

Topics for Today:

- Announcements
 - Matlab? Off-campus students: server or buy student ed.
 - Office hrs: 11:05pm-2:55pm Mon, Wed; 11:05-11:55 Friday
 - Office: EERC 614. Phone: 906.487.2857
 - XFMR exercises posted later today, due Mon Sep 23rd 9am.
 - Recommended problems from Ch.2, solutions posted
- XFMR, Chapter 2 - Transformers and circuits w/transformers
 - Pre-Req Videos 3-6 - View them, study notes !
 - Single phase ideal transformer is building block - V, I, dot convention !
 - 3-phase transformer banks and phase shifts (ANSI/IEEE vs. IEC)
 - Standard 30° shift transformers, non-standard connections
 - Pos/neg sequence phase shifts, sequence networks.
 - Autotransformers
 - Load Tap Changing (LTC) transformers
 - Phase shifting transformers
 - Paralleling transformers with a) unlike impedances; b) unlike tap positions
 - Three-winding transformers

How many possibilities are there
for Δ - γ or γ - Δ phase shifts?

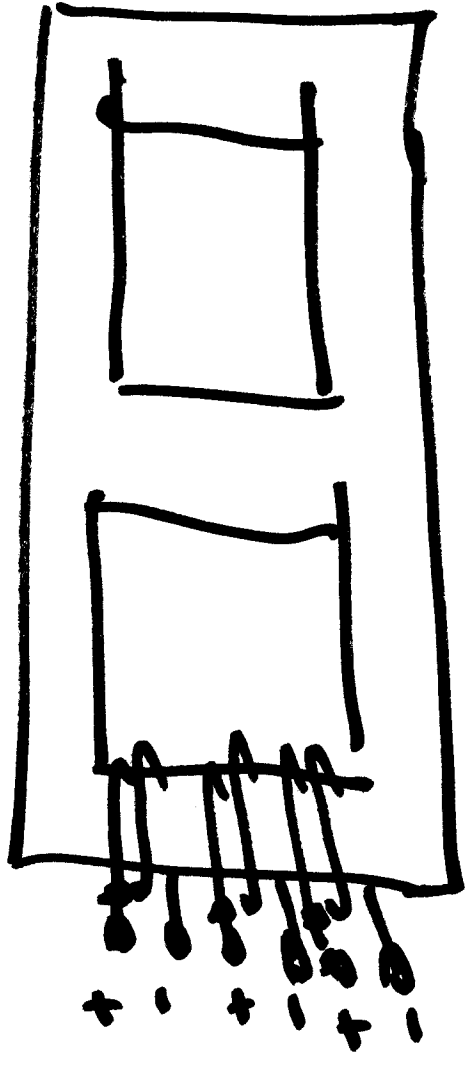
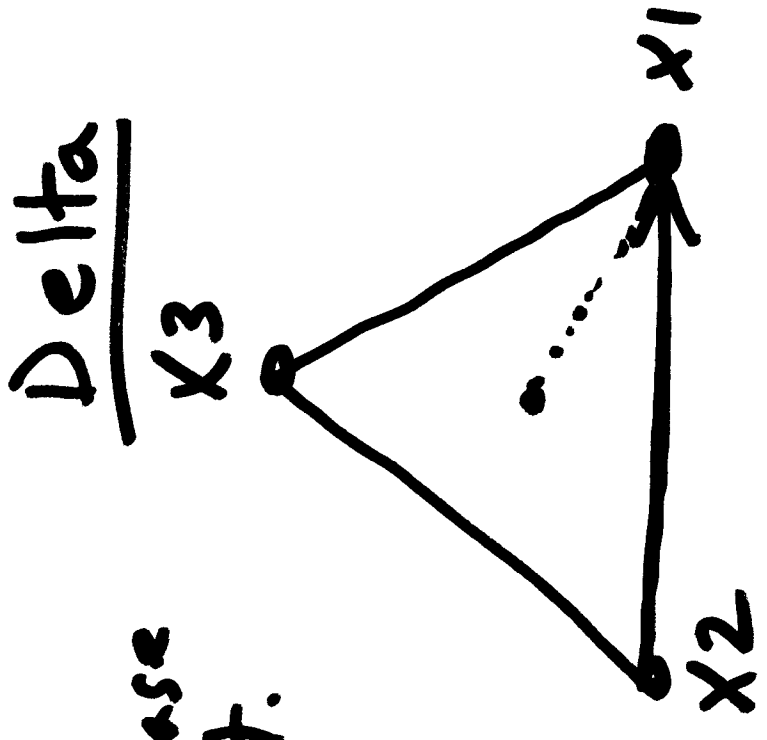
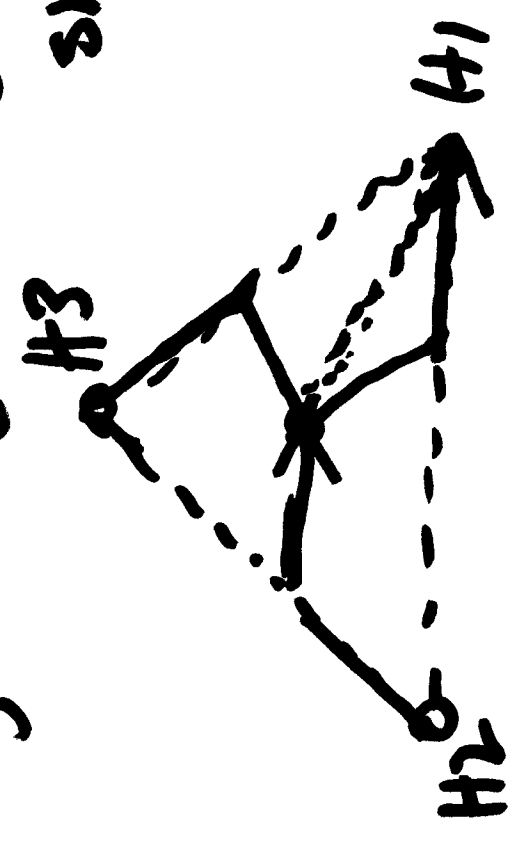
$\pm 30^\circ$
 $\pm 90^\circ$
 $\pm 150^\circ$) 6 each \Rightarrow 12 total.

