
The surface area of a sphere with radius r is

$$A(r) = 4\pi r^2$$

(a) Write a script that asks the user to enter the radius r in the command window and then displays the surface area.

Suppose we wish to calculate the amount by which the surface area changes when the radius is increased by a small amount δr:

$$\delta A = 4\pi(r + \delta r)^2 - 4\pi r^2$$

or, upon expanding $(r + \delta r)^2$ and cancelling a term,

$$\delta A = 4\pi(2r + \delta r)\delta r$$

(b) Write a script that solicits the sphere radius r and the amount of increase δr (both in meters) and then displays the surface area increase (in square meters, to six decimal places) given by each of the two formulas above.

(c) Use your script to estimate the increase in the Earth's surface area if its radius ($r \approx 6367\,\text{km}$, assuming the Earth is spherically shaped) is increased by a few millimeters.

Suppose we want to implement the quadratic formula for finding the solutions of $ax^2 + bx + c = 0$.

(a) Write a **script** which asks the user to enter the coefficients a, b, c in the command window and then displays the two solutions.

(b) Write a **function** whose input arguments are the coefficients a, b, c and whose output arguments are the two solutions x_1, x_2.

The quadratic function $f(x) = x^2 + bx + c$ has a graph in the shape of a parabola that opens upward, with a minimum at the critical point x_c. However, if the domain of f is restricted to a closed bounded interval $[L, R]$ (that is, $L \le x \le R$), then the minimum value is not necessarily attained at x_c.

(a) Write a function whose:

- input arguments are the coefficients b, c in the formula of f followed by the endpoints L, R of the interval domain;
- output arguments consist of the x-value where the minimum of $f(x)$ on $[L, R]$ occurs followed by the minimum value.

(b) Write a script that calls the function you wrote in (a) to generate $\big(x_\text{min}, f(x_\text{min})\big)$ for:

- $f(x) = x^2 + 2x + 4$ on $[1, 5]$;
- $f(x) = x^2 + 2x + 4$ on $[-3, 4]$;
- $f(x) = x^2 + 2x + 4$ on $[-10, -6]$;

and then saves the list of coordinates to an ascii text file `qmin.dat`.