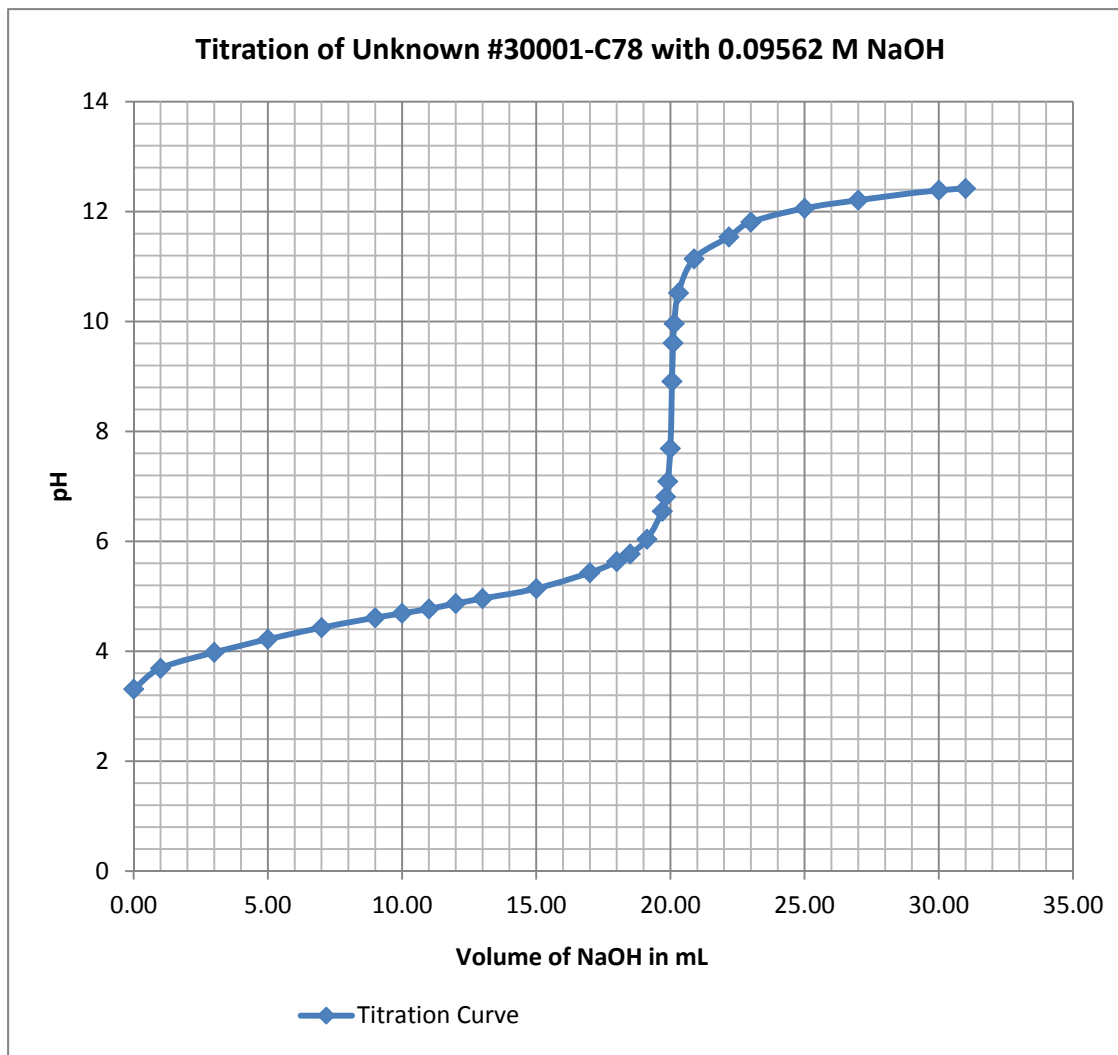


	A	B	C
	Recorded mL NaOH	pH	Delivered mL NaOH
2	0.72	3.31	0.00
3	1.72	3.69	1.00
4	3.72	3.98	3.00
5	5.72	4.22	5.00
6	7.72	4.43	7.00
7	9.72	4.61	9.00
8	10.72	4.69	10.00
9	11.72	4.77	11.00
10	12.72	4.87	12.00
11	13.72	4.96	13.00
12	15.72	5.14	15.00
13	17.72	5.43	17.00
14	18.72	5.63	18.00
15	19.22	5.77	18.50
16	19.85	6.04	19.13
17	20.42	6.55	19.70
18	20.54	6.81	19.82
19	20.62	7.09	19.90
20	20.72	7.69	20.00
21	20.78	8.91	20.06
22	20.82	9.61	20.10
23	20.86	9.96	20.14
24	21.02	10.52	20.30
25	21.60	11.14	20.88
26	22.90	11.54	22.18
27	23.72	11.81	23.00
28	25.72	12.06	25.00
29	27.72	12.21	27.00
30	30.72	12.39	30.00
31	31.72	12.42	31.00