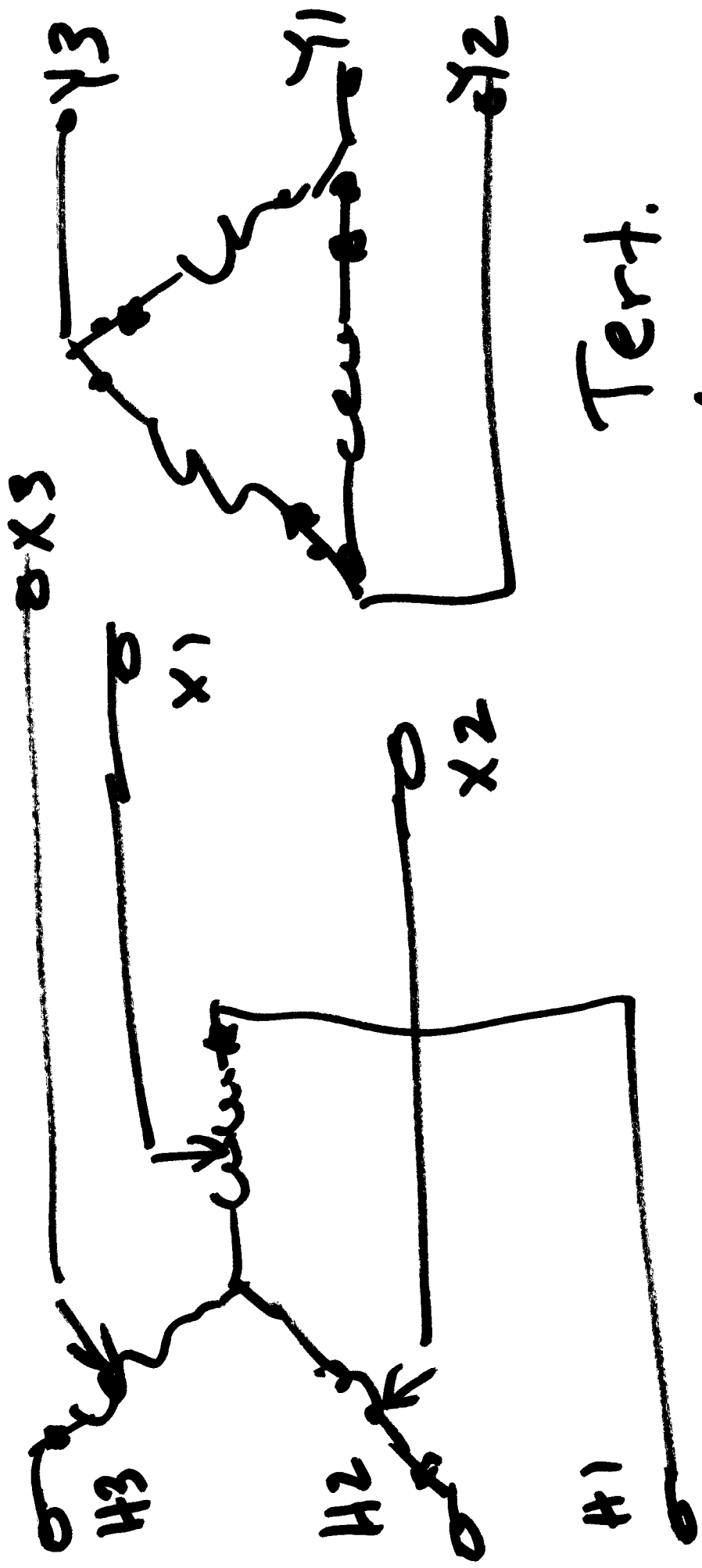
Auto- Δ

Zig-Zig

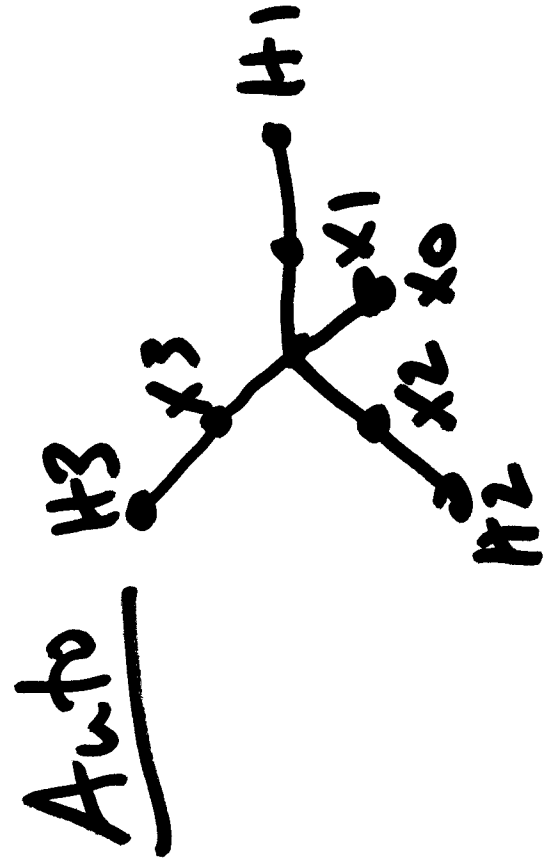
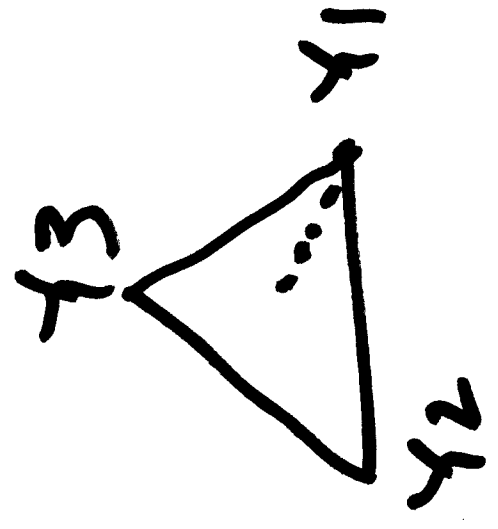
Extended Δ .

