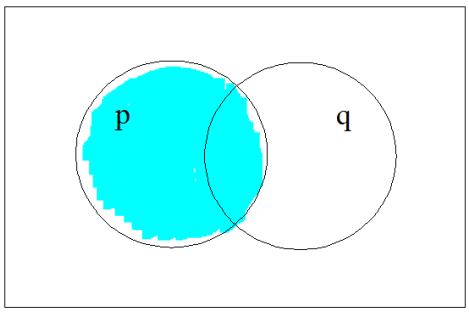
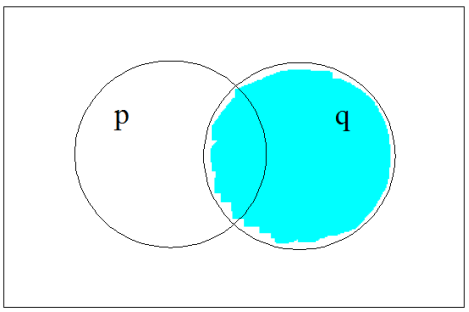
Math 156 – Venn Diagrams Worksheet

Venn Diagrams with Two Propositions

Shade in the following diagrams according to the proposition labeled below them:

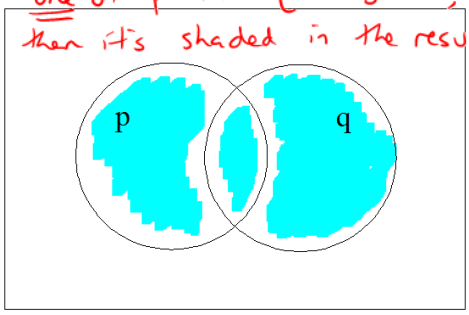


p



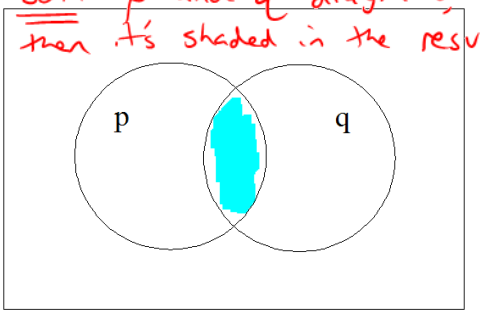
q

OR: if region is shaded in at least one of p and q diagrams, then it's shaded in the result



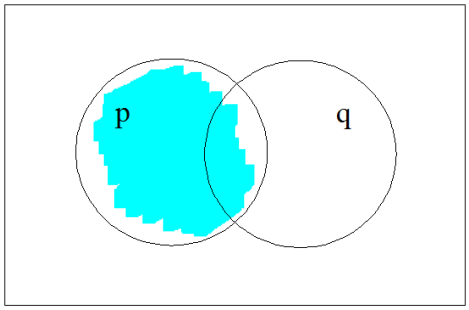
$p \vee q$

AND: if region is shaded in both p and q diagrams, then it's shaded in the result



