Problems for chapter 1.

1.* Calculate the following and give the answers to the appropriate number of significant figures:
   i 2×3.14159
   ii 2.00×3.14159
   iii $5.9832\times10^{-3}\times0.002346/1.0001$
   iv $7.32^{2.21}$
   v $9.981/9.90$

2. Calculate the following and give the answers to the appropriate number of significant figures:
   i 2.0×0.046
   ii 4.65×3.149
   iii $7.42\times10^{-5}\times0.00246/0.000100$
   iv $9.32^{2.41}$
   v $10.01/9.9$

3.* What uncertainties are implied in the following expressions?
   i 36.01
   ii 36.0
   iii 0.053×3.42
   iv $220/(1.1\times10)$
   v $0.022/11$

4. What uncertainties are implied in the following expressions?
   i 36.08
   ii 1.73
   iii 0.098×3.41
   iv $110/(2.1\times10)$
   v $0.066/11$

5.* Complete the calculations with their associated uncertainties:
   i $(34.6\pm0.2) + (2.08\pm0.18)$
   ii $(34.6\pm0.2) - (2.08\pm0.18)$
   iii $(34.6\pm0.2) \times (2.08\pm0.18)$
   iv $(34.6\pm0.2) \div (2.08\pm0.18)$
   v $((34.6\pm0.2)+(2.08\pm0.18))\times(0.32\pm0.02)$

6. Complete the calculations with their associated uncertainties:
   i (43.6±0.2) + (2.28±0.18)
   ii (43.6±0.2) - (2.28±0.18)
   iii (43.6±0.2) × (2.28±0.18)
   iv (43.6±0.2) ÷ (2.28±0.18)
   v ((43.6±0.2)+(2.28±0.18))×(0.32±0.02)

7.* Round off the number 10.495 to four significant figures, now round the same number to three and then two significant figures. Give the product of 9.86×10.193 to the appropriate number of significant figures.

8. Round off the number 10.49 to three significant figures, now round the same number to two significant figures. Give the product of 11.86×8.473 to the appropriate number of significant figures.

9.* Find the mean and standard deviation of {0.34, 0.32, 0.32, 0.33, 0.36, 0.35, 0.31, 0.33}.

10. Find the mean and standard deviation of {0.24, 0.12, -0.22, -0.13, 0.16, -0.10, -0.11}.

11.*The ratio of the circumference of a circle to the radius is π = 3.141592654, the fraction $\frac{22}{7}$ is often used as a convenient approximation, to how many significant figures does this fraction agree with π? What is the next fraction (cancelled to smallest integers) that gives π to one more significant figure?

12. The constant *e* = 1+1+1/2+1/6+1/24+1/120+1/720+1/5040+1/40320+1/362880..., can be generated from the given series. How many terms of this series are required to justify the approximation *e* = 2.718? What is the simplest fraction that gives this number?

13.*The following set of data points is taken from the linear relation $y = 9.8x + 7$, however an error has been added to each point:
{(*x*,*y*):(2.36,26.6),(3.90,45.5),(-.15,12.5),(6.35,66.2),(5.48,50.5),(2.74,36.2)}.

From *regression analysis* the line of best fit for this data is $y = 7.890\,x + 12.390$. Draw the two equations on a sheet of graph paper and include the data points from the set. Draw a rectangle around the data points and use this to estimate the uncertainty in the slope of the best fit line. As a rule the average values of *x* and *y* should lie on the best fit line, show that this is so.

14. Analyse the following set of data points, as you did in the last question.
{(*x*,*y*):(1.8,-5.8),(3.9,-15.8),(0.2,4.1),(-0.9,8.0),(-3.7,25),(1.0,-0.5)}.

The *regression analysis* for the line of best fit for this data is $y = -5.3518x + 4.5515$.

15. Make estimates to determine if there are more people living on the surface of this earth than there are grains of sand in a bucket full of sand.

16. Estimate the number of students enrolled at Macquarie University. You can look up the official figure as a check.

17.*Find as best you can without a computer or calculator the best fit straight line for {(x,y):(1.0,2.4),(1.9,2.9),(3.1,3.6),(4.0,4.0),(6.0,5.1),(7.1,5.6),(9.9,6.8)}.

18. Find as best you can without a computer or calculator the best fit straight line for {(x,y):(-2.8,-17.0),(-2.5,-10.6),(-1.1,3.7),(-0.2,5.0),(0.9,5.73),(1.9,11.9),(3.1,34.8)}.