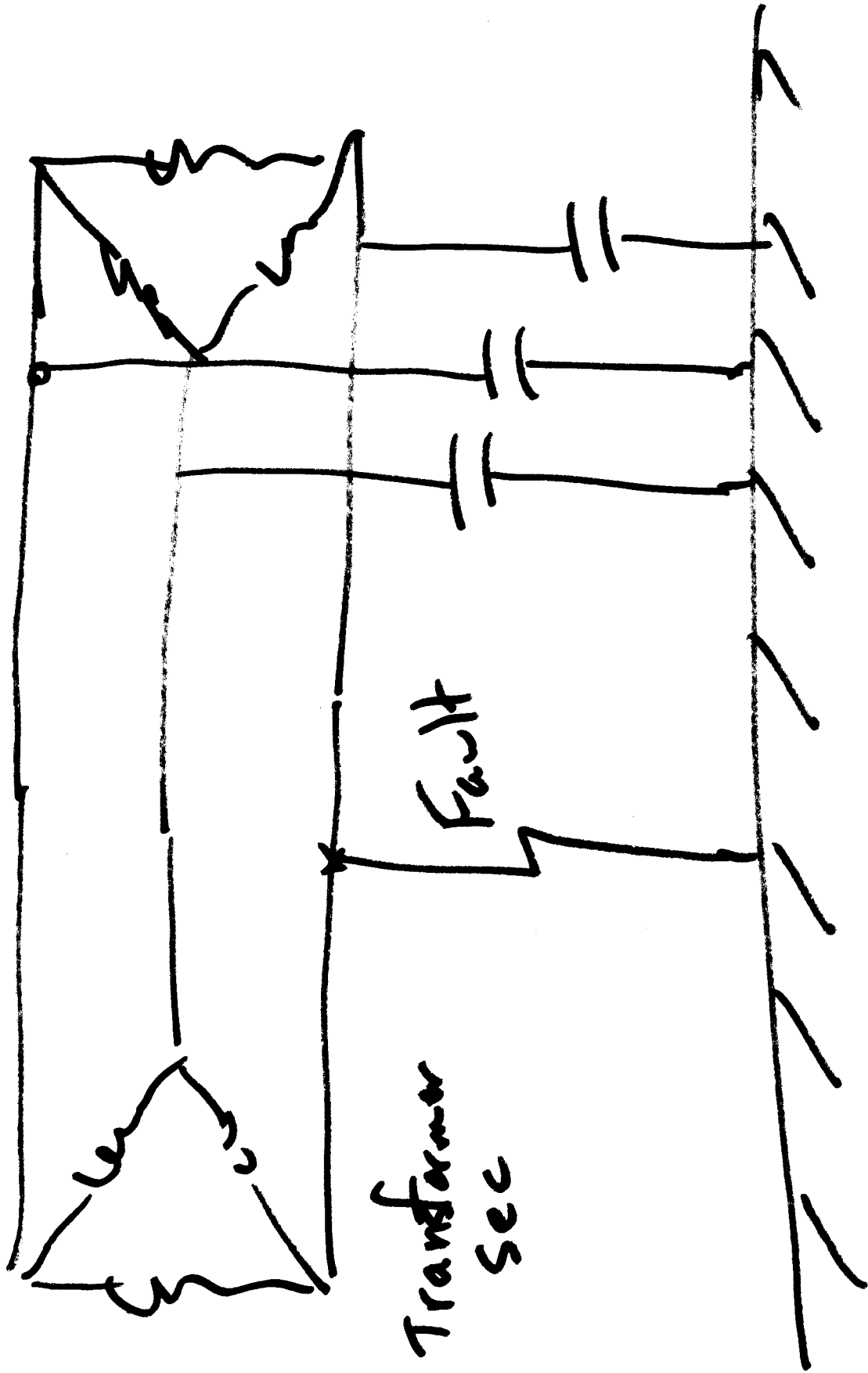
Zig-Zag 0° phase shift.





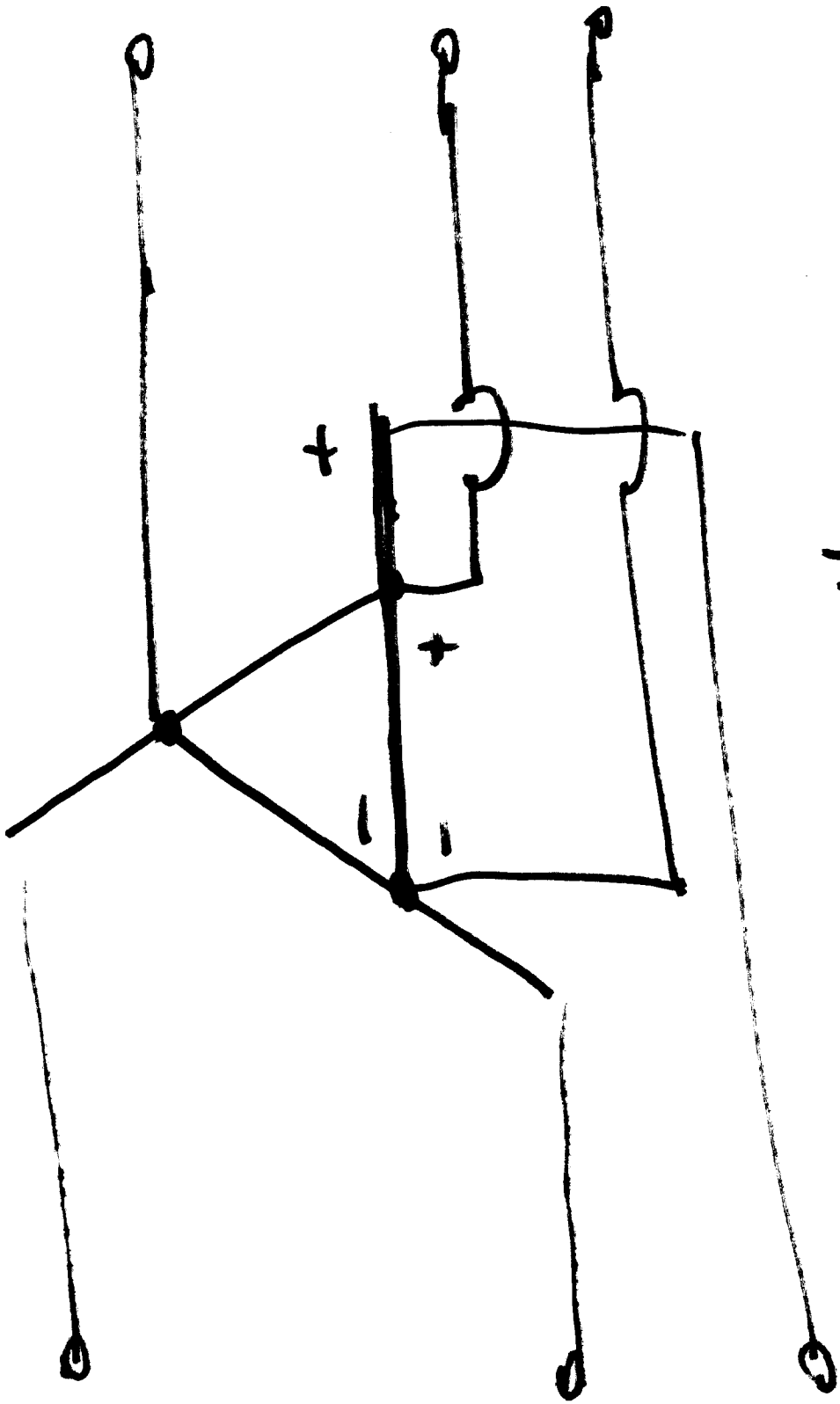
Tert.





