1 Assignments

All numbers below refer to the textbook: Calculus Concepts and Contexts, J. Stewart, 4th Ed.

• §12.5: 5, 9, 13, 15, 19
• §12.6: 3, 7, 15(a), the problem in Section 2
• Extra credit
  - §12.5: 28
  - §12.6: 23

Boldfaced problems weigh 2 points each and all other problems 1 point each. All problems will be graded for a total point of 10.

2 Convergence of mid-point rule

The convergence rate of a numerical formula in approximating a 2D integral is the power of $h$ in the remainder. For example, the convergence rate of the mid-point rule as defined in F139 is four. This problem verifies this convergence rate.

Let $f(x, y) = e^x \sin(y)$, $R = [0, 1] \times [0, 1]$.

(a) derive the exact value of $I = \iint_R f(x, y)\,dA$,
(b) approximate $I$ with the Riemann sum $S_1$ using the midpoint rule with $m = n = 1$, and calculate absolute error $E_1 = |I - S_1|$.
(c) repeat (b) with uniform partition and $m = n = 2$.
   Calculate $E_2 = |I - S_2|$.
(d) repeat (c) with $m = n = 4$.
   Calculate $E_4 = |I - S_4|$.
(e) verify that the convergence rate calculated by

\[
\kappa_1 = \log_2 \frac{E_1}{E_2}, \quad \kappa_2 = \log_2 \frac{E_2}{E_4}
\]

are both close to 4.

3 Directions

In case you missed a lecture, you should be able to figure out most of the problems by reading the examples in the book.

Extra credits: Additional 25% credits will be given to you if you typeset your solutions in $\LaTeX$. You can also get partial extra credit for typesetting solutions of some problems.

From those of you who uses $\LaTeX$, I will select a winner and base the released solution on her/his $\LaTeX$ source. The criteria will be

(i) correctness,
(ii) number of extra credit problems finished,
(iii) the logical flow of explaining the steps.

The homework winner will get another 25% extra credit.

Note: Please send me your latex source (.tex) via email if you typeset your solution in $\LaTeX$ and would like to participate in the competition for the 25% extra credit.