Write a pseudocode algorithm for a program that calculates the total of a retail sale. The program should ask for the amount of the sale and the sales tax rate. The sales tax rate should be entered as a floating-point number. For example, if the sales tax rate is 6 percent, the user should enter 0.06. The program should display the amount of sales tax and the total of the sale.

After you write the pseudocode algorithm, convert it to a complete C++ program.

27. Write a pseudocode algorithm for a program that asks the user to enter a golfer's score for three games of golf, and then displays the average of the three scores.  
After you write the pseudocode algorithm, convert it to a complete C++ program.

### Find the Errors

Each of the following programs has some errors. Locate as many as you can.

28. 

```
using namespace std;
int main ()
{
    double number1, number2, sum;

    Cout << "Enter a number: ";
    Cin << number1;
    Cout << "Enter another number: ";
    Cin << number2;
    number1 + number2 = sum;
    Cout "The sum of the two numbers is " << sum
    return 0;
}
```
29. 

```
#include <iostream>
using namespace std;

int main()
{
    int number1, number2;
    float quotient;
    cout << "Enter two numbers and I will divide\n";
    cout << "the first by the second for you.\n";
    cin >> number1, number2;
    quotient = float<static_cast>(number1) / number2;
    cout << quotient
    return 0;
}
```
30. 

```
#include <iostream>;
using namespace std;

int main()
{
    const int number1, number2, product;

    cout << "Enter two numbers and I will multiply\n";
    cout << "them for you.\n";
    cin >> number1 >> number2;
    product = number1 * number2;
    cout << product
    return 0;
}
```

```

31. #include <iostream>;
    using namespace std;

    main
    {
        int number1, number2;

        cout << "Enter two numbers and I will multiply\n"
        cout << "them by 50 for you.\n"
        cin >> number1 >> number2;
        number1 *= 50;
        number2 *= 50;
        cout << number1 << " " << number2;
        return 0;
    }

32. #include <iostream>;
    using namespace std;

    main
    {
        double number, half;

        cout << "Enter a number and I will divide it\n"
        cout << "in half for you.\n"
        cin >> number1;
        half = / 2;
        cout << fixedpoint << showpoint << half << endl;
        return 0;
    }

33. #include <iostream>;
    using namespace std;

    int main()
    {
        char name, go;

        cout << "Enter your name: ";
        getline >> name;
        cout << "Hi " << name << endl;
        return 0;
    }

```

## Predict the Output

What will each of the following programs display? (Some should be hand traced and require a calculator.)

34. (*Assume the user enters 38700. Use a calculator.*)

```

#include <iostream>
using namespace std;

```

```

int main()
{
    double salary, monthly;
    cout << "What is your annual salary? ";
    cin >> salary;
    monthly = static_cast<int>(salary) / 12;
    cout << "Your monthly wages are " << monthly << endl;
    return 0;
}

```

35. `#include <iostream>`  
`using namespace std;`  
`int main()`  
`{`  
     `long x, y, z;`  
  
     `x = y = z = 4;`  
     `x += 2;`  
     `y -= 1;`  
     `z *= 3;`  
     `cout << x << " " << y << " " << z << endl;`  
     `return 0;`  
`}`

36. *(Assume the user enters George Washington.)*

```

#include <iostream>
#include <iomanip>
#include <string>
using namespace std;

int main()
{
    string userInput;
    cout << "What is your name? ";
    getline(cin, userInput);
    cout << "Hello " << userInput << endl;
    return 0;
}

```

37. *(Assume the user enters 36720152. Use a calculator.)*

```

#include <iostream>
#include <iomanip>
using namespace std;

int main()
{
    long seconds;
    double minutes, hours, days, months, years;

    cout << "Enter the number of seconds that have\n";
    cout << "elapsed since some time in the past and\n";
    cout << "I will tell you how many minutes, hours,\n";
    cout << "days, months, and years have passed: ";
    cin >> seconds;
}

