Ruby Exercises

1 Calculation

1. Calculate the following.
   (a) Convert 22 degrees Celsius to Fahrenheit, where C degrees Celsius is equal to $F = \frac{9}{5}C + 32$ degrees Fahrenheit.
   (b) Convert 50 degrees Fahrenheit to Celsius.
   (c) Translate 535,800 yen (UTokyo tuition fees) to US dollars, where we suppose that 1 US dollar is 93.51 yen.
   (d) Translate 12900 US dollar (Stanford Univ. tuition fees) to Japanese yen.
2. Describe a Ruby expression to compute the following. Note that we have to use multiple functions in some cases.
   (a) $\sqrt{10}$, $(\sqrt{2}\sqrt{5})$, $\sqrt{\sqrt{5}}$, $12^{\sqrt{2}}$
   (b) $\sin 30°$, $\cos 30°$, $\tan 30°$
   (c) $\log 1000$, $\log_{100} 100$, $\log_2 1000$
   (d) 2.7^{10} (with/without using **)
3. Recalculate Problem 1 by using a variable.
4. Do the following computation using variables and assignment.
   (a) Suppose that $x = 10$, $y = x(x-3)$, $z = y(y-3)$. Compute $z(x-3)$. Moreover, describe this expression only using x by your hand.
   (b) Below is a description to compute a quadratic equation.
      i. Suppose that $a = 3$, $b = 5$, $c = -7$.
      ii. We define d as the discriminant of the quadratic equation $ax^2+bx+c = 0$.
      iii. Compute the two solutions of $ax^2+bx+c = 0$, and assign them to variables p, q.
      iv. Compute $ap^2 + bp + c$ and $aq^2 + bq + c$.

2 Functions

1. (a) Define a function f(x) that computes $2x^2 + 3x + 4$.
   (b) Define a function g(x) that computes the remainder of a given number x when divided by 5.
   (c) Define a function h() that returns "hello!" in the terminal.

2. (a) Define an original function log_3(n) that computes $\log_3(n)$, using implemented functions log(x) and/or log10(x).
   (b) Define an original function log_b(n, b) that computes $\log_b(n)$, using log(x) and/or log10(x).

3. (a) Define a function area(r) that computes the area of a circle with radius r.
   (b) Using the function area, compute the length of a regular square whose area is equal to that of a circle with radius 10cm.
   (c) Using the function area, compute the length of a regular square whose area is equal to that of a semicircle with radius 20cm.
   (d) Using the function area, compute the length of a regular square whose area is equal to that of a quarter round with radius 30cm.

4. Define the following functions.
   (a) a function triangle(x) that returns the area of a regular(equilateral) triangle xcm on side.
   (b) a function tetrahedron(x) that computes the volume of a regular tetrahedron xcm on side. Note that the height of the tetrahedron is sqrt(2/3.0)*x.

5. Define a function time_to_seconds(h,m,s) that transform "h hours m minutes s seconds" to seconds.

6. Define the following functions. In addition, give an example of using these functions. It is better to put the functions in a file whose name is given between ( ).
   (a) a function celsius_to_fahrenheit(c) that converts Celsius temperature c to Fahrenheit. (yardpound.rb)
   (b) a function fahrenheit_to_celsius(f) that converts Fahrenheit temperature f to Celsius temperatures. (yardpound.rb)
   (c) a function ms_to_mph(v) that converts a velocity v[m/s] to mile per hour(mph). (yardpound.rb)
   (d) a function mph_to_ms(v) that converts a velocity v[mph] to meter per seconds[m/s]. (yardpound.rb)
   (e) In U.S., the Wind Chill Index[$\circ^F$] is defined as

   $$35.74 + 0.6215t - 35.75(v^{0.16}) + 0.4275t(v^{0.16}),$$

   where t is Fahrenheit temperature and v is wind speed[mph]. Describe a function wind_chill_index(t, v) that computes the Wind Chill Index for a given t and v. (wci.rb)

(f) A function wind_chill_index_celsius(t, v) that computes the Wind Chill Index when t and v are given by Celsius temperature and meter per second, respectively, and the output should be given as Celsius temperature[$\circ C$].(wci.rb)

7. Define the following functions on computing a quadratic equation $ax^2 + bx + c = 0$.(quadratic.rb)

   (a) a function det(a,b,c) that computes the discriminant.

   (b) a function solution1(a,b,c) that returns a solution $\frac{-b+\sqrt{b^2-4ac}}{2a}$. (use the function det(a,b,c))

   (c) a function solution2(a,b,c) that returns a solution $\frac{-b-\sqrt{b^2-4ac}}{2a}$. (use an auxiliary variable to represent the common part of the two solutions)

   (d) a function quadratic(a,b,c,x) that computes the function value of the quadratic function $f(x) = ax^2 + bx + c$.

8. Do the following to know behavior of local variables.

   (a) Error happens because the variable s is determined outside the function.

```
irb
def heron(a,b,c)
   sqrt(s*(s-a)*(s-b)*(s-c))
end
a=1
b=1
c=1
s=0.5*(a+b+c)
heron(a,b,c)
quit
```

   (b) Error happens because the variable s does not exist outside the function heron.

```
irb
def heron(a,b,c)
  s=0.5*(a+b+c)
  sqrt(s*(s-a)*(s-b)*(s-c))
end
heron(1,1,1)
s
quit
```

   (c) We can use variable names different from those in the function definition.

```
irb
def heron(a,b,c)
 s=0.5*(a+b+c)
 sqrt(s*(s-a)*(s-b)*(s-c))
end
t=3
```

```
u=4
v=5
heron(t,u,v)
quit
```

9. Consider the output without making a program.

```
def f(x)
  x=1
  a=2
end
a=0
f(a)
a
```