

Problem 1:

$$T = dz \rightarrow d = \frac{8}{z} = \left(\frac{qn}{0.47 z S^{0.5}} \right)^{0.375}$$

$$z = 8^{1/(1-0.375)} \left(\frac{0.47 S^{0.5}}{qn} \right)^{1-0.375} = 8^{1/(1-0.375)} \left(\frac{0.47 (0.017)^{0.5}}{5.1 \times (0.015)} \right)^{1-0.375} = 24.25$$

$$d = \frac{8}{24.25} = 0.33 \text{ ft} = 4 \text{ in.}$$

Problem 2:

$$D^5 - 2(h_i)D^4 + \frac{16q^2}{C_d^2 g \pi^2} = 0$$

$$D^5 - 2(5.6)D^4 + \frac{16 \times (74)^2}{(0.6)^2 \times 9.81 \times \pi^2} = 0$$

$$D = 36 \text{ inches}$$

Problem 3:

Reach A:

Using Manning Equation:

$$V = \frac{1.49}{0.07} \times (4)^{\frac{2}{3}} \times (0.01)^{\frac{1}{2}} = 5.36 \frac{ft}{s}$$

$$K = \frac{L}{V} = \frac{15000}{5.36} = 2798 \text{ sec} = 46.63 \text{ min}$$

$$C = \frac{V}{(1.7 + V)} = \frac{5.36}{(1.7 + 5.36)} = 0.759$$

$$\Delta t^* = C \times K = 0.759 \times 46.63 = 35.39 \text{ min}$$

$$C^* = 1 - (1 - C)^{\frac{\Delta t}{\Delta t^*}} = 1 - (1 - 0.759)^{\frac{10}{35.39}} = 0.33$$

Reach B:

Using Manning Equation:

$$V = \frac{1.49}{0.05} \times (5)^{\frac{2}{3}} \times (0.05)^{\frac{1}{2}} = 6.16 \frac{ft}{s}$$

$$K = \frac{L}{V} = \frac{17000}{6.16} = 2759 \text{ sec} = 45.98 \text{ min}$$

$$C = \frac{V}{(1.7 + V)} = \frac{6.16}{(1.7 + 6.16)} = 0.78$$

$$\Delta t^* = C \times K = 0.78 \times 45.98 = 35.86 \text{ min}$$

$$C^* = 1 - (1 - C)^{\frac{\Delta t}{\Delta t^*}} = 1 - (1 - 0.78)^{\frac{10}{35.86}} = 0.34$$

Therefore for reach A and B we would have:

$$Q(t + \Delta t)^* = C^* I_t + (1 - C^*) \times Q_t$$

Reach A:

$$Q(t + \Delta t)^* = 0.33 I_t + 0.67 \times Q_t$$

Reach B:

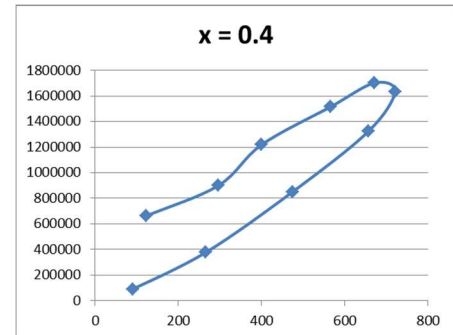
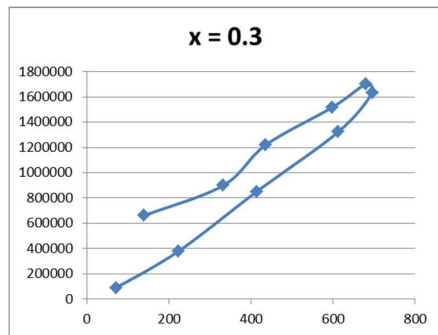
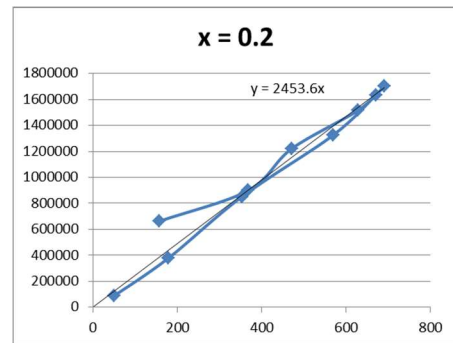
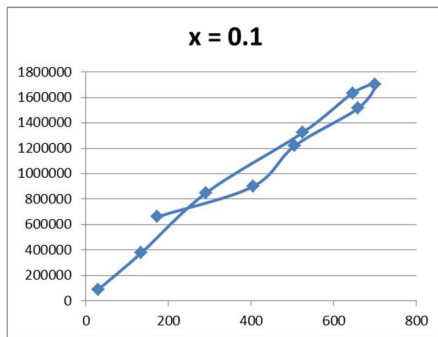
$$Q(t + \Delta t)^* = 0.34 I_t + 0.66 \times Q_t$$

