Highway Design
CE 424

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Engineering Faculty

Civil Engineering Department

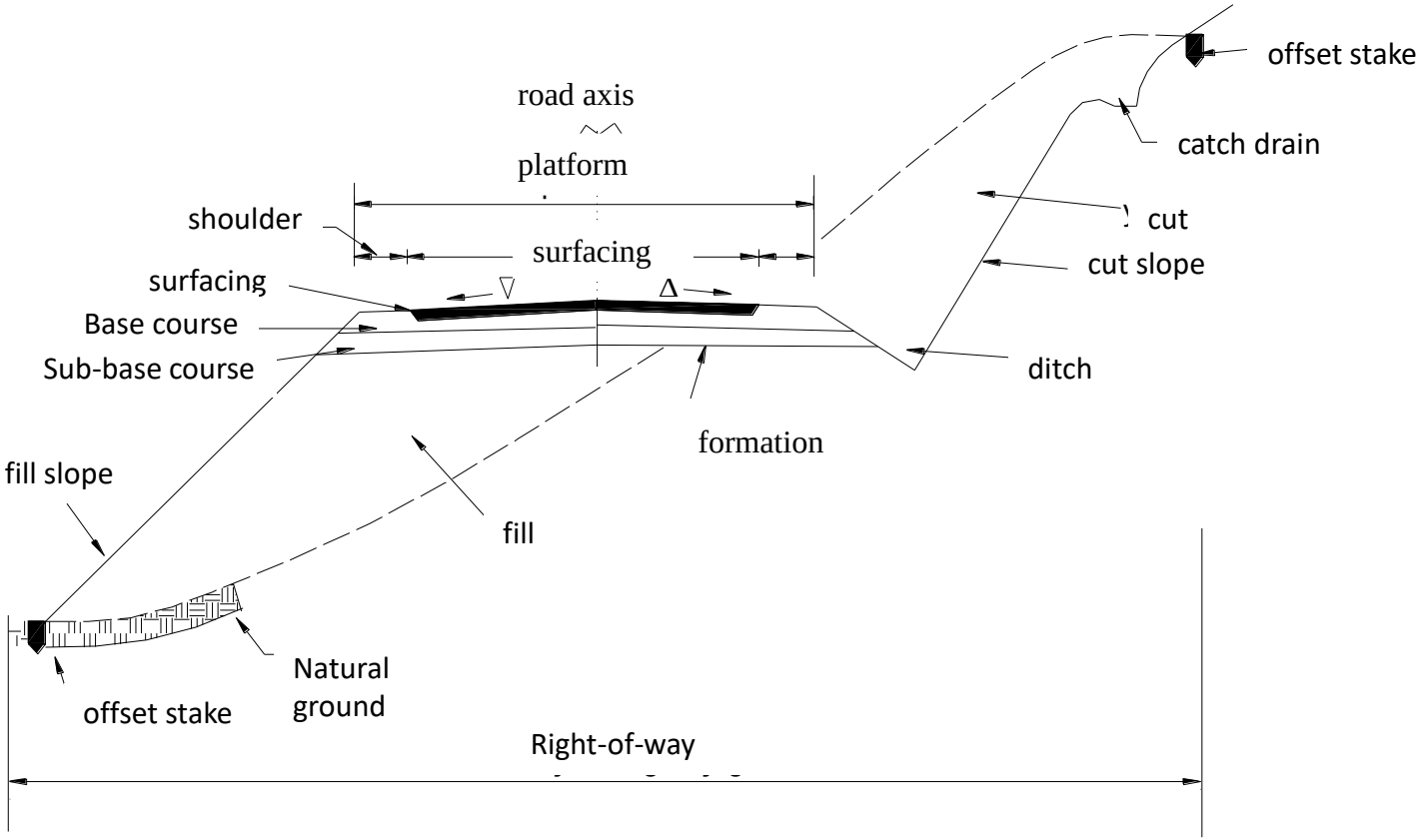