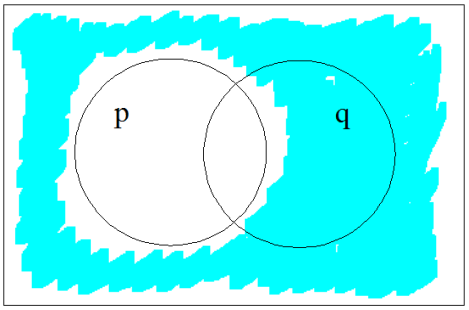
$p \wedge q$

Negation of Venn Diagrams



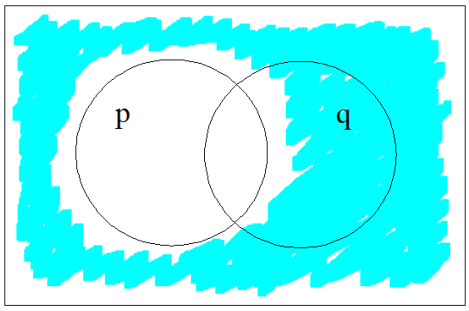
p

NOT: if it's shaded in p, then it's not shaded in the result and vice versa

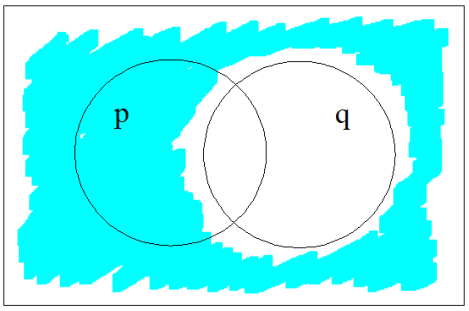


$\sim p$

Let's do a more complicated one by steps: $\sim p \wedge \sim q$

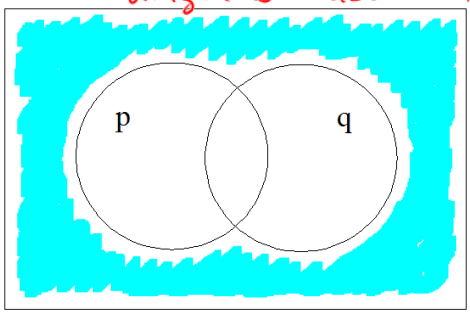


$\sim p$



$\sim q$

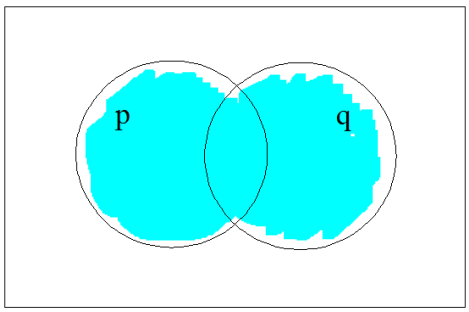
AND: must be shaded in both diagrams above to be shaded in result



$\sim p \wedge \sim q$

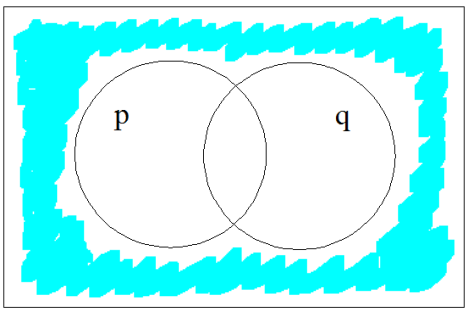
Another example: $\sim (p \vee q)$

from previous page, we know that $p \vee q$ looks like this:



$p \vee q$

NOT: if shaded in original, not in result and vice versa



$\sim (p \vee q)$

What do you notice about the results of the last two exercises?

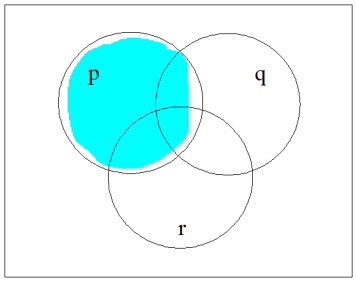
same! so $\sim p \wedge \sim q$ is logically equivalent to $\sim (p \vee q)$

note: it turns out the $\sim p \vee \sim q$ is logically equiv. to $\sim (p \wedge q)$

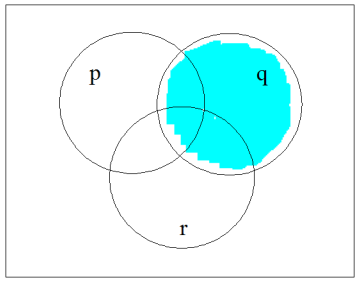
(called de Morgan's law: more on this later)

Venn Diagrams with Three Propositions

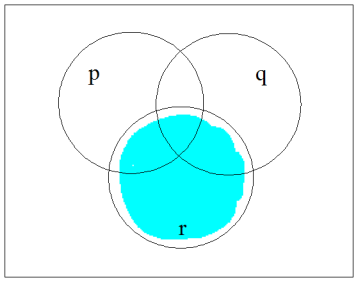
Shade in the following diagrams according to the propositions labeled below them:



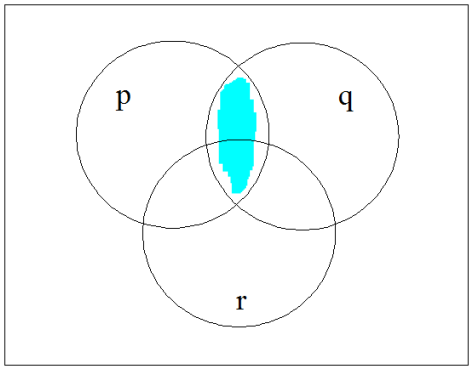
p



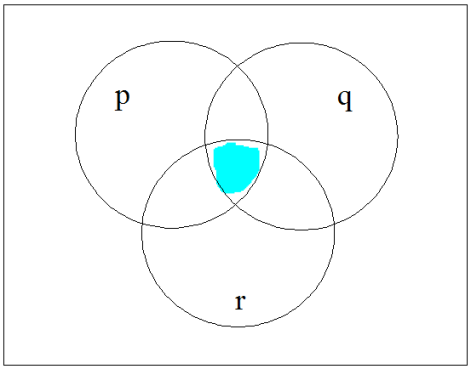
q



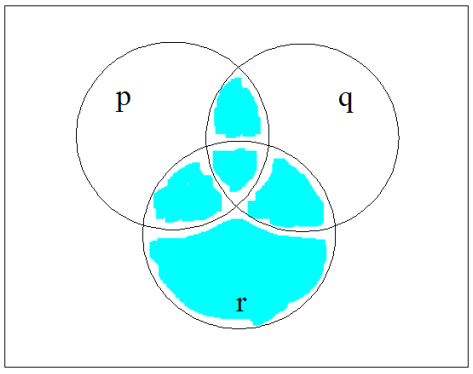
r



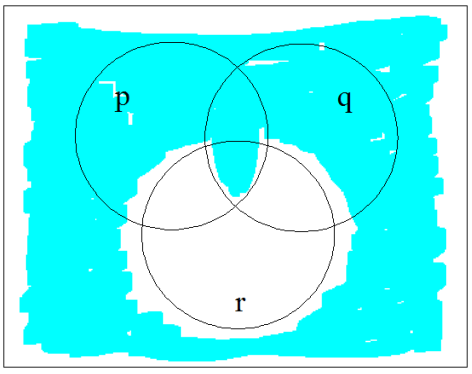
$p \wedge q$



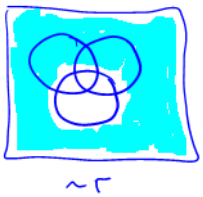
$p \wedge q \wedge r$



$(p \wedge q) \vee r$

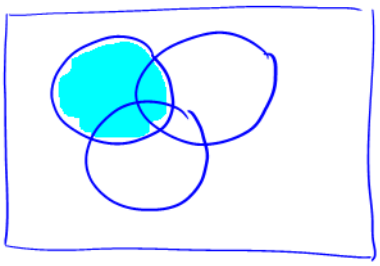


$(p \wedge q) \vee \sim r$

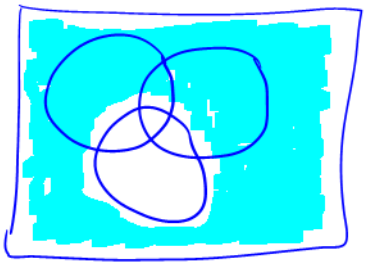


A full example with three sets:

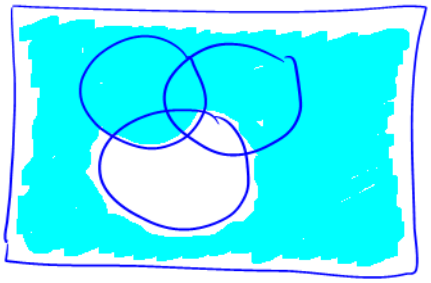
Represent $\sim(p \vee \sim r) \vee \sim q$ on the following Venn diagram by shading in the appropriate regions. Show intermediate steps on separate sketches and label them clearly.



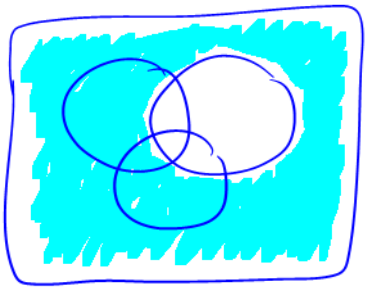
p



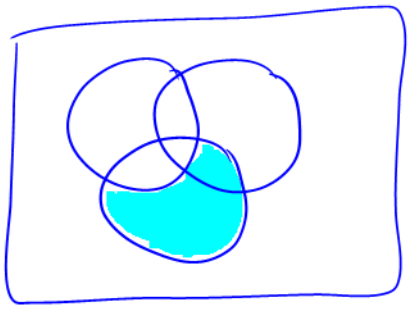
~r



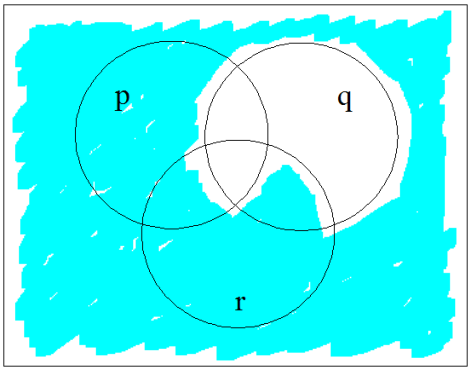
p v ~r



~q



~(p v ~r)



~(p v ~r) v ~q