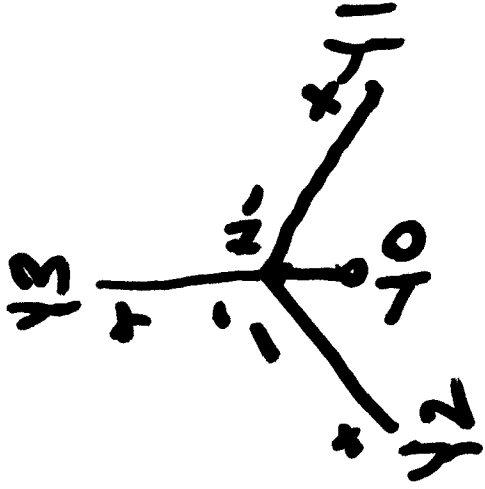
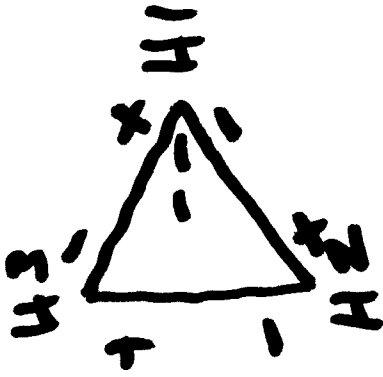
Balanced 3-ph voltages:

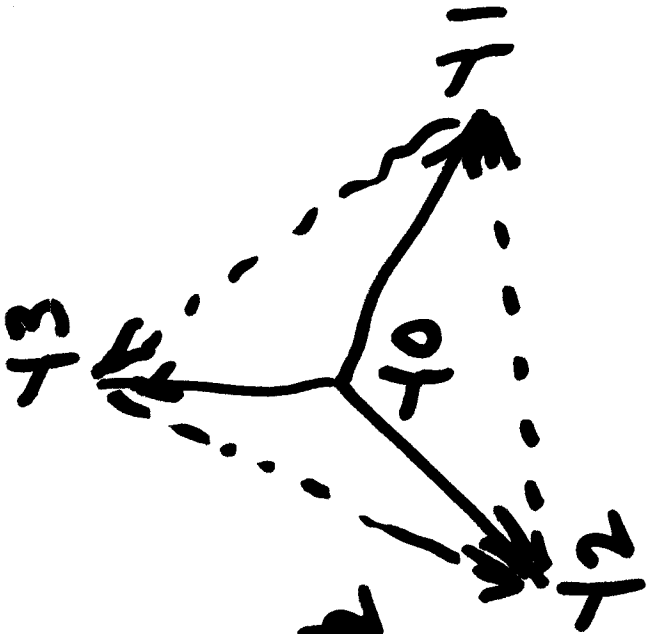
$$|\tilde{V}_{AG}| = |\tilde{V}_{BG}| = |\tilde{V}_{CG}|$$

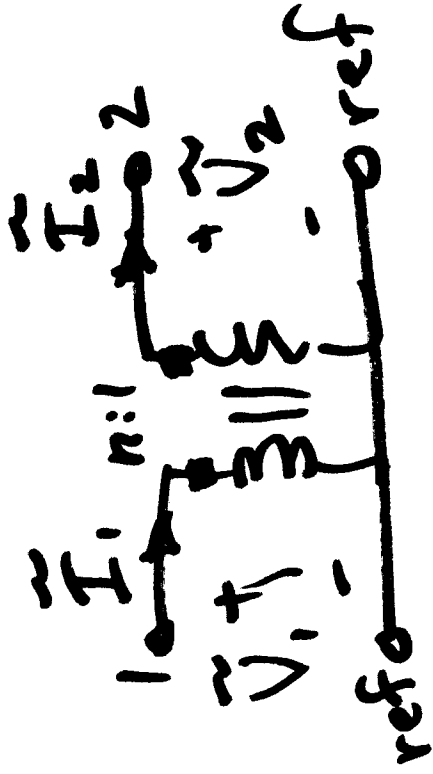


Extend Delta

Δ - Y Std Phase Shift.