Cross Sections

-Drawing typical cross-section

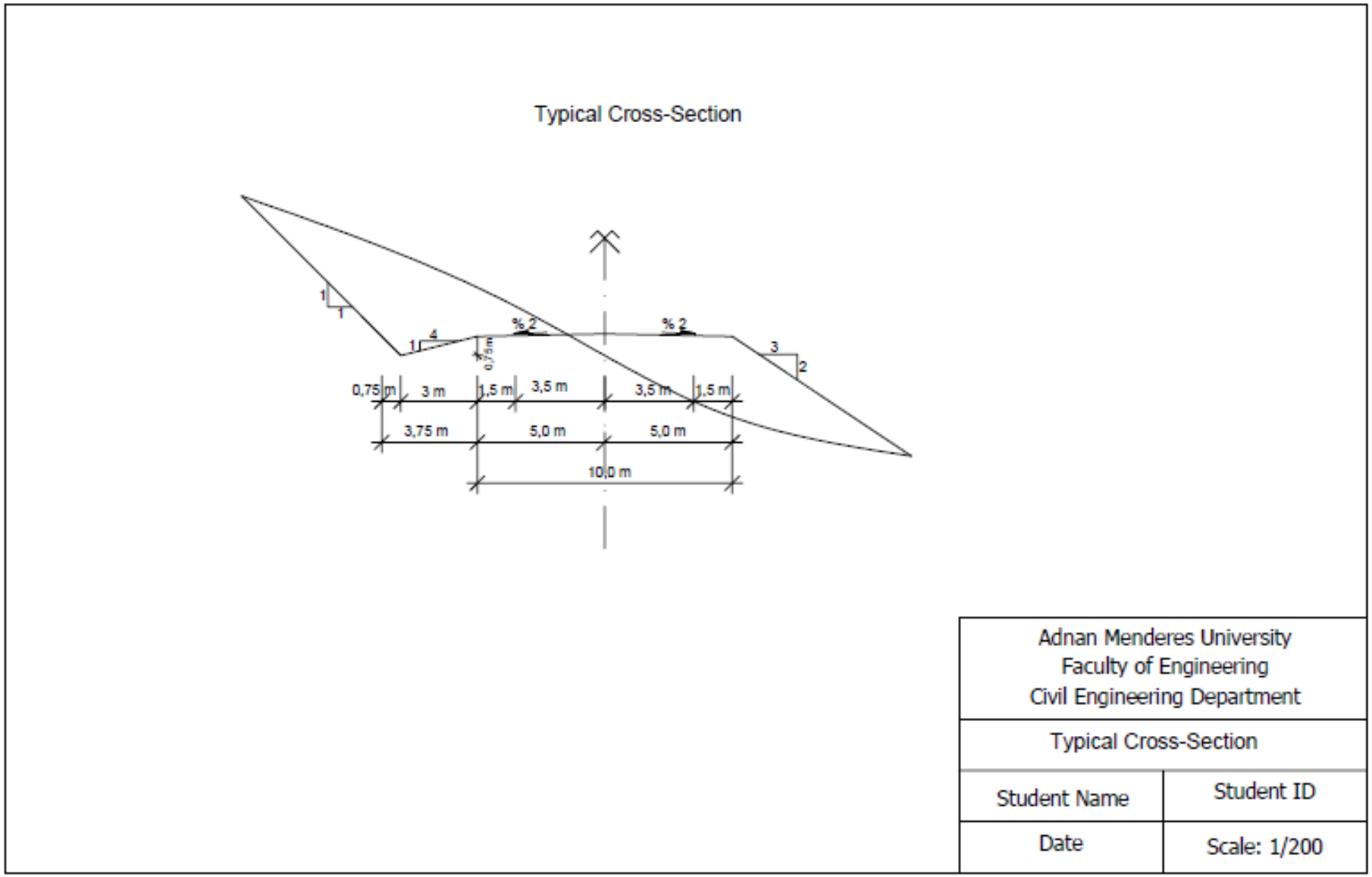
-Drawing cross-sections

-Calculation of cross-sections areas.