```

```

    minutes = seconds / 60;
    hours = minutes / 60;
    days = hours / 24;
    years = days / 365;
    months = years * 12;
    cout << setprecision(4) << fixed << showpoint << right;
    cout << "Minutes: " << setw(6) << minutes << endl;
    cout << "Hours: " << setw(6) << hours << endl;
    cout << "Days: " << setw(6) << days << endl;
    cout << "Months: " << setw(6) << months << endl;
    cout << "Years: " << setw(6) << years << endl;
    return 0;
}

```

## Programming Challenges

### 1. Miles per Gallon

Write a program that calculates a car's gas mileage. The program should ask the user to enter the number of gallons of gas the car can hold and the number of miles it can be driven on a full tank. It should then display the number of miles that may be driven per gallon of gas.

### 2. Stadium Seating

There are three seating categories at a stadium. For a softball game, Class A seats cost \$15, Class B seats cost \$12, and Class C seats cost \$9. Write a program that asks how many tickets for each class of seats were sold, then displays the amount of income generated from ticket sales. Format your dollar amount in fixed-point notation, with two decimal places of precision, and be sure the decimal point is always displayed.

### 3. Test Average

Write a program that asks for five test scores. The program should calculate the average test score and display it. The number displayed should be formatted in fixed-point notation, with one decimal point of precision.

### 4. Average Rainfall

Write a program that calculates the average rainfall for three months. The program should ask the user to enter the name of each month, such as June or July, and the amount of rain (in inches) that fell each month. The program should display a message similar to the following:

The average rainfall for June, July, and August is 6.72 inches.

### 5. Male and Female Percentages

Write a program that asks the user for the number of males and the number of females registered in a class. The program should display the percentage of males and females in the class.

*Hint: Suppose there are 8 males and 12 females in a class. There are 20 students in the class. The percentage of males can be calculated as  $8 \div 20 = 0.4$ , or 40%. The percentage of females can be calculated as  $12 \div 20 = 0.6$ , or 60%.*

## 6. Ingredient Adjuster

A cookie recipe calls for the following ingredients:

- 1.5 cups of sugar
- 1 cup of butter
- 2.75 cups of flour

The recipe produces 48 cookies with this amount of the ingredients. Write a program that asks the user how many cookies he or she wants to make, and then displays the number of cups of each ingredient needed for the specified number of cookies.

## 7. Box Office

A movie theater only keeps a percentage of the revenue earned from ticket sales. The remainder goes to the movie distributor. Write a program that calculates a theater's gross and net box office profit for a night. The program should ask for the name of the movie, and how many adult and child tickets were sold. (The price of an adult ticket is \$10.00 and a child's ticket is \$6.00.) It should display a report similar to

Movie Name:	"Wheels of Fury"
Adult Tickets Sold:	382
Child Tickets Sold:	127
Gross Box Office Profit:	\$ 4582.00
Net Box Office Profit:	\$ 916.40
Amount Paid to Distributor:	\$ 3665.60

**NOTE:** Assume the theater keeps 20 percent of the gross box office profit.

## 8. How Many Widgets?

The Yukon Widget Company manufactures widgets that weigh 12.5 pounds each. Write a program that calculates how many widgets are stacked on a pallet, based on the total weight of the pallet. The program should ask the user how much the pallet weighs by itself and with the widgets stacked on it. It should then calculate and display the number of widgets stacked on the pallet.

## 9. How Many Calories?

A bag of cookies holds 30 cookies. The calorie information on the bag claims that there are 10 "servings" in the bag and that a serving equals 300 calories. Write a program that asks the user to input how many cookies he or she actually ate and then reports how many total calories were consumed.

## 10. How Much Insurance?

Many financial experts advise that property owners should insure their homes or buildings for at least 80 percent of the amount it would cost to replace the structure. Write a program that asks the user to enter the replacement cost of a building and then displays the minimum amount of insurance he or she should buy for the property.