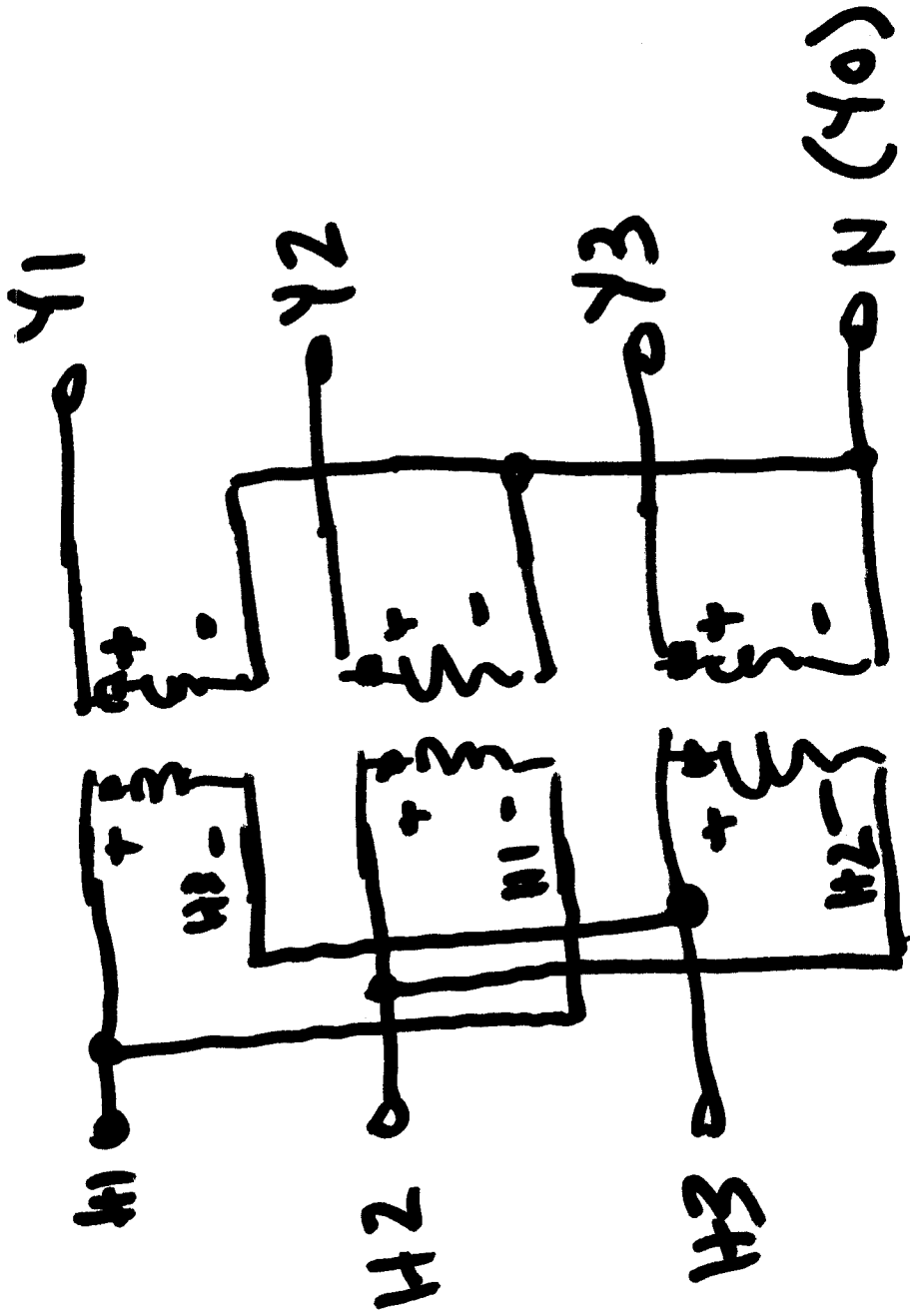
$$\frac{|\vec{V}_1|}{|\vec{V}_2|} = n = \frac{|\vec{I}_2|}{|\vec{I}_1|}$$