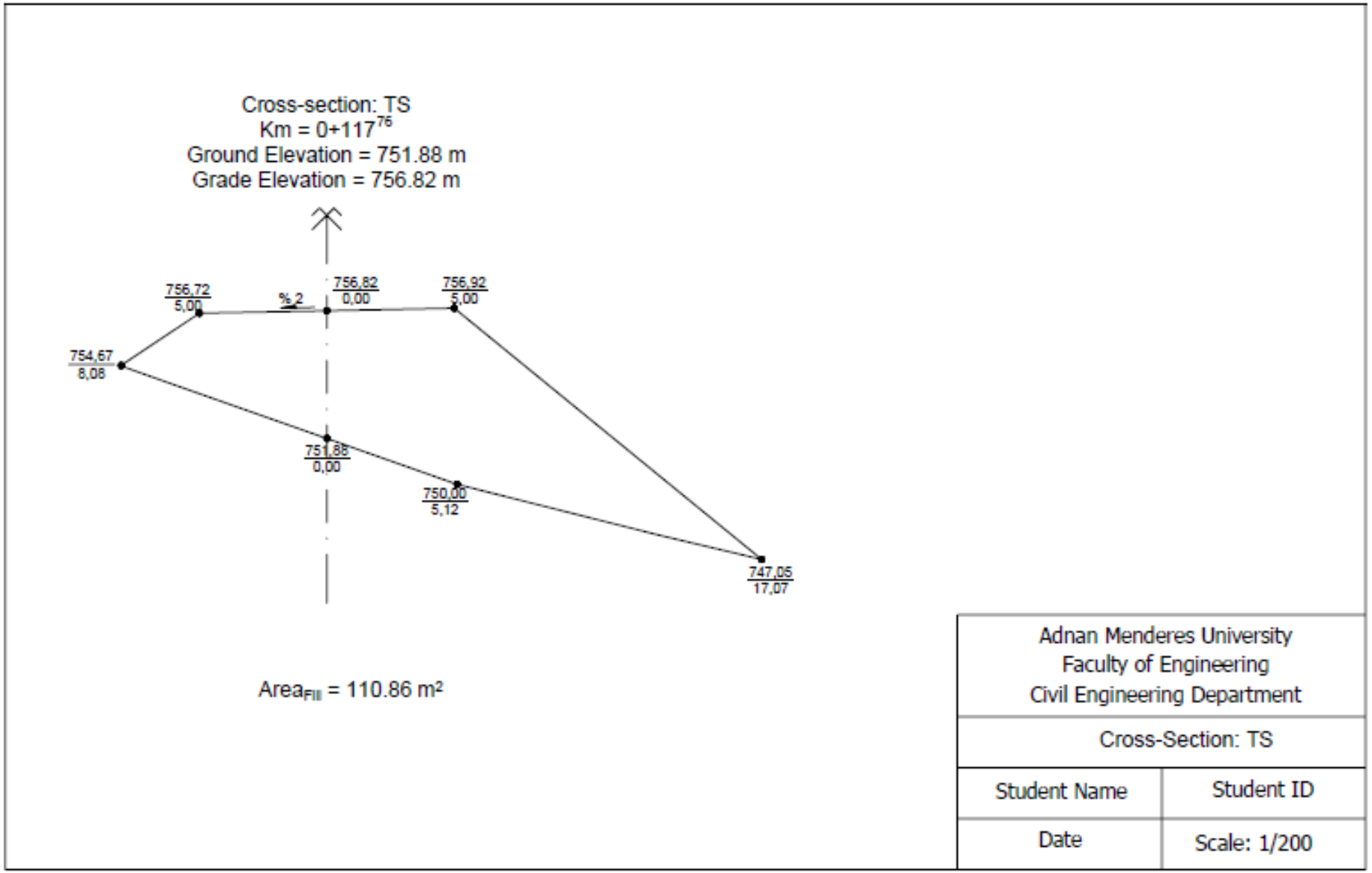
Cross section and elements of road



Typical cross-section



Cross-Section



Retaining structures (walls)

