

ΦΥΛΛ. 4 , ΑΣΚΗΣΗ 12, ΠΑΡΕΜΒΟΛΗ ΕΑΡΙΝΟ 2024

(2 ΤΡΟΠΟΙ, ο ένας από online solver)

Επίλυση μέσω online solver (πολυώνυμο με χρήση όλων των δεδομένων -- πολύ υψηλού βαθμού!!!)

$f(1.005)=300, f(1.013)=400, f(1.029)=500, f(1.051)=600, f(1.075)=700,$
 $f(1.089)=800, f(1.121)=900, f(1.142)=1000, f(1.155)=1100, f(1.173)=1200$

$$\begin{aligned} f(x) = & 2.01581 \times 10^{13} x^9 - 1.97103 \times 10^{14} x^8 \\ & + 8.56221 \times 10^{14} x^7 - 2.16882 \times 10^{15} x^6 + 3.53025 \\ & \times 10^{15} x^5 - 3.82935 \times 10^{15} x^4 + 2.76812 \times 10^{15} x^3 \\ & - 1.28584 \times 10^{15} x^2 + 3.48288 \times 10^{14} x - 4.1912 \\ & \times 10^{13} \end{aligned}$$

4. (20 points) The heat capacity of air as a function of temperature is shown in the table below.

C_p (kJ/kg·K)	1.005	1.013	1.029	1.051	1.075	1.099	1.121	1.142	1.155	1.173
T (K)	300	400	500	600	700	800	900	1000	1100	1200

Find the interpolated value of heat capacity at T = 750 K using a cubic polynomial: $a_0 + a_1(x - x_0) + a_2(x - x_0)(x - x_1) + a_3(x - x_0)(x - x_1)(x - x_2)$.

For a cubic polynomial we require four data points. The four points closest to T = 750 are T = 600, 700, 800, and 900. The divided difference table for these points is shown at the right. The calculations are shown below.

$$F_0 = \frac{1.075 - 1.051}{700 - 600} = 0.00024 \quad F_1 = \frac{1.099 - 1.075}{800 - 700} = 0.00024$$

$$F_2 = \frac{1.121 - 1.099}{900 - 800} = 0.00022 \quad S_0 = \frac{.00024 - .00024}{800 - 600} = 0$$

$$S_1 = \frac{.00022 - .00024}{900 - 700} = -10^{-7} \quad T_0 = \frac{-10^{-7} - 0}{900 - 600} = 3.3310^{-10}$$

T	Cp	F	S	T
600	1.051			
		0.00024		
700	1.075		0	
		0.00024		-3.3x10 ⁻¹⁰
800	1.099		-1e-7	
		0.00022		
900	1.121			

We have $a_0 = y_0 = 1.051$, $a_1 = F_0 = 0.00024$, $a_2 = S_0 = 0$, and $a_3 = T_0 = 3.3x10^{-10}$

Plugging these values into our Newton polynomial gives $a_0 + a_1(x - x_0) + a_2(x - x_0)(x - x_1) + a_3(x - x_0)(x - x_1)(x - x_2) = 1.051 + 0.00024(T - 600) + (0)(T - 600)(T - 700) + (-3.3x10^{-10})(T - 600)(T - 700)(T - 600)(T - 800) = 1.063$