

Step (Initiated by master programmer. Consists of several operations)	Number of Unit of ENIAC			1	2	3	4	5	6	7	8 (and 9)	10 (and 9)	11 and 12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	CODE	
	Serial Order	Setting of Accumulator Round-off Switch	Decimal Point of Accumulator	6	6	6	7	7	7	7	7	10	—	10	—	10	—	—	—	5	7	—	5	8	—	NOT USED	—	—	—	—	—	—	—		—
				Addition Times Required	Program Line Used	Accumulator x $0 < x < 10^3$	Accumulator x_1	Accumulator y $0 < y < 10^4$	Accumulator y_1	Accumulator F $0.1 < F < 0.4$	Accumulator F_1	Multiplicand Accumulator	Multiplicand Accumulator	Multiplicand Accumulator	Left-Hand Product Accumulator #1	NOT USED	Right-Hand Product Accumulator #1	NOT USED	Master Programmer	Accumulator t	Argument Accumulator	Function Table	Accumulator x	Storage	NOT USED	NOT USED	NOT USED	NOT USED	Constant Transmitter (Push Button)	Constant Transmitter (Switch)	Printer Accumulator x_p, y_p	Printer Accumulator y_p, y_p	Printer Accumulator t_p		Printer Accumulator
Initial Conditions Step				i_1	1	5-1	$\dot{x}_1 \leftarrow$																												<ul style="list-style-type: none"> ○ Transmit from add output to accumulator indicated. ⊖ Transmit from subtract output to accumulator indicated. ⊕ Transmit from add output n times to accumulator indicated. ⊗ Indicates that incoming number is shifted n places to the left before being placed in accumulator. (A negative number indicates a shift to the right.) [n] Indicates number of digits before and after decimal point respectively. ⊞ Clear contents of accumulator to zero. ⊙ Indicates the number of multiplier digits used in multiplication. f(a) Function table transmits the value of the function corresponding to the first two places of the argument, i.e. corresponding to the 4th and 5th places in the argument accumulator. f(a+1) Function table transmits the value of the function corresponding to the first two places of the argument plus 1. ⊞ Indicates a special adaptor which deletes all but the 6th & 7th places of the argument and shifts them five places to the left. ◇ Indicates multiplication. c Indicates correction pulse must be put in
Step of Integration				1	1	0-1	\dot{x}_0 [3.3] ○																												<p>DIFFERENCE EQUATIONS (HEUN METHOD)</p> <p>NOTATION:</p> <p>Values at beginning of integration step: $t_0, x_0, \dot{x}_0, y_0, \dot{y}_0, F_0, G_0, E_0$</p> <p>Intermediate values of variables: $x_1, \dot{x}_1, y_1, \dot{y}_1, F_1, G_1, E_1$</p> <p>Values at end of integration steps: $t_2, x_2, \dot{x}_2, y_2, \dot{y}_2, F_2, G_2, E_2$</p> <p>VALUES OF CONSTANTS:</p> <p>$\frac{\Delta t}{2} = 0.01$ seconds $0 < x < 10^5$ meters $b = 9.85 \times 10^{-6} \frac{1}{meters}$ $0 < y < 10^4$ meters $h = 95.736 \times 10^{-6} \frac{1}{seconds}$ $0 < \dot{x} < 10^3$ meters/second $H_0 = 1$ $0 < \dot{y} < 10^3$ meters/second $c = 2.5$ to 5.0 $0 < (x^2 + y^2) < \frac{1}{3} 10^6$ $F_0 = \frac{1}{c}$ $0.1 < F < 0.4$</p> <p>THE EQUATIONS:</p> $\dot{x}_2 = \dot{x}_0 + 2\left(\frac{\Delta \dot{x}}{\Delta t}\right)$ $\frac{\Delta \dot{y}_0}{\Delta t} = -(E_0 \dot{y}_0 + g) \frac{\Delta t}{2} \quad \dot{y}_1 = \dot{y}_0 + 2\left(\frac{\Delta \dot{y}_0}{\Delta t}\right)$ $\frac{\Delta \dot{y}_1}{\Delta t} = -(E_1 \dot{y}_1 + g) \frac{\Delta t}{2} \quad \dot{y}_2 = \dot{y}_0 + \frac{\Delta \dot{y}_0}{\Delta t} + \frac{\Delta \dot{y}_1}{\Delta t}$ $\frac{\Delta \dot{x}_0}{\Delta t} = -(E_0 \dot{x}_0) \frac{\Delta t}{2} \quad \dot{x}_1 = \dot{x}_0 + 2\left(\frac{\Delta \dot{x}_0}{\Delta t}\right)$ $\frac{\Delta \dot{x}_1}{\Delta t} = -(E_1 \dot{x}_1) \frac{\Delta t}{2} \quad \dot{x}_2 = \dot{x}_0 + \frac{\Delta \dot{x}_0}{\Delta t} + \frac{\Delta \dot{x}_1}{\Delta t}$ $\frac{\Delta F_0}{\Delta t} = -(h F_0 \dot{y}_0) \frac{\Delta t}{2} \quad F_1 = F_0 + 2\left(\frac{\Delta F_0}{\Delta t}\right)$ $\frac{\Delta F_1}{\Delta t} = -(h F_1 \dot{y}_1) \frac{\Delta t}{2} \quad F_2 = F_0 + \frac{\Delta F_0}{\Delta t} + \frac{\Delta F_1}{\Delta t}$ $\frac{\Delta \dot{y}_0}{\Delta t} = \dot{y}_0 \frac{\Delta t}{2} \quad \dot{y}_1 = \dot{y}_0 + 2\left(\frac{\Delta \dot{y}_0}{\Delta t}\right)$ $\frac{\Delta \dot{y}_1}{\Delta t} = \dot{y}_1 \frac{\Delta t}{2} \quad \dot{y}_2 = \dot{y}_0 + \frac{\Delta \dot{y}_0}{\Delta t} + \frac{\Delta \dot{y}_1}{\Delta t}$ $\frac{\Delta \dot{x}_0}{\Delta t} = \dot{x}_0 \frac{\Delta t}{2} \quad \dot{x}_1 = \dot{x}_0 + 2\left(\frac{\Delta \dot{x}_0}{\Delta t}\right)$ $\frac{\Delta \dot{x}_1}{\Delta t} = \dot{x}_1 \frac{\Delta t}{2} \quad \dot{x}_2 = \dot{x}_0 + \frac{\Delta \dot{x}_0}{\Delta t} + \frac{\Delta \dot{x}_1}{\Delta t}$ $\frac{\Delta t_2}{\Delta t} = x_1 \frac{\Delta t}{2} \quad t_2 = t_0 + \Delta t$ <p>The range of the argument of G is extended by a factor of 3 to make full use of the range of the E.N.I.A.C. function table. Hence:</p> $G_0 = G\left[3(x_0^2 + y_0^2)(1 - b y_0)^2\right] \quad E_0 = F_0 G_0$ $G_1 = G\left[3(x_1^2 + y_1^2)(1 - b y_1)^2\right]$ <p>Linear interpolation is performed to get the value for G. Hence:</p> $G = f(a) + \Delta a [f(a+1) - f(a)]$ <p>where a is the first two places of the argument, and Δa, the third and fourth places.</p>
Printing Step (Values transmitted from accumulator)				P	1	4-8	\dot{x}_p ○																											<p>START PULSE</p> <p>t_2</p> <p>x_2</p> <p>\dot{x}_p</p> <p>\dot{y}_p</p> <p>y_p</p> <p>t_p</p> <p>x_p</p> <p>FINISH PULSE</p>	
Check Step (Initial conditions for integration step)				C ₁	1	5-5	$\dot{x}_c \leftarrow$																												<p>FINISH PULSE</p> <p>START PULSE</p> <p>(\dot{x}_c)</p> <p>(\dot{y}_c)</p> <p>(F_c)</p> <p>FINISH PULSE</p>