

1.
 - raw = 3.1415926...
 - chopped at 5 digits = 3.1415
 - rounded at 5 digits = 3.1416
2. (a)
 - absolute error = $|\hat{x} - x| = 0.1 \cdot 10^{-4}$
 - relative error = $\frac{|\hat{x} - x|}{|x|} = \frac{0.1 \cdot 10^{-4}}{0.3 \cdot 10^{-3}} = \frac{1}{30}$
 (b)
 - absolute error = $|\hat{x} - x| = |40320 - 39900| = 420$
 - relative error = $\frac{|\hat{x} - x|}{|x|} = \frac{420}{39900} = \frac{1}{95}$
3.
 - $-x + y = \frac{5}{7} + \frac{1}{3} = \frac{22}{21} = 1.047619\dots$
 - Chopped = 1.0476.
 - Absolute error = $\frac{22 - 21 \cdot 1.0476}{21} = \frac{22 - 21.9996}{21} = \frac{0.0004}{21} = \frac{4}{210000}$
 - Relative error = $\frac{|\frac{4}{210000}|}{|\frac{22}{21}|} = \frac{2}{11000}$
 - $-x - y = \frac{5}{7} - \frac{1}{3} = \frac{8}{21} = 0.380952\dots$
 - Chopped = 0.38095.
 - Absolute error = $\frac{8 - 21 \cdot 0.38095}{21} = \frac{8 - 7.99995}{21} = \frac{0.00005}{21} = \frac{1}{4200000}$
 - Relative error = $\frac{|\frac{1}{4200000}|}{|\frac{8}{21}|} = \frac{1}{1600000}$
 - $-x \cdot y = \frac{5}{7} \cdot \frac{1}{3} = \frac{5}{21} = 0.2380952\dots$
 - Chopped = 0.23809.
 - Absolute error = $\frac{5 - 0.23809 \cdot 21}{21} = \frac{5 - 4.99989}{21} = \frac{0.00011}{21} = \frac{11}{2100000}$
 - Relative error = $\frac{|\frac{11}{2100000}|}{|\frac{5}{21}|} = \frac{11}{500000}$
 - $-x/y = (\frac{5}{7}) / (\frac{1}{3}) = \frac{15}{7} = 2.1428571\dots$
 - Chopped = 2.1428.
 - Absolute error = $\frac{15 - 2.1428 \cdot 7}{7} = \frac{15 - 14.9996}{7} = \frac{0.0004}{7} = \frac{1}{17500}$
 - Relative error = $\frac{|\frac{1}{17500}|}{|\frac{15}{7}|} = \frac{1}{37500}$
4. $0.54617 + 0.54611 = 1.09228$. Absolute error = 0.00028 and relative error = $\frac{0.00028}{1.09228}$. The result has 4 significant digits.
5. (a) $\lim_{x \rightarrow 0} f(x) = \lim_{x \rightarrow 0} \frac{-x \sin x - \cos x}{-\cos x} = 1$
 (b) $f(0.1) = \frac{0.1 \cos 0.1 - \sin 0.1}{0.1 - \sin 0.1} = \frac{0.1 \cdot 0.9950 - 0.09983}{0.1 - 0.09983} = -\frac{0.00033}{0.00017} = -1.941176\dots$
 (c) $f(0.1) = \frac{0.1(1 - \frac{(0.1)^2}{2!}) - (0.1 - \frac{(0.1)^3}{3!})}{0.1 - (0.1 - \frac{(0.1)^3}{3!})} = \frac{\frac{(0.1)^3 \cdot (2! - 3!)}{3! \cdot 2!}}{\frac{(0.1)^3}{3!}} = \frac{2! - 3!}{2!} = \frac{-4}{2} = -2.0$
 (d)
 - For (b) the relative error = $\frac{|-1.9989999 - (-1.9411)|}{|-1.9989999|} = \frac{1.9989999 - 1.9411}{1.9989999} = \frac{0.0578999}{1.9989999}$
 - For (c) the relative error = $\frac{|-1.9989999 - (-2)|}{|-1.9989999|} = \frac{2 - 1.9989999}{1.9989999} = \frac{0.0010001}{1.9989999}$
6. (a) $13.0_{10} = 1101.0_2$
 (b) $\frac{3}{8} = 0.375_{10} = 0.011_2$
 (c) $1.32_{10} = 1.0101000111101\dots_2$
7. (a) $1 + 4 + 16 + 64 = 85$
 (b) 11.625

(c) $39.0 + \sum_{i=1}^{\infty} \frac{1}{4^i} = 39.\bar{3}$

8. (a) $-5_{10} = 11111011_2$

(b) $-17_{10} = 11101111_2$

9. $10011111 = 31 - 128 = -97$