$$S_{in} = \vec{V}_1 \vec{I}_1^* = \vec{V}_2 \vec{I}_2^* = S_{out}$$

Polarity Marks: "same" polarity

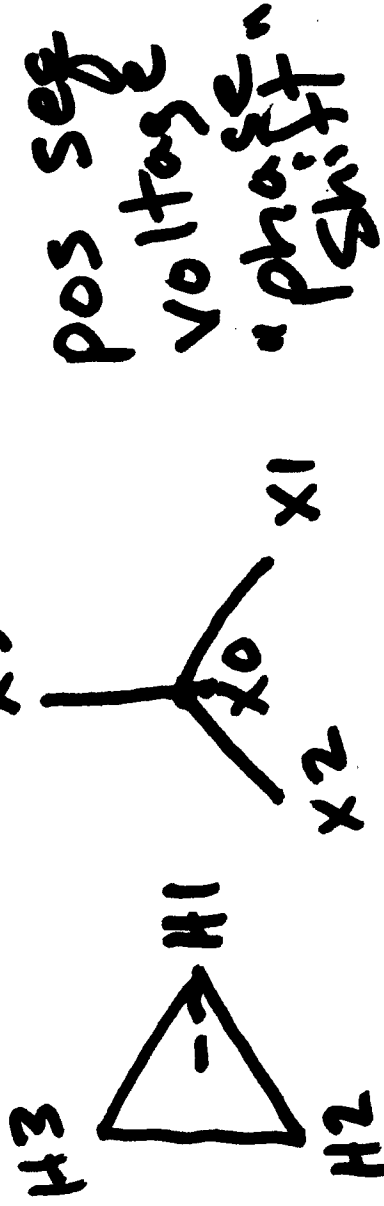
$$\angle \vec{V}_1 = \angle \vec{V}_2$$

$$\angle \vec{I}_1 = \angle \vec{I}_2$$



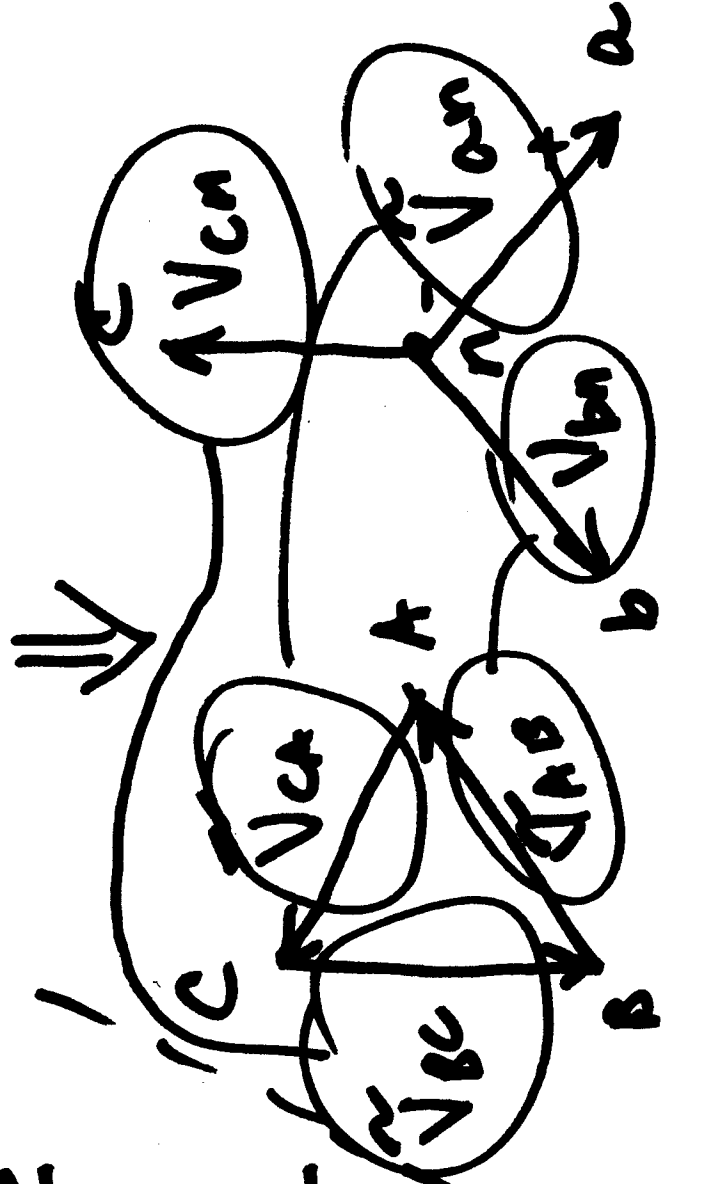
Transformer Phase Shifts

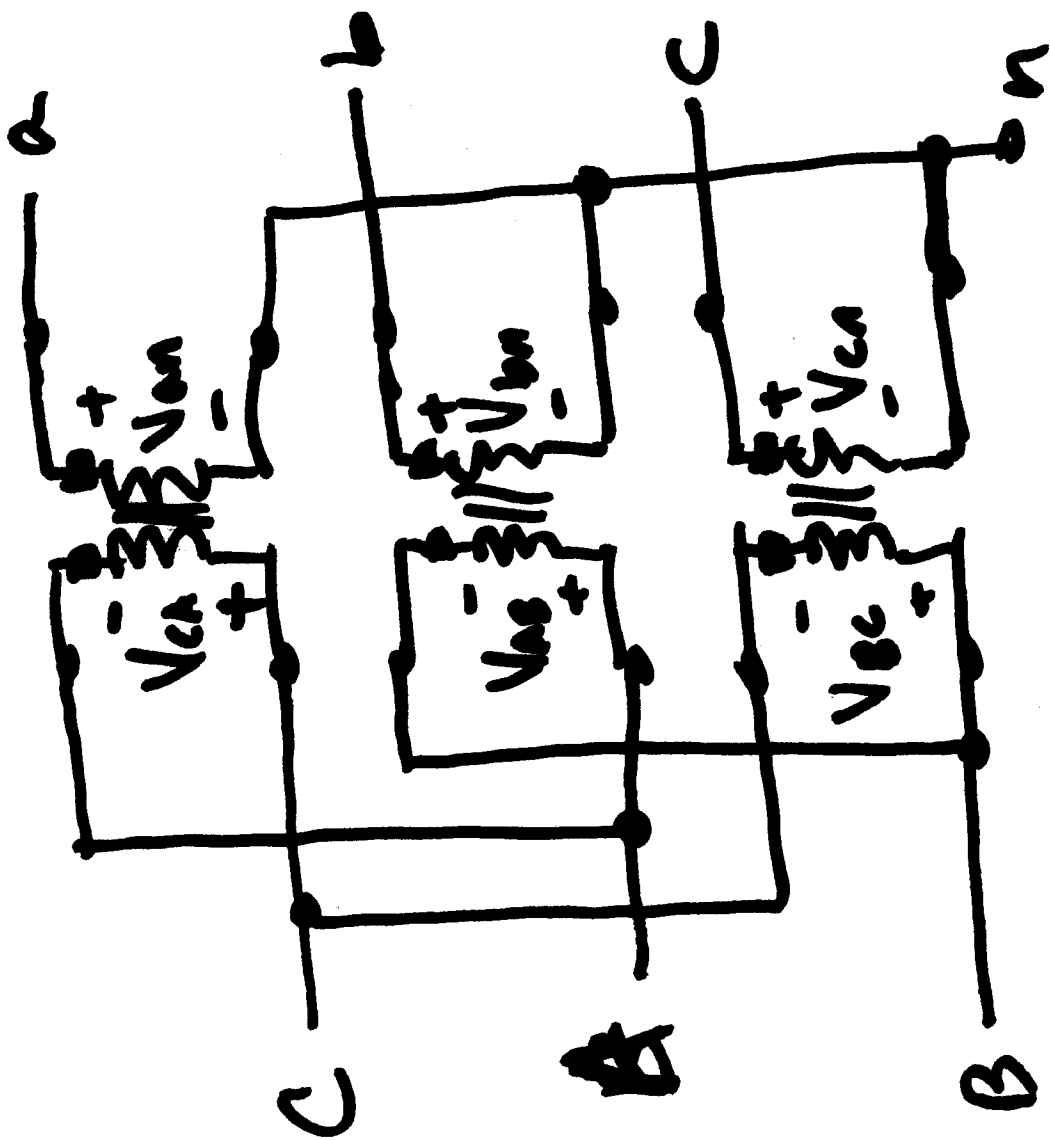
