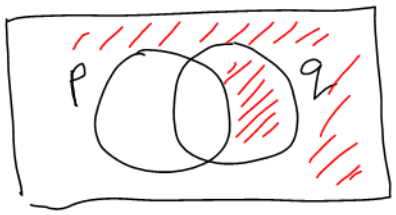
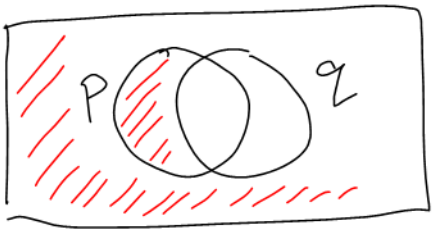
2.2 Venn Diagrams Cont'd

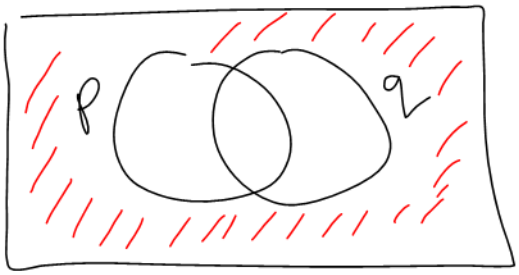
Ex: Draw the Venn diagram for $\sim p \wedge \sim q$



$\sim p$

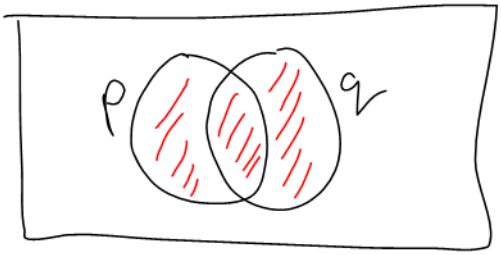


$\sim q$

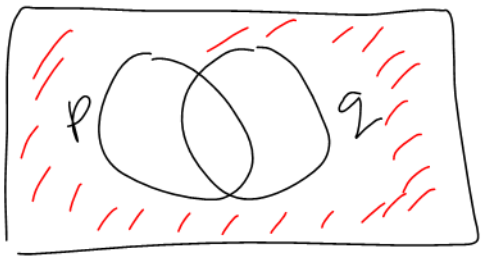


$\sim p \wedge \sim q$

Ex: Draw the Venn diagram for $\sim (p \vee q)$



$p \vee q$



$\sim (p \vee q)$

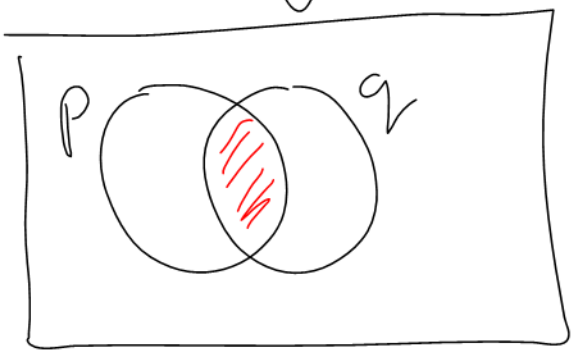
Conclude: $\sim p \wedge \sim q$ and $\sim(p \vee q)$ are logically equivalent.

Quick Ex: $\sim p \wedge \sim q$:
I don't want cream and I don't want sugar.

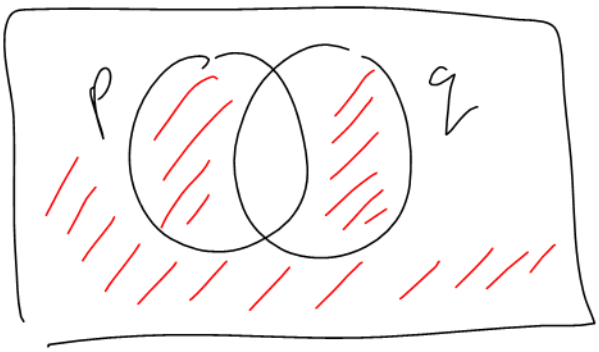
$\sim(p \vee q)$:
It's not true that I want cream or sugar.

