Floating Point Arithmetic

1. Evaluate the following expressions using 3-significant-digit base-10 floating point arithmetic. Round to the nearest floating point number and on a tie choose the mantissa whose least significant digit is even.

   **(i)** $(3.14159)^*$

   **(ii)** $6.19 \times 10^2 +^* 3.61 \times 10^1$

   **(iii)** $1.23 \times 10^3 *9.54 \times 10^{-5}$

   **(iv)** $3.52 \times 10^3 +^* 5.43 \times 10^0$

   **(v)** $(2.71459)^* +^* (-2.72687)^*$

2. A hypothetical computer carries out calculations using 3-significant-digit base-10 floating point arithmetic. The rounding mode is round to the nearest floating point number and on a tie choose the mantissa whose least significant digit is even.

   **(i)** Suppose the program

   ```
   1 input x
   2 input y
   3 print x
   4 print y
   5 print x+y
   ```

   is executed and the output is

   ```
   5.14
   6.71
   11.8
   ```

   Find bounds on the absolute errors $e_x$, $e_y$, $e_{\text{prop}}$, $e_{\text{gen}}$ and $e_{\text{tot}}$.

   **(ii)** Suppose the program

   ```
   1 input x
   2 input y
   3 print x
   4 print y
   5 print x*y
   ```

   is executed and the output is

   ```
   5.14
   6.71
   34.5
   ```

   Find bounds on the relative errors $\tilde{e}_x$, $\tilde{e}_y$, $\tilde{e}_{\text{prop}}$, $\tilde{e}_{\text{gen}}$ and $\tilde{e}_{\text{tot}}$.