

D.4

$$\alpha = 7.65 \times 10^{10} \text{ m/Kg}$$

$$R_m = 6.7 \times 10^9 \text{ m}^{-1}$$

$$\mu = 0.0016 \text{ Kg/sm}$$

$$\rho_c = 9.5 \text{ Kg/m}^3$$

$$A = 25 \text{ m}^2$$

$$V = 40 \text{ m}^3$$

GOVERNING EQN IS
$$V = \frac{A}{\alpha \mu \rho_c} \left[\frac{A \Delta P}{Q} - \mu R_m \right]$$

$$= \frac{25}{(7.65 \times 10^{10})(0.0016)(9.5)} \left[\frac{25 \Delta P}{Q} - (0.0016)(6.7 \times 10^9) \right]$$

$$V = 5.375 \times 10^{-7} \left[\frac{\Delta P}{Q} - 4.288 \times 10^5 \right]$$

MAKE A TABLE IN EXCEL ...

	X		Y	
	$\frac{Q}{(\text{GPM})}$	$\frac{\Delta P}{(\text{ft})}$	$\frac{Q}{(\text{m}^3/\text{s})}$	$\frac{\Delta P}{(\text{Pa})}$
CONVERSION FACTORS USED				
			$1 \text{ m}^3/\text{s} = 15850 \text{ GPM}$	
				$1 \text{ ft} = 2989 \text{ Pa}$
				USING EQUATION ABOVE

FIND AREAS, WHICH IS EQUAL TO TIME

STOP WHEN V CALCULATED BY EQN IS 40 m^3

$$t = 3.33 \text{ h}$$

Problem D4

Q (gpm)	ΔP (ft)	Q (m ³ /s)	ΔP (Pa)	V (m ³)	1/Q (s/m ³)	Area
128	17	0.008076	50813	3.15	123.8	390.25
124	19.5	0.007823	58286	3.77	127.8	78.33
120	22.2	0.007571	66356	4.48	132.1	91.80
116	24.4	0.007319	72932	5.13	136.6	86.72
112	26.4	0.007066	78910	5.77	141.5	89.85
108	28.3	0.006814	84589	6.44	146.8	96.62
104	30	0.006562	89670	7.12	152.4	100.65
100	31.8	0.006309	95050	7.87	158.5	116.93
96	33.1	0.006057	98936	8.55	165.1	110.39
92	34.2	0.005804	102224	9.24	172.3	115.76
88	35.8	0.005552	107006	10.13	180.1	157.39
84	37	0.005300	110593	10.99	188.7	158.05
80	38.1	0.005047	113881	11.90	198.1	176.19
76	39.1	0.004795	116870	12.87	208.6	197.92
72	40	0.004543	119560	13.92	220.1	224.23
68	41	0.004290	122549	15.12	233.1	273.44
64	42	0.004038	125538	16.48	247.7	326.30
60	42.8	0.003785	127929	17.93	264.2	371.99
56	43.5	0.003533	130022	19.55	283.0	442.08
52	44	0.003281	131516	21.32	304.8	519.19
48	44.7	0.003028	133608	23.48	330.2	688.02
44	45.1	0.002776	134804	25.87	360.2	824.13
40	45.5	0.002524	136000	28.74	396.3	1083.56
36	45.8	0.002271	136896	32.17	440.3	1434.91
32	46.1	0.002019	137793	36.45	495.3	2006.04
29.24	46.2	0.001845	138092	40.00	542.1	1841.24
28	46.3	0.001767	138391	41.88	566.1	
24	46.6	0.001514	139287	49.21	660.4	
20	46.8	0.001262	139885	59.36	792.5	
From Pump Characteristic				From Governing Equation	sum	12001.94 s
						3.33 h