FACT:
$\sim p \vee \sim q$ is logically equivalent to $\sim(p \wedge q)$

Venn Diagram

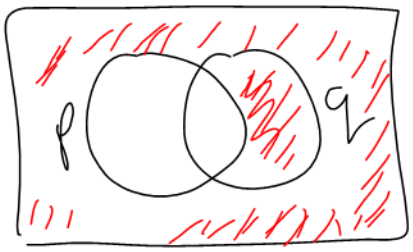


$p \wedge q$

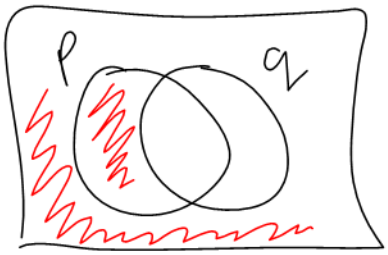


$\sim(p \wedge q)$

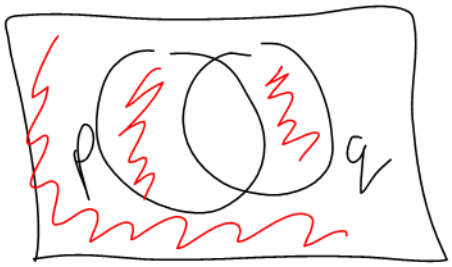
same



$\sim p$



$\sim q$



$\sim p \vee \sim q$

Language

p: I want cream.

q: I want sugar

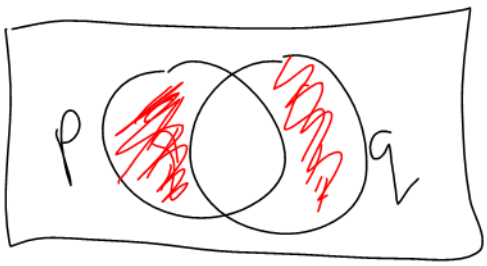
$\sim(p \wedge q)$: It's not true that I want cream and sugar.

$\sim p \vee \sim q$: I don't want cream or I don't want sugar.

ASIDE:

$p \oplus q$ is logically equivalent to

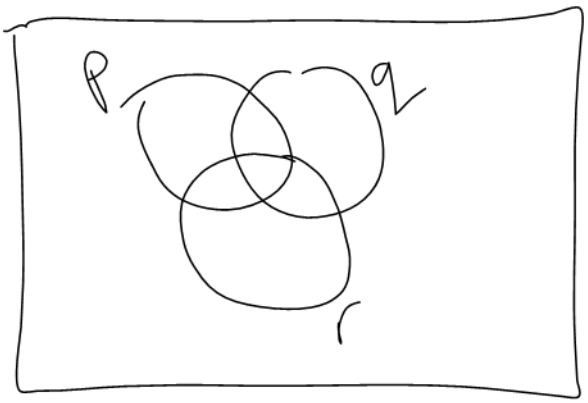
$(p \wedge \sim q) \vee (\sim p \wedge q)$ (don't memorize this)