Time (min)	Q	Q (A)	Q (B)
0	200	200	200
10	300	200	200
20	700	233	200
30	600	387.11	211.22
40	500	457.3637	271.0226
50	400	471.4337	334.3786
60	350	447.8606	380.9773
70	300	415.5666	403.7176
80	250	377.4296	407.7463
90	225	335.3778	397.4386
100	210	298.9532	376.3379
110	205	269.5986	350.0271
120	200	248.2811	322.6814

Problem 4:

Time (Sec)	Time (min)	I (cfs)	O (cfs)	I (avg)	O (avg)	S (Cubic feet)	Weighted Discharge				
							x = 0.1	x = 0.2	x = 0.3	x = 0.4	x = 0.5
0	0	0	0				0	0	0	0	0
900	15	210	10	105	5	90000	30	50	70	90	110
1800	30	530	90	370	50	378000	134	178	222	266	310
2700	45	840	230	685	160	850500	291	352	413	474	535
3600	60	920	480	880	355	1323000	524	568	612	656	700
4500	75	870	620	895	550	1633500	645	670	695	720	745
5400	90	610	710	740	665	1701000	700	690	680	670	660
6300	105	380	690	495	700	1516500	659	628	597	566	535
7200	120	190	540	285	615	1219500	505	470	435	400	365
8100	135	80	440	135	490	900000	404	368	332	296	260
9000	150	20	190	50	315	661500	173	156	139	122	105

$$K = 2453.6 \quad x = 0.2$$



Problem 5:

$$A = 175 \times (75 + 10h)$$

$$S = \int_0^h (13125 + 1750h) dh = 13125h + 875h^2$$

Considering a rectangular weir:

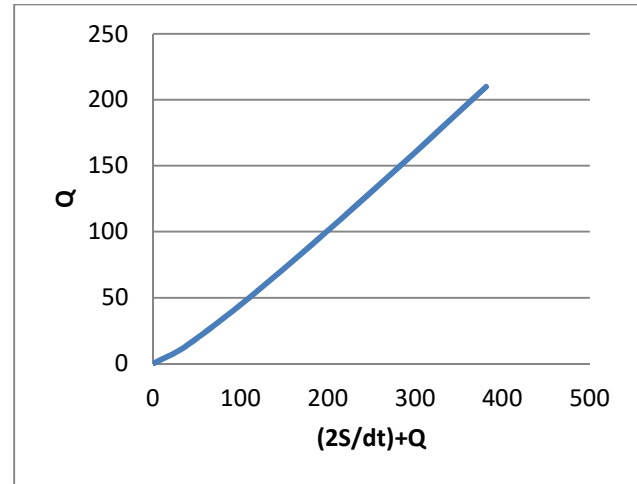
$$Q = CLH^{3/2} = 3.1 \times 6 \times h^{3/2}$$

$$h = \left(\frac{Q}{18.6}\right)^{2/3}$$

Plotting between $\left(\frac{2S_n}{dt} + Q_n\right)$ and Q_n :

$$\frac{2S_n}{dt} + Q_n = \frac{2(13125h + 875h^2)}{900} + Q_n = 4.154 \times Q^{2/3} + 71 \times Q^{4/9} + Q$$

Q	$(2S_n/d_t) + Q_n$
0	0
10	29.70558
20	51.67641
30	71.9428
40	91.2804
50	110.0072
60	128.2924
70	146.2389
80	163.9154
90	181.3703
100	198.6391
110	215.7493
120	232.7221
130	249.5747
140	266.321
150	282.9727
160	299.5394
170	316.0295
180	332.45
190	348.8071
200	365.1061
210	381.3517



Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7
Time (h)	In (cms)	In+In+1	(2S/dt)-Q	(2Sn+1/dt)+Qn+1	Qn+1	Sn+1
0	0	30	0	30	10	9000
15	30	105	10	115	52.73	28021.5
30	75	195	9.54	204.54	103.44	45495
45	120	295	-2.34	292.66	155.84	61569
60	175	335	-19.02	315.98	169.97	65704.5
75	160	285	-23.96	261.04	136.84	55890
90	125	210	-12.64	197.36	99.25	44149.5
105	85	140	-1.14	138.86	65.88	32841
120	55	90	7.1	97.1	43.1	24300
135	35	55	10.9	65.9	25.23	18301.5
150	20	30	15.44	45.44	15.52	13464
165	10	10	14.4	24.4	8.21	7285.5