$C2 = A2 - 0.72$

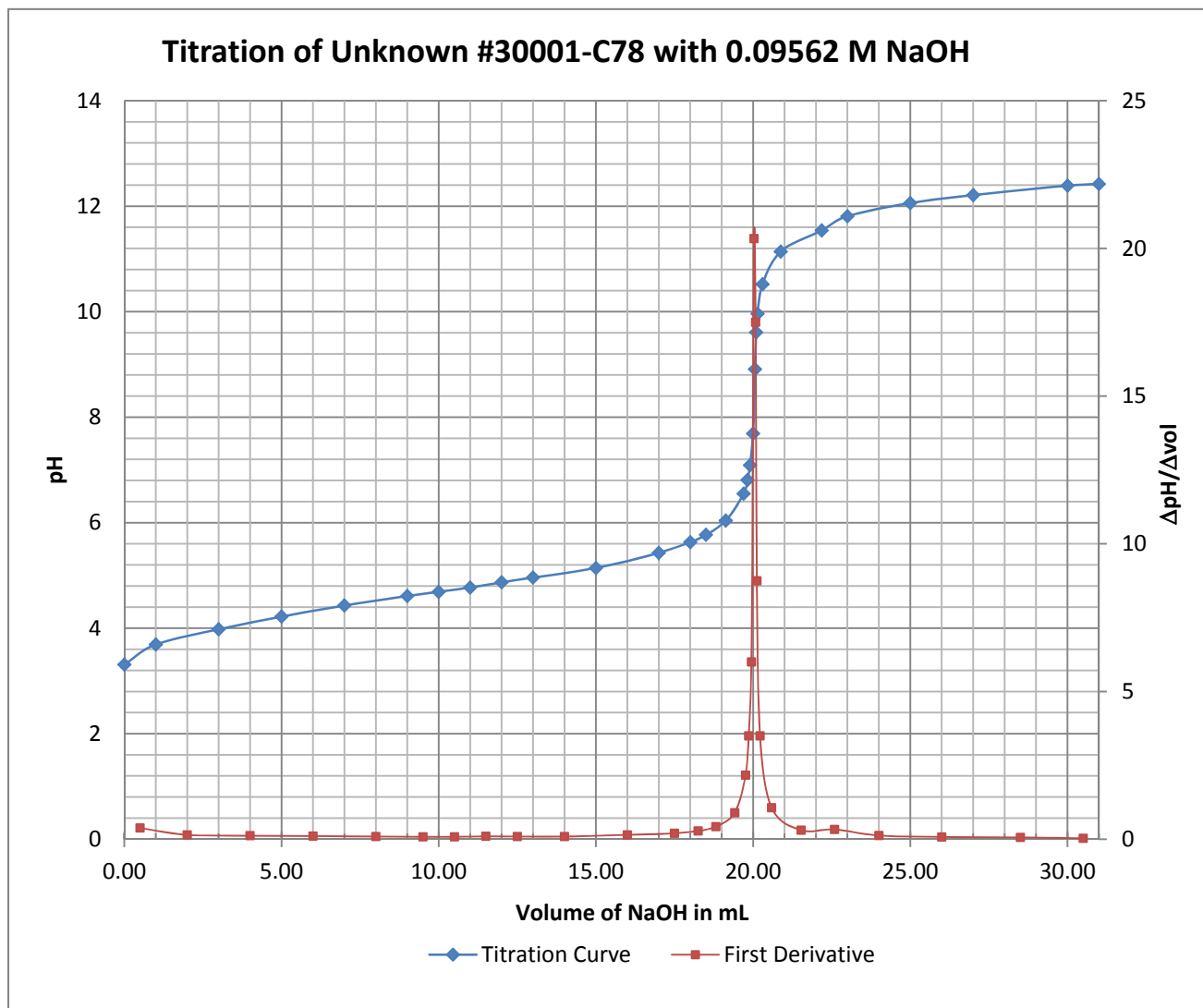
Data from page 56 of the Lab Manual



	D	E
	$\Delta\text{pH}/\Delta\text{Vol}$	Avg. Volume
2	0.380	0.50
3	0.145	2.00
4	0.120	4.00
5	0.105	6.00
6	0.090	8.00
7	0.080	9.50
8	0.080	10.50
9	0.100	11.50
10	0.090	12.50
11	0.090	14.00
12	0.145	16.00
13	0.200	17.50
14	0.280	18.25
15	0.429	18.82
16	0.895	19.42
17	2.167	19.76
18	3.500	19.86
19	6.000	19.95
20	20.333	20.03
21	17.500	20.08
22	8.750	20.12
23	3.500	20.22
24	1.069	20.59
25	0.308	21.53
26	0.329	22.59
27	0.125	24.00
28	0.075	26.00
29	0.060	28.50
30	0.030	30.50