- See Δ -Y transformer nameplate



$$\vec{I}_1 \rightarrow \vec{V}_1 = \vec{V}_2 \vec{I}_2$$

$$\vec{I}_2 \rightarrow \vec{V}_2 = \vec{V}_1 \vec{I}_1$$

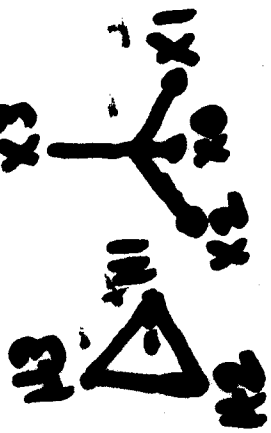




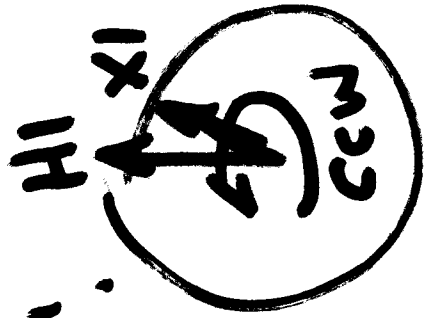
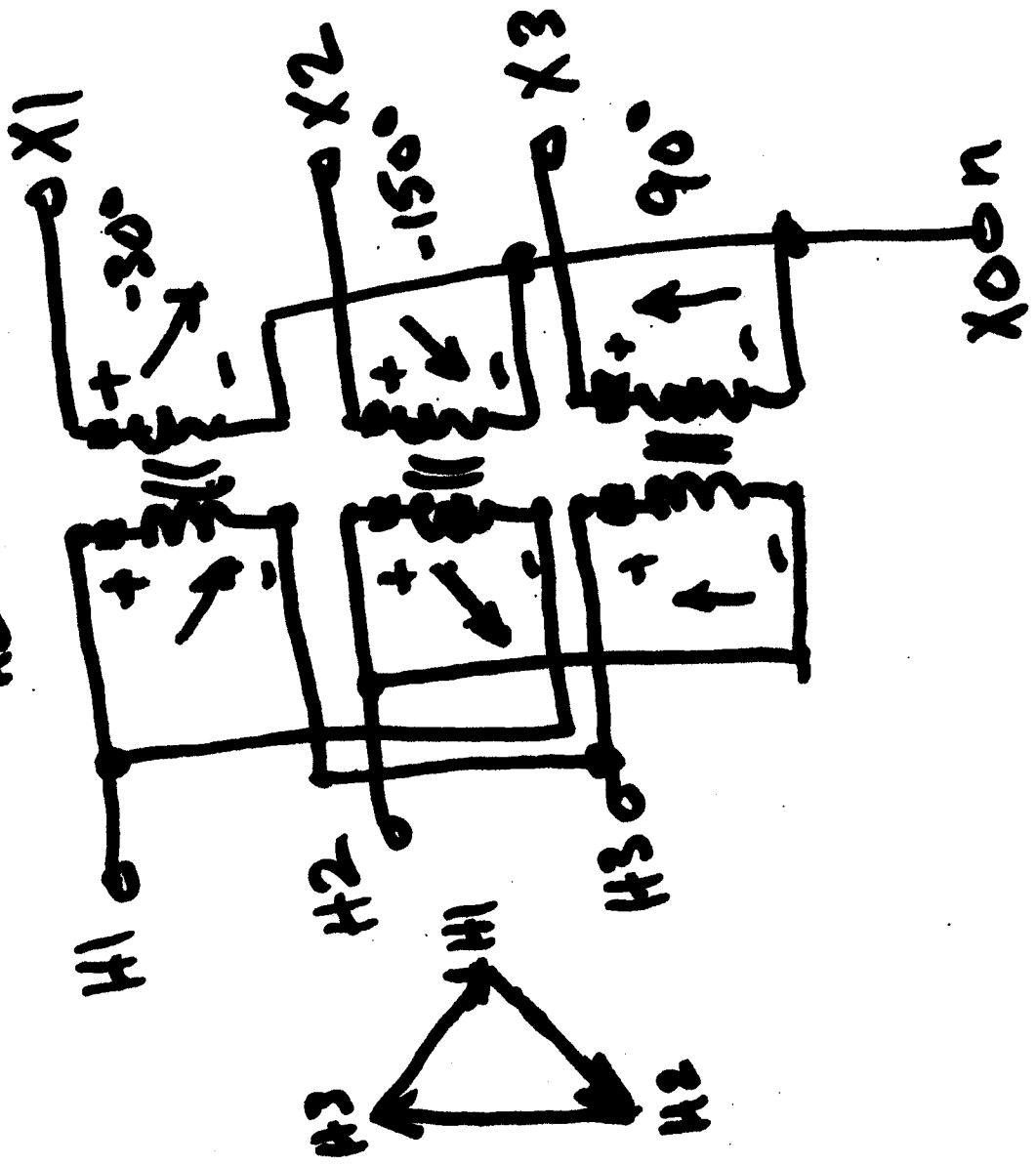
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3-PHASE XFMR BANKS