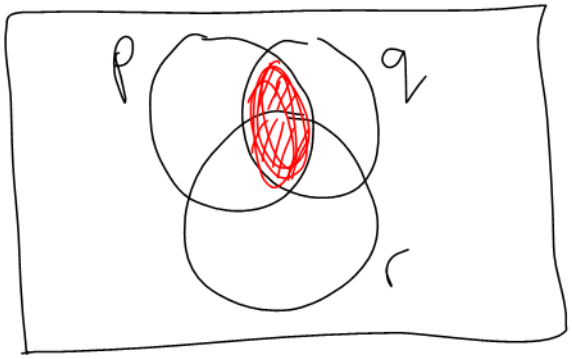
Also logically equivalent to

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

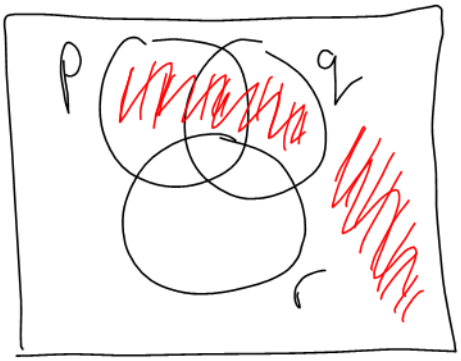
Venn diagrams with 3 propositions



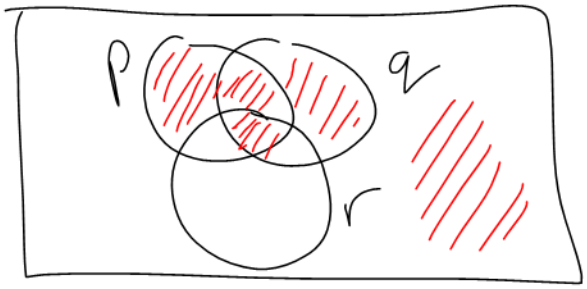
Ex: Draw the Venn diagram for $(p \wedge q) \vee \sim r$



$p \wedge q$

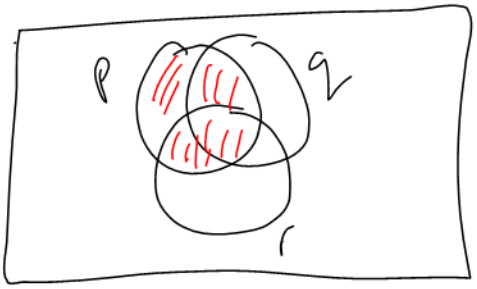


$\sim r$

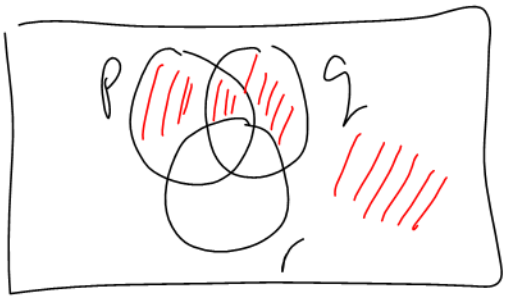


$(p \wedge q) \vee \sim r$

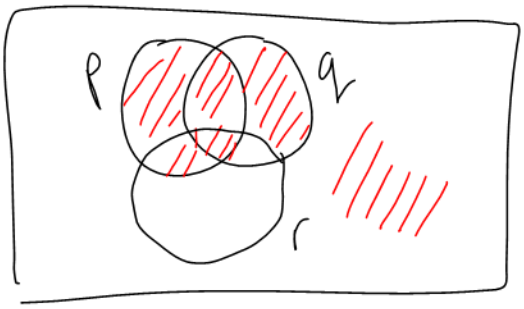
Ex: Draw the Venn diagram for $\sim(p \vee \sim r) \vee \sim q$



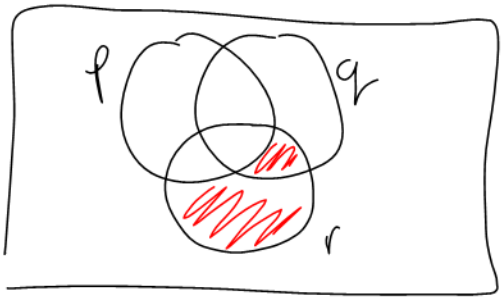
p



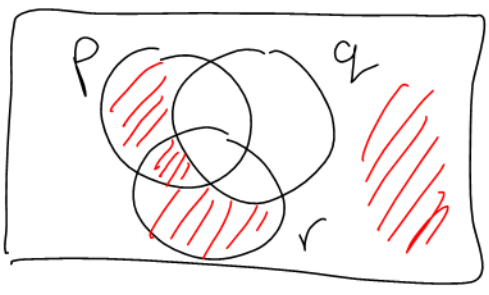
$\sim r$



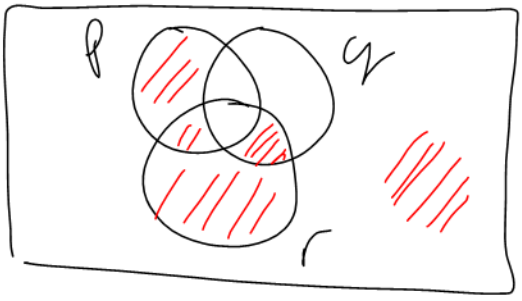
$p \vee \sim r$



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



$\sim q$



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