## 11. Automobile Costs

Write a program that asks the user to enter the monthly costs for the following expenses incurred from operating his or her automobile: loan payment, insurance, gas, oil, tires, and maintenance. The program should then display the total monthly cost of these expenses, and the total annual cost of these expenses.



## 12. Celsius to Fahrenheit

Write a program that converts Celsius temperatures to Fahrenheit temperatures. The formula is

$$F = \frac{9}{5}C + 32$$

F is the Fahrenheit temperature, and C is the Celsius temperature.

## 13. Currency

Write a program that will convert U.S. dollar amounts to Japanese yen and to euros, storing the conversion factors in the constants `YEN_PER_DOLLAR` and `EUROS_PER_DOLLAR`. To get the most up-to-date exchange rates, search the Internet using the term “currency exchange rate”. If you cannot find the most recent exchange rates, use the following:

1 Dollar = 98.93 Yen

1 Dollar = 0.74 Euros

Format your currency amounts in fixed-point notation, with two decimal places of precision, and be sure the decimal point is always displayed.

## 14. Monthly Sales Tax

A retail company must file a monthly sales tax report listing the sales for the month and the amount of sales tax collected. Write a program that asks for the month, the year, and the total amount collected at the cash register (that is, sales plus sales tax). Assume the state sales tax is 4 percent and the county sales tax is 2 percent.

If the total amount collected is known and the total sales tax is 6 percent, the amount of product sales may be calculated as:

$$S = \frac{T}{1.06}$$

S is the product sales and T is the total income (product sales plus sales tax).

The program should display a report similar to

```
Month: October
-----
Total Collected:    $ 26572.89
Sales:               $ 25068.76
County Sales Tax:    $   501.38
State Sales Tax:     $  1002.75
Total Sales Tax:     $   1504.13
```

## 15. Property Tax

A county collects property taxes on the assessment value of property, which is 60 percent of the property’s actual value. If an acre of land is valued at \$10,000, its assessment value is \$6,000. The property tax is then 75¢ for each \$100 of the assessment value. The tax for the acre assessed at \$6,000 will be \$45. Write a program that asks for the actual value of a piece of property and displays the assessment value and property tax.

## 16. Senior Citizen Property Tax

Madison County provides a \$5,000 homeowner exemption for its senior citizens. For example, if a senior’s house is valued at \$158,000 its assessed value would be \$94,800,

as explained above. However, he would only pay tax on \$89,800. At last year's tax rate of \$2.64 for each \$100 of assessed value, the property tax would be \$2,370.72. In addition to the tax break, senior citizens are allowed to pay their property tax in four equal payments. The quarterly payment due on this property would be \$592.68. Write a program that asks the user to input the actual value of a piece of property and the current tax rate for each \$100 of assessed value. The program should then calculate and report how much annual property tax a senior homeowner will be charged for this property and what the quarterly tax bill will be.

### 17. Math Tutor

Write a program that can be used as a math tutor for a young student. The program should display two random numbers to be added, such as

$$\begin{array}{r} 247 \\ +129 \\ \hline \end{array}$$

The program should then pause while the student works on the problem. When the student is ready to check the answer, he or she can press a key and the program will display the correct solution:

$$\begin{array}{r} 247 \\ +129 \\ \hline 376 \end{array}$$

### 18. Interest Earned

Assuming there are no deposits other than the original investment, the balance in a savings account after one year may be calculated as

$$\text{Amount} = \text{Principal} * (1 + \frac{\text{Rate}}{\text{T}})^{\text{T}}$$

**Principal** is the balance in the savings account, **Rate** is the interest rate, and **T** is the number of times the interest is compounded during a year (**T** is 4 if the interest is compounded quarterly).

