Using Matlab as a scientific calculator

Calculate the following quantities:

$3.17 \times 5.6 + \dfrac{19}{4}$

$(6.02 \times 10^{23})^{3/2}$

$2^{-20} - 3.7592 \times 10^{-8}$

The golden ratio $\dfrac{1+\sqrt{5}}{2}$

π^3 to 15 decimal places

$e^6 - 6e$

$\sin\left(\frac{5\pi}{8}\right)$

$\cos(22°)$

$\ln 8$

$\log_{10}(2)$

$\log_2(10)$

$\log_3(10)$

$\tanh(e/3)$

12! and its prime factors

$z = 4xy^2$ where $x = \ln 17$ and $y = \cos(0.5)$

The side length c of a triangle ABC where $a = 3.7, b = 5.7$ and $C = 79°$
(use the cosine rule $c^2 = a^2 + b^2 - 2ab\cos C$)

The angle B (in degrees) in the same triangle ABC (use the sine rule $\dfrac{\sin C}{c} = \dfrac{\sin B}{b}$)

$\sqrt[3]{-2}$

$e^{i\pi}$ where $i = \sqrt{-1}$

The real and imaginary parts of the complex number $(5-6i)(8+i)$

The modulus and argument of the complex number $\dfrac{5-6i}{8+i}$

The complex conjugate of $(-1)^{0.25}$

The volume, in liters, of a sphere with radius (a) 0.7 cm; (b) 9 cm; (c) 113 cm

See what you get when you type the following:

```
1/0
0/0
Inf+Inf
Inf-Inf
Inf/Inf
exp(log(10))-10
exp(log(1))-1
```

Writing M-files

An M-file is a text file containing Matlab commands and saved with the extension `.m`

A **script** M-file is simply a sequence of Matlab commands; it has no input or output arguments and operates on variables in the workspace.

A **function** M-file can accept input arguments and return output arguments; its internal variables are local to the function.

To run (execute) a script, type the name of the file without the `.m` extension at the command window prompt.

To call a function, type

```
[<list of variables of output>]=<function name>(<list of input parameters>)
```

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.