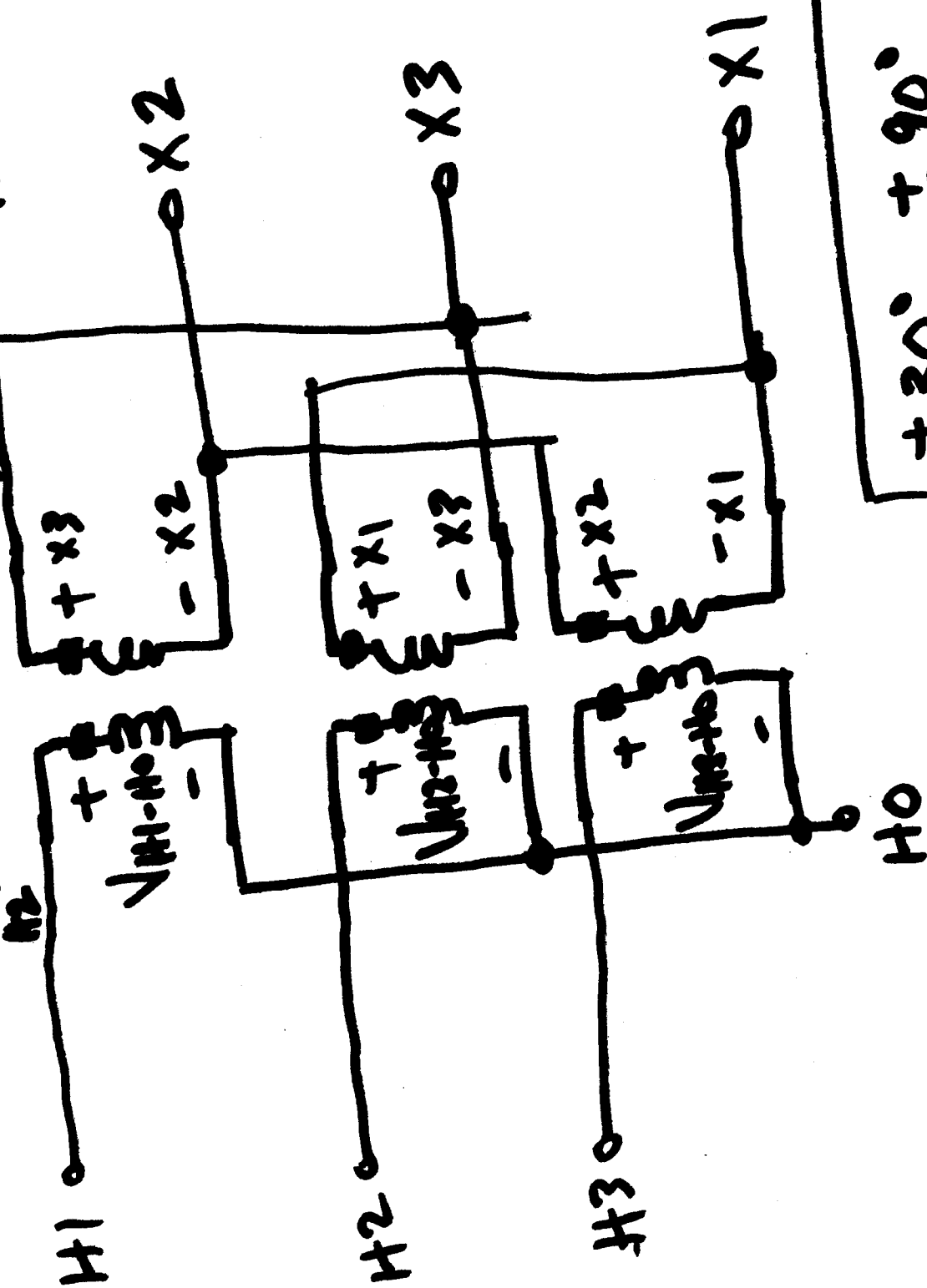
Ex: Δ -Y



(Dyn1)

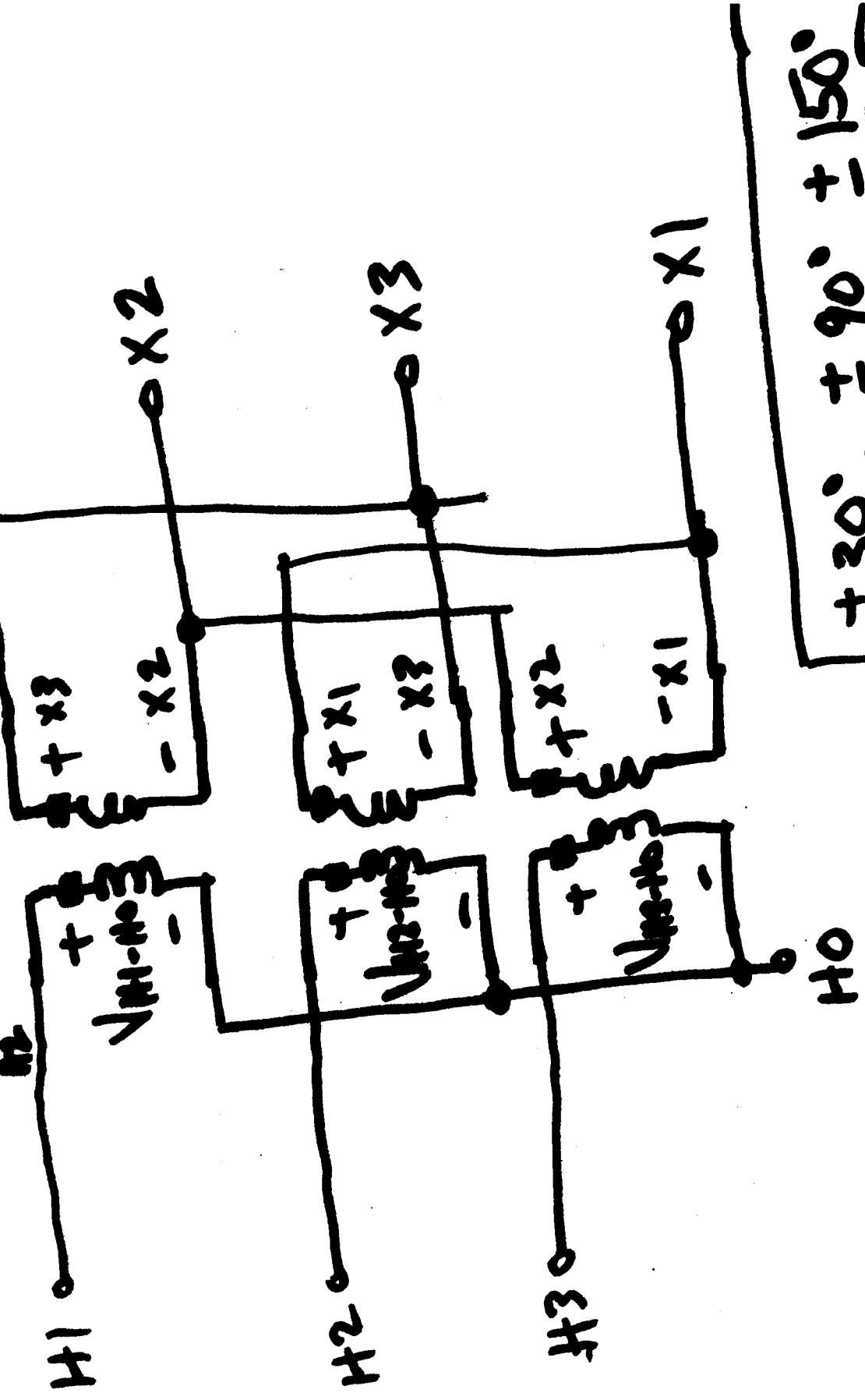
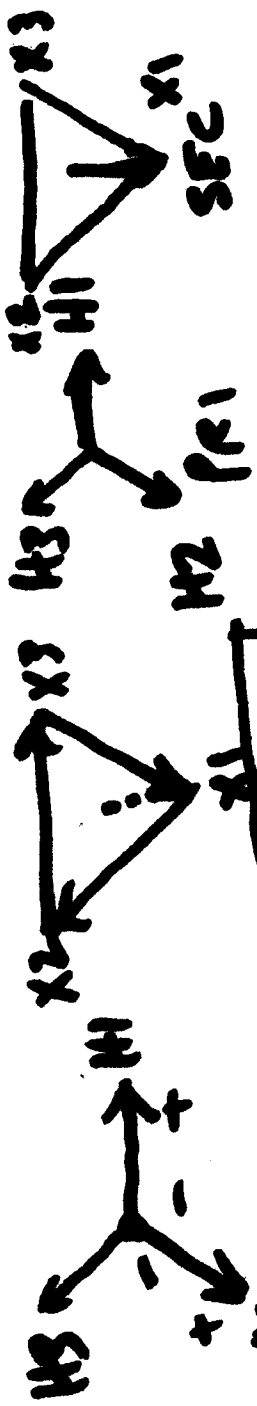


From:
Review
Lecture 5



$$\pm 30^\circ, \pm 90^\circ, \pm 150^\circ$$

YNd3



$$\pm 30^\circ, \pm 90^\circ, \pm 150^\circ$$