Write a program that asks for the principal, the interest rate, and the number of times the interest is compounded. It should display a report similar to

Interest Rate:	4.25%
Times Compounded:	12
Principal:	\$ 1000.00
Interest:	\$ 43.34
Amount in Savings:	\$ 1043.34

### 19. Monthly Payments

The monthly payment on a loan may be calculated by the following formula:

$$\text{Payment} = \frac{\text{Rate} * (1 + \text{Rate})^{\text{N}}}{((1 + \text{Rate})^{\text{N}} - 1)} * \text{L}$$

**Rate** is the monthly interest rate, which is the annual interest rate divided by 12. (12% annual interest would be 1 percent monthly interest.) **N** is the number of payments, and

$L$  is the amount of the loan. Write a program that asks for these values and displays a report similar to

Loan Amount:	\$ 10000.00
Monthly Interest Rate:	1%
Number of Payments:	36
Monthly Payment:	\$ 332.14
Amount Paid Back:	\$ 11957.15
Interest Paid:	\$ 1957.15

## 20. Pizza Pi

Joe's Pizza Palace needs a program to calculate the number of slices a pizza of any size can be divided into. The program should perform the following steps:

- Ask the user for the diameter of the pizza in inches.
- Calculate the number of slices that may be taken from a pizza of that size.
- Display a message telling the number of slices.

To calculate the number of slices that may be taken from the pizza, you must know the following facts:

- Each slice should have an area of 14.125 inches.
- To calculate the number of slices, simply divide the area of the pizza by 14.125.
- The area of the pizza is calculated with this formula:

$$\text{Area} = \pi r^2$$

**NOTE:**  $\pi$  is the Greek letter pi. 3.14159 can be used as its value. The variable  $r$  is the radius of the pizza. Divide the diameter by 2 to get the radius.

Make sure the output of the program displays the number of slices in fixed point notation, rounded to one decimal place of precision. Use a named constant for pi.

## 21. How Many Pizzas?

Modify the program you wrote in Programming Challenge 18 (Pizza Pi) so that it reports the number of pizzas you need to buy for a party if each person attending is expected to eat an average of four slices. The program should ask the user for the number of people who will be at the party and for the diameter of the pizzas to be ordered. It should then calculate and display the number of pizzas to purchase.

## 22. Angle Calculator

Write a program that asks the user for an angle, entered in radians. The program should then display the sine, cosine, and tangent of the angle. (Use the `sin`, `cos`, and `tan` library functions to determine these values.) The output should be displayed in fixed-point notation, rounded to four decimal places of precision.

## 23. Stock Transaction Program

Last month Joe purchased some stock in Acme Software, Inc. Here are the details of the purchase:

- The number of shares that Joe purchased was 1,000.
- When Joe purchased the stock, he paid \$45.50 per share.
- Joe paid his stockbroker a commission that amounted to 2% of the amount he paid for the stock.

Two weeks later Joe sold the stock. Here are the details of the sale:

- The number of shares that Joe sold was 1,000.
- He sold the stock for \$56.90 per share.
- He paid his stockbroker another commission that amounted to 2% of the amount he received for the stock.

Write a program that displays the following information:

- The amount of money Joe paid for the stock.
- The amount of commission Joe paid his broker when he bought the stock.
- The amount that Joe sold the stock for.
- The amount of commission Joe paid his broker when he sold the stock.
- Display the amount of profit that Joe made after selling his stock and paying the two commissions to his broker. (If the amount of profit that your program displays is a negative number, then Joe lost money on the transaction.)

## 24. Word Game

Write a program that plays a word game with the user. The program should ask the user to enter the following:

- His or her name
- His or her age
- The name of a city
- The name of a college
- A profession
- A type of animal
- A pet's name

After the user has entered these items, the program should display the following story, inserting the user's input into the appropriate locations:

There once was a person named **NAME** who lived in **CITY**. At the age of **AGE**, **NAME** went to college at **COLLEGE**. **NAME** graduated and went to work as a **PROFESSION**. Then, **NAME** adopted a(n) **ANIMAL** named **PETNAME**. They both lived happily ever after!