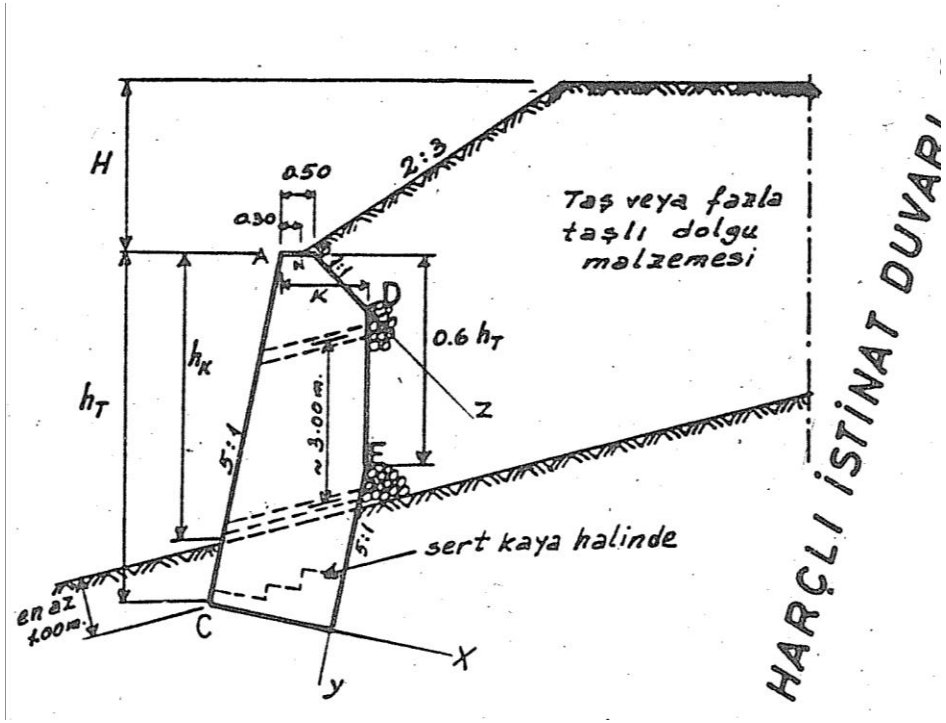
Retaining walls are constructed on the cut and fill slope.

(İstinat duvarı – iksa duvarı)

