

Geometry 2.2

Determine truth values of conjunctions, disjunctions, negations
 Represent conjunctions, disjunctions, negations using Venn diagrams
 Determine counterexamples

statement (proposition)

negation

opposite \sim

truth value

T F

compound statement

2 or more

P: Today is Monday

conjunction (and)

\wedge

disjunction (or)

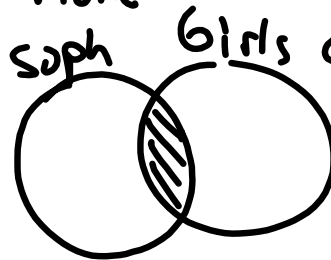
\vee

truth table

Venn diagram

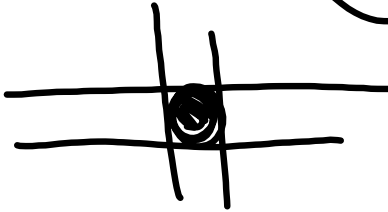
intersection

both



Q: Sept has 30 days

p: A rectangle is a quadrilateral.



Sep 21-1:12 PM

Compound statement:

p: Today is Monday

q: September has 37 days.

T F

F

p and q

$(P \wedge Q)$

p or q

$(P \vee Q)$

not p

$\sim P$

not q

$\sim Q$

Sep 15-7:20 PM

p : A rectangle is a quadrilateral.
 q : A rectangle is convex.

T T



p and q :

$(P \wedge Q)$

T

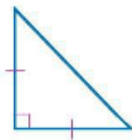
"and" means both are true

Sep 21-1:44 PM

Example 1 Truth Values of Conjunctions

Use the following statements to write a compound statement for each conjunction. Then find its truth value. Explain your reasoning.

- p : The figure is a triangle. T
- q : The figure has two congruent sides. F
- r : The figure has three acute angles. T



a. p and r

$P \wedge R$
 $(T \wedge T)$
 T

$Q \wedge \sim R$
 $(F \wedge \sim T)$
 F

b. $q \wedge \sim r$

Sep 21-1:47 PM

p: Today is Tuesday. **F**
 q: October has 31 days. **T**

p or q

P V Q
 (F V T)
 T

"Or" means at least one is true...could be both

Sep 21-1:48 PM

Example 2 Truth Values of Disjunctions



Use the following statements to write a compound statement for each disjunction. Then find its truth value. Explain your reasoning.

F p: January is a fall month.
F q: January has only 30 days.
T r: January 1 is the first day of a new year.



a. $p \vee r$
 c. $\sim p \vee r$

q

$r \vee p$

$q \vee \sim r$

$p \vee \sim q$

► **Guided Practice**

2A. $r \vee p$

2B. $q \vee \sim r$

2C. $p \vee \sim q$

Sep 21-1:49 PM

ConceptSummary Negation, Conjunction, Disconjunction		
Statement	Words	Symbols
<u>negation</u>	a statement that has the opposite meaning and truth value of an original statement	$\sim p$, read not p
conjunction	a compound statement formed by joining two or more statements using the word <i>and</i>	$p \wedge q$, read p and q
disconjunction	a compound statement formed by joining two or more statements using the word <i>or</i>	$p \vee q$, read p or q

disjunction

\sim
 \wedge
 \vee

Sep 21-1:50 PM

A convenient method for organizing the truth values of statements is to use a **truth table**. Truth tables can be used to determine truth values of negations and compound statements.

Generic: When you don't have the actual statement(s) yet.

Negation	
p	$\sim p$
T	F
F	T

Conjunction		
p	q	$p \wedge q$
T	T	T
T	F	F
F	T	F
F	F	F

Disjunction		
p	q	$p \vee q$
T	T	T
T	F	T
F	T	T
F	F	F

p	$\sim p$
T	F
F	T

negation and or

p	q	$(p \wedge q)$	ans.
T	T	T	T
T	F	F	F
F	T	F	F
F	F	F	F

p	q	$p \vee q$	ans.
T	T	T	T
T	F	T	T
F	T	T	T
F	F	F	F

Sep 21-1:51 PM

Example 3 Construct Truth Tables

Start with columns for p, q

Construct a truth table for $\sim p \vee q$.

p	q	$\sim p$	$\sim p \vee q$	ans
T	T	F	F V T	T
T	F	F	F V F	F
F	T	T	T V T	T
F	F	T	T V F	T

Sep 21-1:51 PM

p.101

1 Make columns with headings that include each original statement, any negations of these statements, and the compound statement itself.

