

### Practice Problems Set – 1

Topics Covered: Sequence type of Statement's (Variables, Data Types, Expressions, Operators, Type Casting)

1	<p>(<i>Convert Celsius to Fahrenheit</i>) Write a program that reads a Celsius degree in a <b>double</b> value from the console, then converts it to Fahrenheit and displays the result. The formula for the conversion is as follows:</p> $\text{fahrenheit} = (9 / 5) * \text{celsius} + 32$ <p>Here is a sample run:</p> <div><p>Enter a degree in Celsius: 43 <input type="button" value="Enter"/></p><p>43 Celsius is 109.4 Fahrenheit</p></div>
2	<p>(<i>Financial application: calculate tips</i>) Write a program that reads the subtotal and the gratuity rate, then computes the gratuity and total. For example, if the user enters <b>10</b> for subtotal and <b>15%</b> for gratuity rate, the program displays <b>\$1.5</b> as gratuity and <b>\$11.5</b> as total. Here is a sample run:</p> <div><p>Enter the subtotal and a gratuity rate: 10 15 <input type="button" value="Enter"/></p><p>The gratuity is \$1.5 and total is \$11.5</p></div>

3	<p><i>(Convert pounds into kilograms)</i> Write a program that converts pounds into kilograms. The program prompts the user to enter a number in pounds, converts it to kilograms, and displays the result. One pound is 0.454 kilograms. Here is a sample run:</p> <div><pre>Enter a number in pounds: 55.5 ↵ Enter 55.5 pounds is 25.197 kilograms</pre></div>
4	<p><i>(Find the number of years)</i> Write a program that prompts the user to enter the minutes (e.g., 1 billion), and displays the number of years and days for the minutes. For simplicity, assume a year has 365 days. Here is a sample run:</p> <div><pre>Enter the number of minutes: 1000000000 ↵ Enter 1000000000 minutes is approximately 1902 years and 214 days</pre></div>

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(*Physics: finding runway length*) Given an airplane's acceleration  $a$  and take-off speed  $v$ , you can compute the minimum runway length needed for an airplane to take off using the following formula:

$$\text{length} = \frac{v^2}{2a}$$

Write a program that prompts the user to enter  $v$  in meters/second (m/s) and the acceleration  $a$  in meters/second squared ( $\text{m/s}^2$ ), and displays the minimum runway length. Here is a sample run:

```
Enter speed and acceleration: 60 3.5 ↵ Enter
The minimum runway length for this airplane is 514.286
```

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(Financial application: compound value) Suppose you save \$100 each month into a savings account with the annual interest rate 5%. Thus, the monthly interest rate is  $0.05/12 = 0.00417$ . After the first month, the value in the account becomes

$$100 * (1 + 0.00417) = 100.417$$

After the second month, the value in the account becomes

$$(100 + 100.417) * (1 + 0.00417) = 201.252$$

After the third month, the value in the account becomes

$$(100 + 201.252) * (1 + 0.00417) = 302.507$$

and so on.

Write a program that prompts the user to enter a monthly saving amount and displays the account value after the sixth month. (In Exercise 5.30, you will use a loop to simplify the code and display the account value for any month.)

Enter the monthly saving amount: 100   
After the sixth month, the account value is \$608.81

(*Science: wind-chill temperature*) How cold is it outside? The temperature alone is not enough to provide the answer. Other factors including wind speed, relative humidity, and sunshine play important roles in determining coldness outside. In 2001, the National Weather Service (NWS) implemented the new wind-chill temperature to measure the coldness using temperature and wind speed. The formula is

$$t_{wc} = 35.74 + 0.6215t_a - 35.75v^{0.16} + 0.4275t_av^{0.16}$$

where  $t_a$  is the outside temperature measured in degrees Fahrenheit and  $v$  is the speed measured in miles per hour.  $t_{wc}$  is the wind-chill temperature. The formula cannot be used for wind speeds below 2 mph or temperatures below  $-58^{\circ}\text{F}$  or above  $41^{\circ}\text{F}$ .

Write a program that prompts the user to enter a temperature between  $-58^{\circ}\text{F}$  and  $41^{\circ}\text{F}$  and a wind speed greater than or equal to 2 and displays the wind-chill temperature. Use `Math.pow(a, b)` to compute  $v^{0.16}$ . Here is a sample run:

```
Enter the temperature in Fahrenheit between -58°F and 41°F:
5.3 ↵ Enter
Enter the wind speed (>=2) in miles per hour: 6 ↵ Enter
The wind chill index is -5.56707
```

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(*Geometry: area of a triangle*) Write a program that prompts the user to enter three points  $(x_1, y_1)$ ,  $(x_2, y_2)$ ,  $(x_3, y_3)$  of a triangle and displays its area. The formula for computing the area of a triangle is

$$s = (\text{side1} + \text{side2} + \text{side3})/2;$$
$$\text{area} = \sqrt{s(s - \text{side1})(s - \text{side2})(s - \text{side3})}$$

Here is a sample run:

```
Enter three points for a triangle: 1.5 -3.4 4.6 5 9.5 -3.4 ↵Enter
The area of the triangle is 33.6
```



(Financial application: calculate future investment value) Write a program that reads in investment amount, annual interest rate, and number of years, and displays the future investment value using the following formula:

$$\text{futureInvestmentValue} = \text{investmentAmount} \times (1 + \text{monthlyInterestRate})^{\text{numberOfYears} \times 12}$$

For example, if you enter amount **1000**, annual interest rate **3.25%**, and number of years **1**, the future investment value is **1032.98**.

Here is a sample run:

```
Enter investment amount: 1000.56 ↵Enter
Enter annual interest rate in percentage: 4.25 ↵Enter
Enter number of years: 1 ↵Enter
Accumulated value is $1043.92
```

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(*Financial application: calculate interest*) If you know the balance and the annual percentage interest rate, you can compute the interest on the next monthly payment using the following formula:

$$\text{interest} = \text{balance} \times (\text{annualInterestRate}/1200)$$

Write a program that reads the balance and the annual percentage interest rate and displays the interest for the next month. Here is a sample run:

```
Enter balance and interest rate (e.g., 3 for 3%): 1000 3.5 ↵ Enter
The interest is 2.91667
```