Department of Electrical and Computer Engineering
University of Waterloo
Please send any comments or criticisms to dwharder@alumni.uwaterloo.ca
with the subject ECE 250 Questions 2.3.
Assistances and comments will be acknowledged.

2.3*a* When $n = 1000$, the relative error is approximately 0.002000988 or approximately 0.2 %.

2.3*b* The answers for 4 and 5 are

$$\lim_{n\to\infty}\frac{2n+4}{5n\ln(n)+3n+2}=\lim_{n\to\infty}\frac{2}{5\ln(n)+8}=0$$

$$\lim_{n\to\infty}\frac{n\ln(n)}{n\ln(n^5)}=\lim_{n\to\infty}\frac{n\ln(n)}{5n\ln(n)}=\lim_{n\to\infty}\frac{1}{5}=\frac{1}{5}$$

2.3*d* In each case, determine the appropriate relationship between $f(n) + g(n)$ and $h(n)$.

1. $f(n) + g(n) = \Theta(h(n))$
2. $f(n) + g(n) = \Omega(h(n))$
3. $f(n) + g(n) = \Theta(h(n))$
4. $f(n) + g(n) = \mathbf{O}(h(n))$
5. $f(n) + g(n) = \omega(h(n))$

2.3*d* The third answer is that $f_1(n) + f_2(n) = \mathbf{o}(g_1(n) + g_2(n))$ because $g_2(n) = \mathbf{o}(g_1(n))$.

2.3*f* In the first case, $2 = \lg(4) < \lg(6)$, so $5n^2 + 4n + 3n^{\lg(6)} + 4 + \ln(n) = \Theta(n^{\lg(6)})$. The second and third are $\Theta(n\ln(n))$ and $\Theta(n^6)$, respectively.

2.3*g* The third answer is that no relationship can be determined.