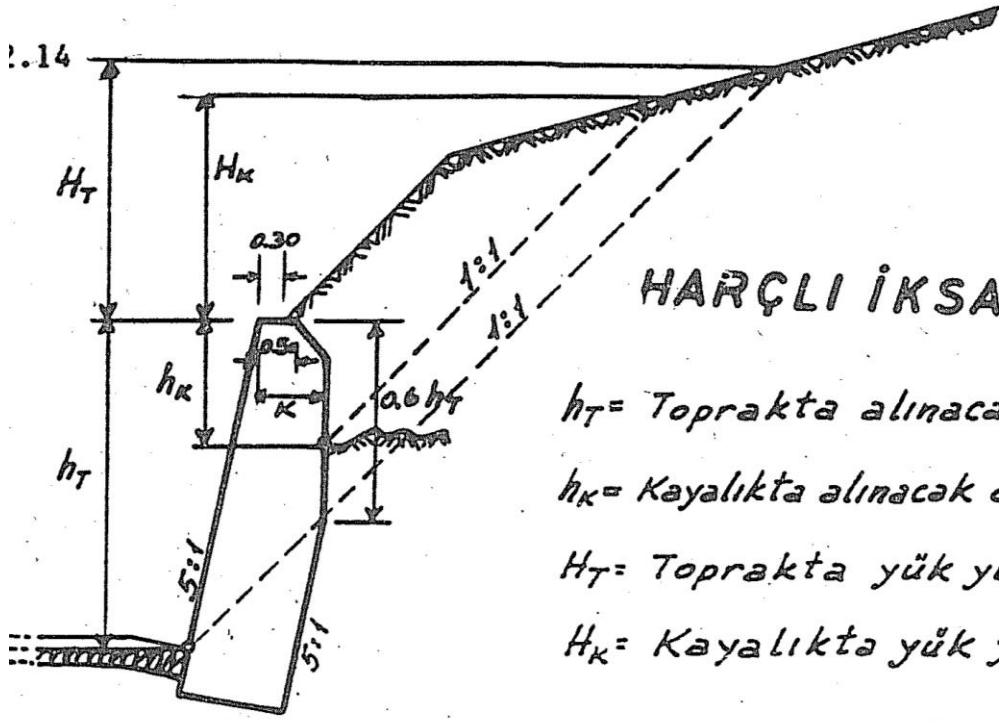








HARÇLI İSTİNAT DUVARI



HARÇLI İKSA

h_T= Toprakta alınaca

h_K= Kayalıkta alınacak

H_T= Toprakta yük y

H_K= Kayalıkta yük

Calculation of cross-sections areas

- Cross method

$$S = \tfrac{1}{2}\,[(Y_1 + Y_2)(X_1 - X_2) + (Y_4 + Y_1)(X_4 - X_1) - (Y_3 + Y_2)(X_3 - X_2) - (Y_4 + Y_3)(X_4 - X_3)]$$

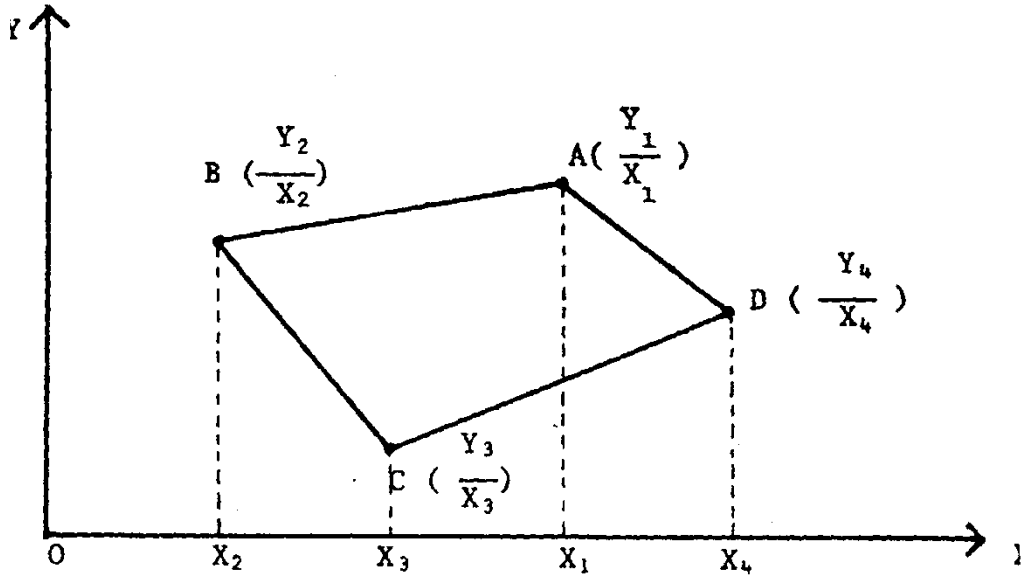
$$S = \tfrac{1}{2}\,[Y_1 (X_4 - X_2) + Y_2 (X_1 - X_3) + Y_3 (X_2 - X_4) + Y_4 (X_3 - X_1)]$$