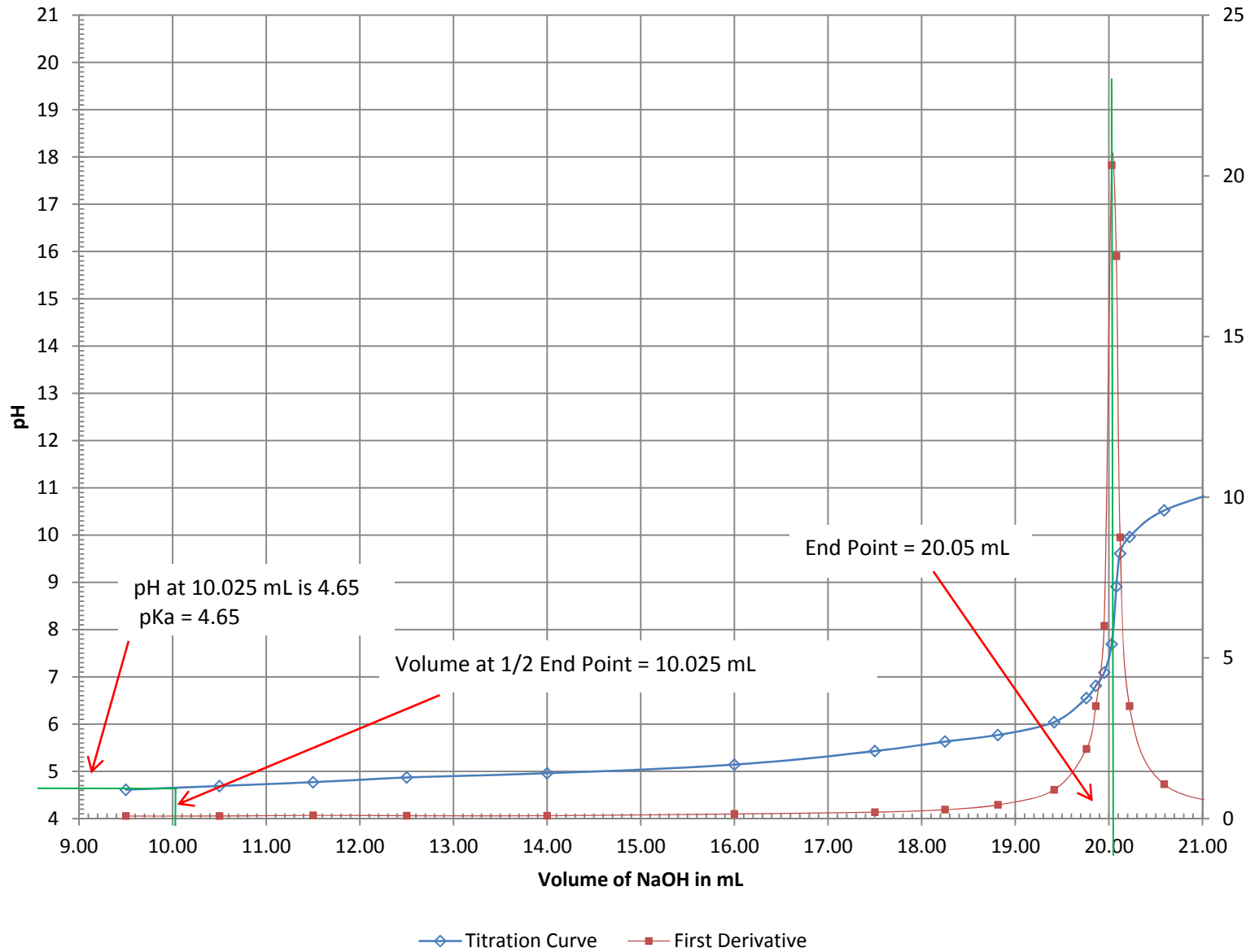
$$D2 = \text{ABS}((B3-B2)/(C3-C2))$$

$$E2 = (C2+C3)/2$$



Note: you have one less data point because of the equation  $(C2+C3)/2$

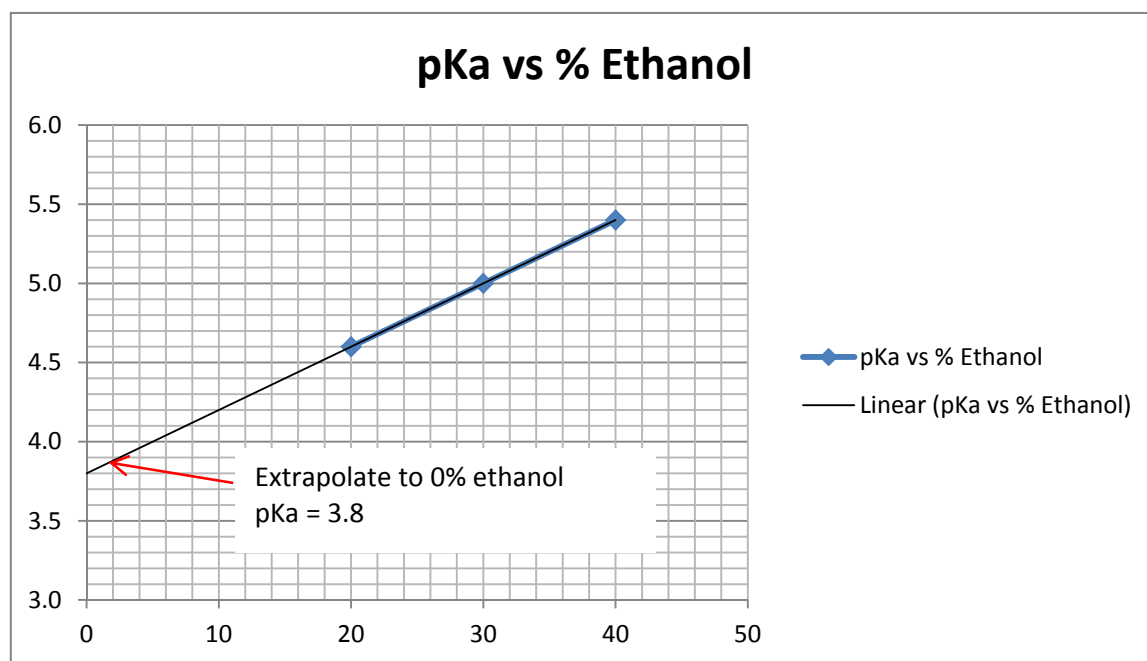
### Titration of Unknown #30001-C78 with 0.09562 M NaOH



pKa	% EtOH
4.6	20
5.0	30
5.4	40

If you must use ethanol to dissolve your unknown acid it is best to run at least three titrations in different % ethanol (between 10% and 50%; try not go above 50% ethanol). Graph pKa vs. % ethanol and extrapolate to get pKa in 0% ethanol.

$$\% \text{EtOH at End point} = \frac{\text{mL EtOH}}{(\text{mL EtOH} + \text{mL water} + \text{mL NaOH at } 1/2 \text{ end point Vol})}$$



If you do not have enough pure unknown or time to run three pKa titrations you may estimate the pKa in water using this formula:

$$\text{pKa (in water)} \approx \text{PKa (in \% EtOH)} - (0.0365 * \% \text{EtOH})$$

For Example, if you dissolved your acid in 25 mL EtOH and 75mL water and it took 22.74 mL of NaOH to reach the end point, and the pKa from this titration was 4.9 then

$$\% \text{EtOH} = 25\text{ml} / (25\text{mL} + 75\text{mL} + 11.37 \text{ mL}) = 22.45 \%$$

$$\text{pKa (in water)} = 4.9 - (0.0365 * 22.45) = 4.9 - .8194 = 4.08 = 4.1$$