**Quiz 4**

The first letter of your LAST name

First Name _____ Last Name _____

| Q4-1 (25 pts) | Q4-2 (25 pts) | Q4-3 (25 pts) | Q4-4 (25 pts) | Total |
|---|---|---|---|---|
| | | | | |

Note: You have 75 min. Be careful about the time allocation. Try not to leave any problems totally blank so that I can give you some partial credit. Good luck!

**24-311 NUMERICAL METHOD Fall 02**

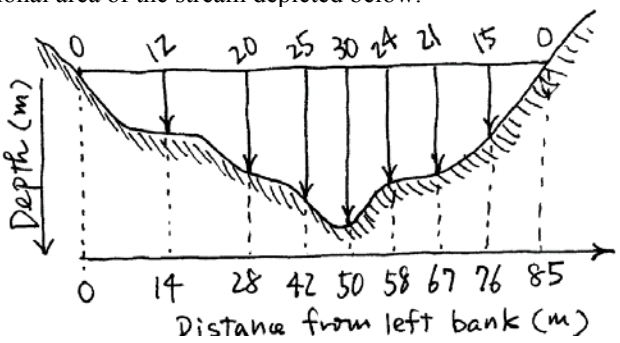
**QUIZ 4**

| | |
|---|---|
| Date and time | 11/12 (Tue), 10:35AM-11:50AM (75 min) |
| Weight | 10 % of final grade |
| Coverage | lectures and reading assignments: 18-22<br>problem sets: PS9 and 10 |
| Format | closed book, closed notes |
| Note | bring a basic calculator with + - x / keys<br>(no computer allowed in quiz!) |

**Q4-1**

**(25pts)**

Stream cross-sectional areas are required for a number of tasks in water resources engineering, including flood forecasting and reservoir designing. Unless electronic sounding devices are available to obtain continuous profiles of the channel bottom, the engineer must rely on discrete depth measurements to computer the area. Apply Simpton's 1/3 rule and Simpson's 3/8 rule to find the cross-sectional area of the stream depicted below.



**Q4-2** **(25pts)** What is quartic Lagrange's interpolation polynomial function $f(x)$ that interpolates five points: (0,2), (1,3), (3,0), (4,4), and (6,1). Find the function value at $x = 2$ using the polynomial function.

**Q4-3** Suppose you want to fit a line $y = a_0 + a_1 x$ to the following data points using least square regression.

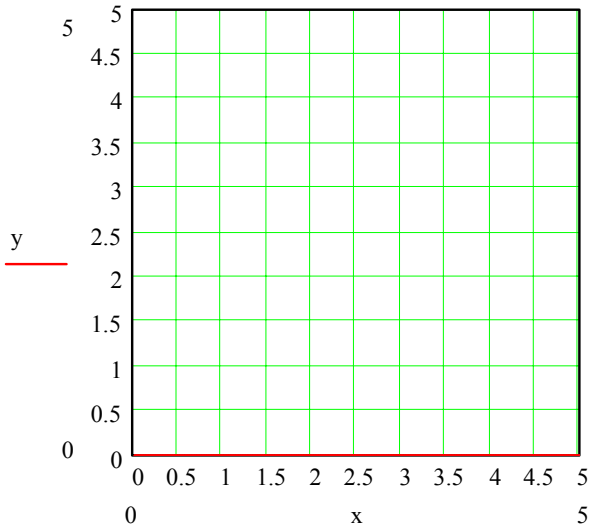
**(25pts)**

| x | 0 | 1 | 2 | 5 |
|---|---|---|---|---|
| y | 1 | 2 | 3 | 4 |

(1) What is the function $S_r$ to be minimized to find the least square regression line?

(2) Find the two equations to find the coefficients of the line of the least square regression. Write the 2 x 2 matrix equation to be solved to find the coefficients. Show the derivation for full credit

(3) Solve the 2 x 2 matrix equation and find out the coefficients of the line of the least-square regression. Plot the line along with four data points.



**Q4-4** In class we derived the forward finite-divided difference formula for the first derivative $f'$.

**(25pts)** (1) Using a similar approach show how to derive the backward finite-divided difference formula for the first derivative:

$$f'(x_i) = \frac{f(x_i) - f(x_{i-1})}{h} + O(h)$$

(2) Show how to derive a more accurate backward finite-divided difference formula for the first derivative:

$$f'(x_i) = \frac{3f(x_i) - 4f(x_{i-1}) + f(x_{i-2})}{2h} + O(h^2)$$

This is the last page of Quiz 4, and this page is intentionally left blank
so that you can use it if you need more space to write your solution or do some calculations.