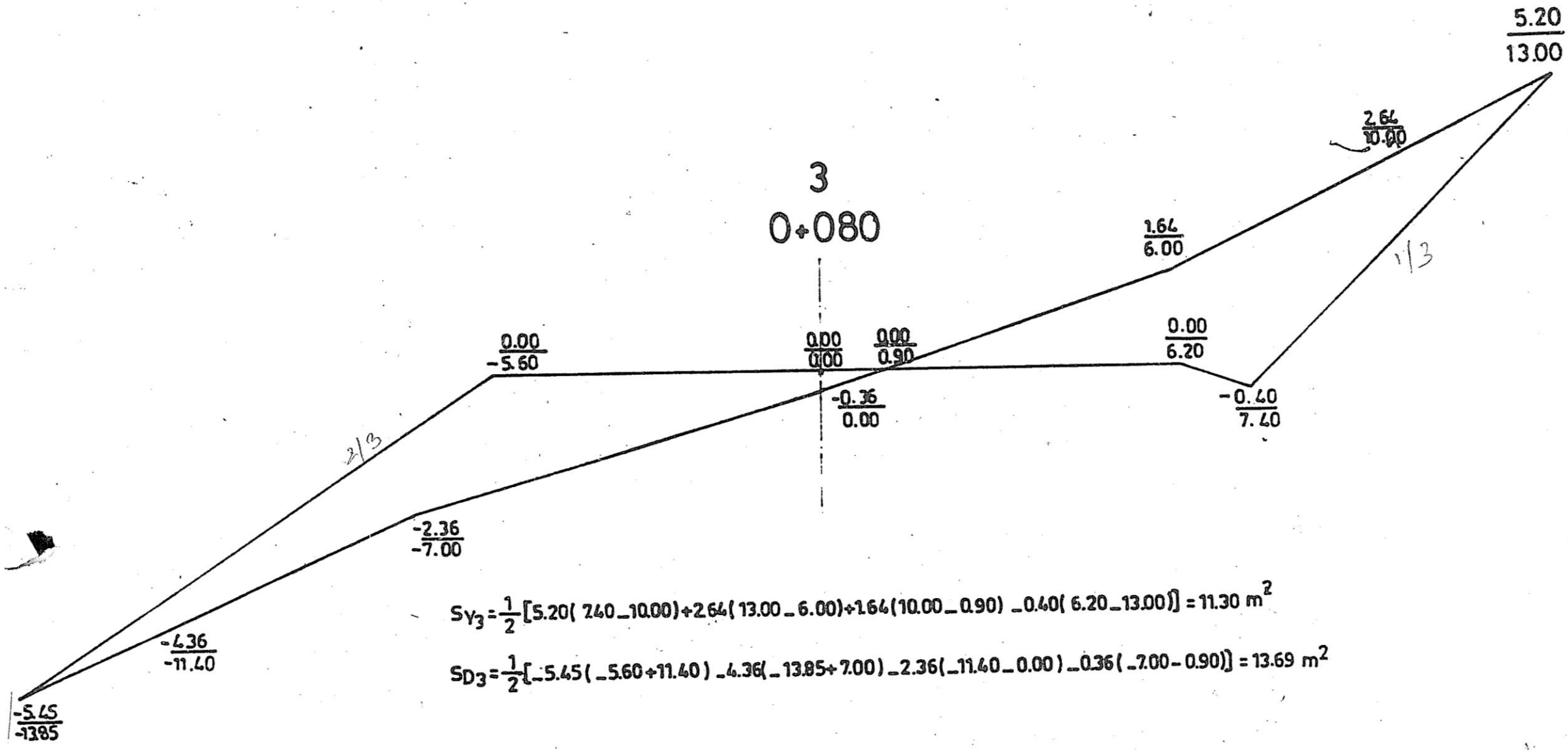
YOX (counter clockwise direction)

$$S = \frac{1}{2}\sum_{i=1}^{n} Y_i (X_{i-1} - X_{i+1})$$

XOY (clockwise direction)