4 Use the truth values for each part of the compound statement to determine the truth value of the statement.

p	q	$\sim p$	$\sim p \vee q$
T	T	F	T
T	F	F	F
F	T	T	T
F	F	T	T

2 List the possible combinations of truth values.

3 Use the truth values of p to determine the truth values of its negation.

Add a column for your final answer

Sep 21-1:52 PM

Guided Practice

3. Construct a truth table for $\sim p \wedge \sim q$.

$$\sim p \wedge \sim q$$

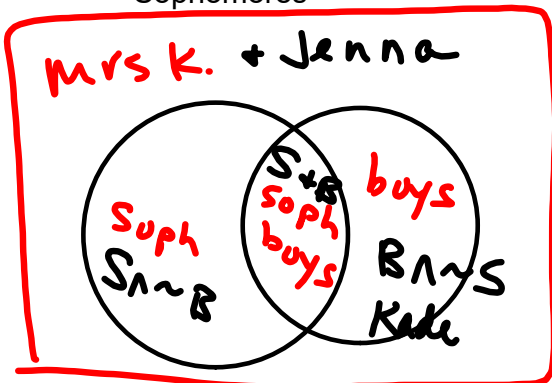
P	Q	$\sim P$	$\sim Q$	$\sim P \wedge \sim Q$	ans.
T	T	F	F	F \wedge F	F
T	F	F	T	F \wedge T	F
F	T	T	F	T \wedge F	F
F	F	T	T	T \wedge T	T

Sep 21-1:52 PM

Venn diagram:

Sophomores

Boys

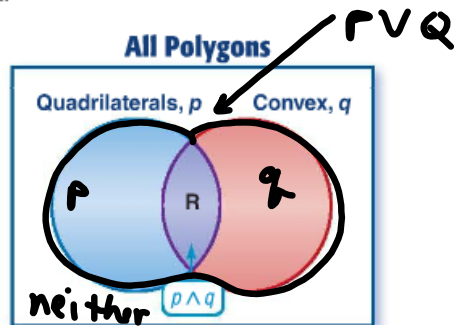


Sep 13-4:15 PM

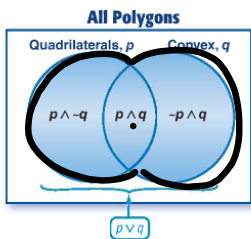
2 Venn Diagrams Conjunctions can be illustrated with Venn diagrams. Consider the conjunction given at the beginning of the lesson.

p and *q*: **A rectangle is a quadrilateral**, and **a rectangle is convex**.

The Venn diagram shows that a rectangle (R) is located in the *intersection* of the set of quadrilaterals and the set of convex polygons. In other words, rectangles must be in the set containing quadrilaterals *and* in the set of convex polygons.



Sep 21-1:54 PM



Sep 21-1:54 PM

Real-World Example 4 Use Venn Diagrams

SCHEDULING The Venn diagram shows the number of people who can or cannot attend the May or the June Spanish Club meetings.

a. How many people can attend the May or the June meeting?

25



b. How many people can attend both the May and the June meetings?

6

c. Describe the meetings that the 14 people located in the nonintersecting portion of the June region can attend.

Sep 21-1:55 PM

Guided Practice

4. **PROM** The Venn diagram shows the number of graduates last year who did or did not attend their junior or senior prom.

A. How many graduates attended their senior but not their junior prom?

25

B. How many graduates attended their junior and senior proms?

123

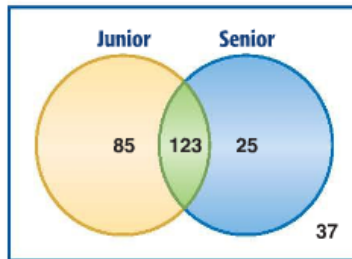
C. How many graduates did not attend either of their proms?

37

D. How many students graduated last year? Explain your reasoning.

270

Prom Attendance



Sep 21-1:56 PM

2. 2
11-290
49-670

Sep 21-1:47 PM

Sep 21-1:45 PM