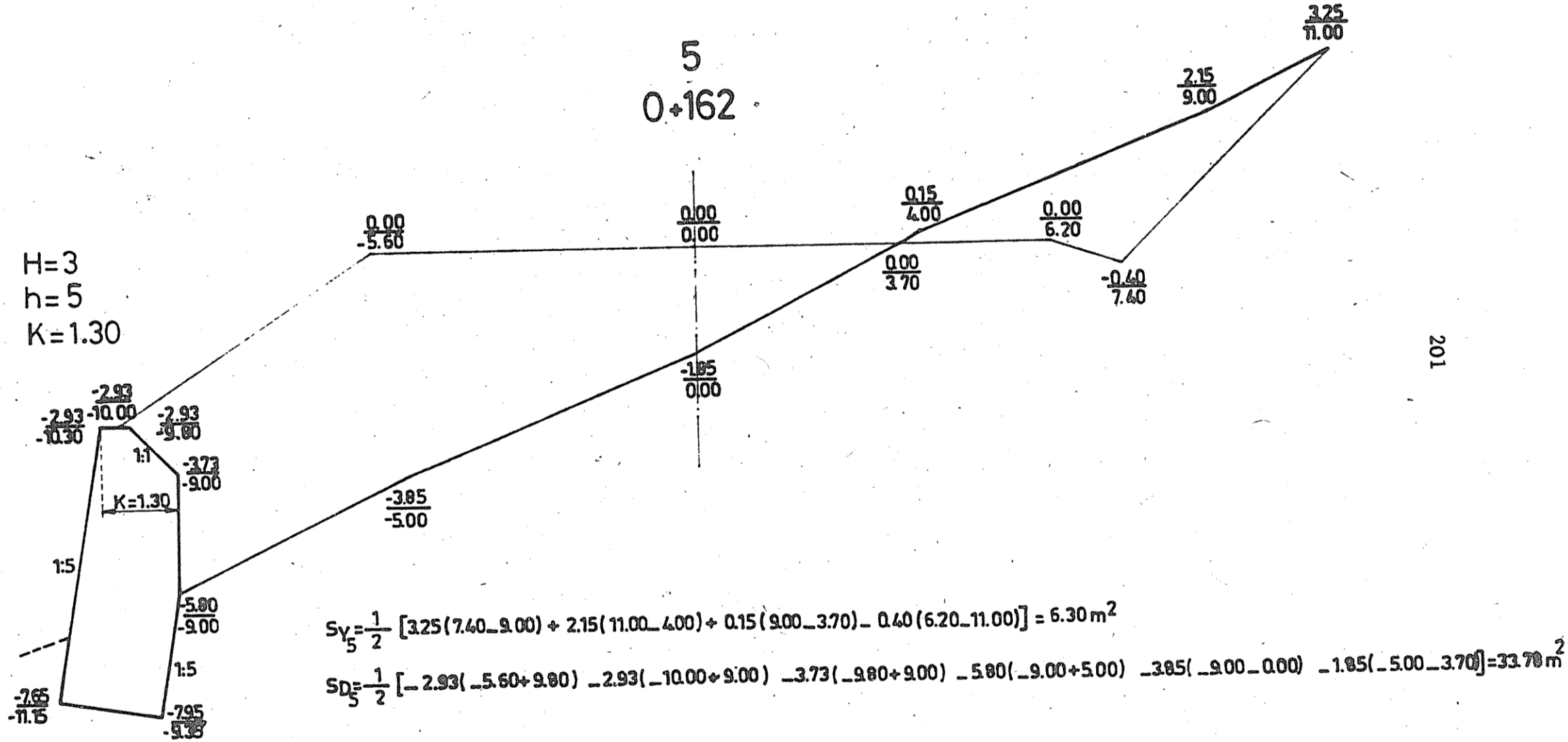
$$S = \frac{1}{2}\sum_{i=1}^{n} X_i (Y_{i-1} - Y_{i+1})$$





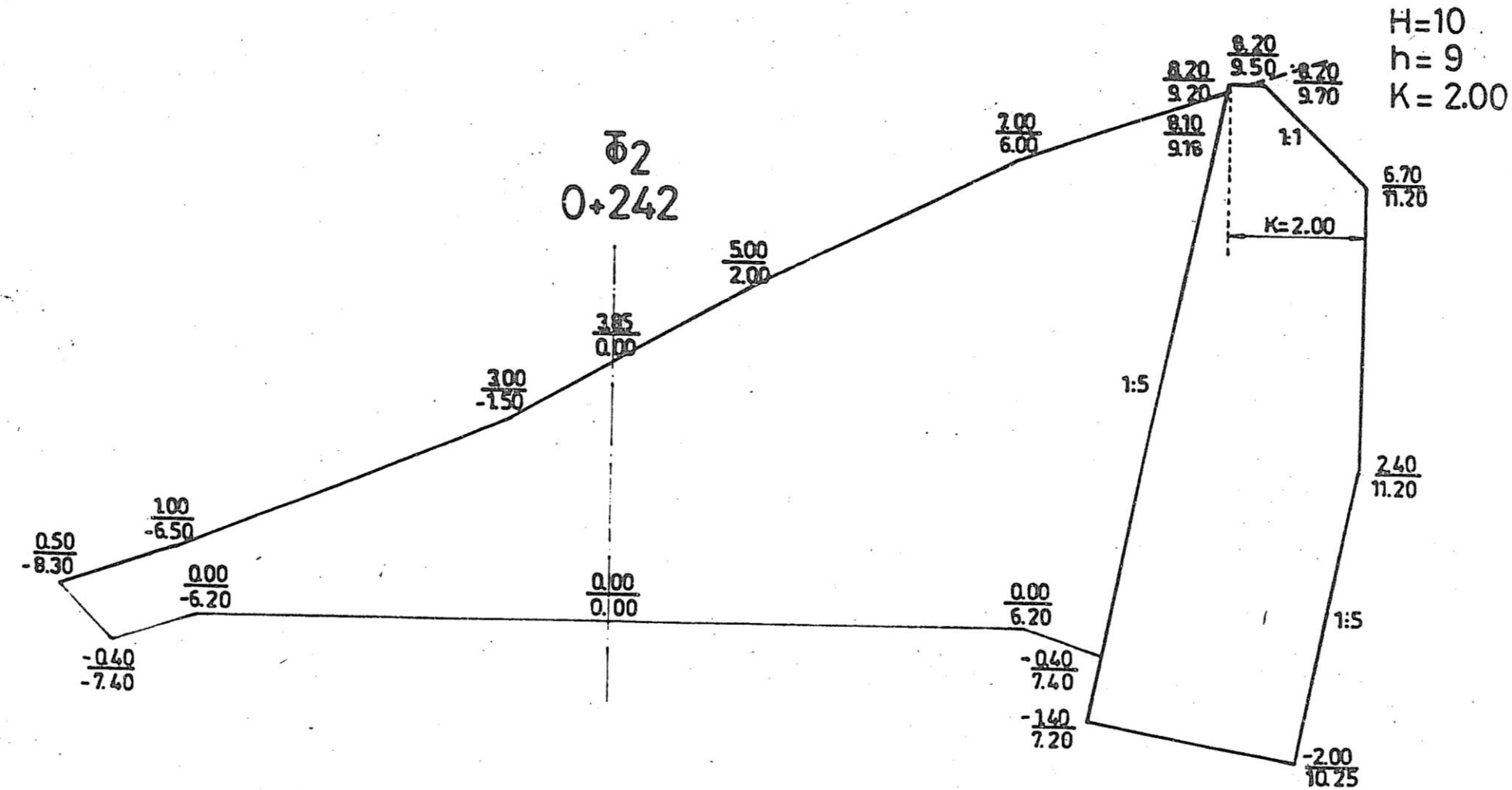
$$S_{Y_3} = \frac{1}{2}[5.20(7.40 - 10.00) + 2.64(13.00 - 6.00) + 1.64(10.00 - 0.90) - 0.40(6.20 - 13.00)] = 11.30\ m^2$$

$$S_{D_3} = \frac{1}{2}[-5.45(-5.60 + 11.40) - 4.36(-13.85 + 7.00) - 2.36(-11.40 - 0.00) - 0.36(-7.00 - 0.90)] = 13.69\ m^2$$



$$S_{Y_5} = \frac{1}{2}\left[3.25(7.40-9.00) + 2.15(11.00-4.00) + 0.15(9.00-3.70) - 0.40(6.20-11.00)\right] = 6.30\ m^2$$

$$S_{D_5} = \frac{1}{2}\left[-2.93(-5.60+9.80) - 2.93(-10.00+9.00) - 3.73(-9.80+9.00) - 5.80(-9.00+5.00) - 3.85(-9.00-0.00) - 1.85(-5.00-3.70)\right] = 33.78\ m^2$$



$$S_{V_{\Phi_2}} = \frac{1}{2}\Big| 8.20(9.70-9.16) + 8.10(9.50-6.00) + 2.00(9.16-2.00) + 5.00(6.00+0.00) + 3.85(2.00+1.50) + 3.00(0.00+6.50) + 1.00(-1.50+8.30) + 0.50(-6.5+74)$$

$$-0.40(-8.30\ 6.20) - 0.40(6.20-7.20) - 1.40(7.40-10.25) - 2(7.20-11.20) + 2.40(10.25-11.20) + 6.70(11.20-9.70) + 8.20(11.20-9.20)\Big| = 97.53\,m^2$$