2-2 Conditional Statements

take note

Key Concept Conditional Statements

Definition

A **conditional** is an *if-then* statement.

The **hypothesis** is the part p following *if*.

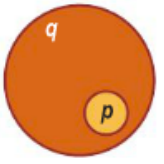
The **conclusion** is the part q following *then*.

Symbols

$p \rightarrow q$

Read as "if p then q" or "p implies q."

Diagram



Problem 1 Identifying the Hypothesis and the Conclusion

What are the hypothesis and the conclusion of the conditional?

If an angle measures 130, then the angle is obtuse.

hypothesis: an angle measures 130

conclusion: the angle is obtuse

Problem 2 Writing a Conditional

How can you write the following statement as a conditional?
Vertical angles share a vertex.

If two angles are vertical angles, then they share a vertex.

2. How can you write "Dolphins are mammals" as a conditional?

If animals are dolphins, then they are mammals.

The **truth value** of a conditional is either *true* or *false*.

3. Is the conditional *true* or *false*? If it is false, find a counterexample.

a. If a month has 28 days, then it is February.

b. If two angles form a linear pair, then they are supplementary.

a. False, all months have 28 days.

b. True

The **negation** of a statement p is the opposite of the statement. The symbol is $\sim p$ and is read "not p."

Take note

Key Concept Related Conditional Statements

Statement	How to Write It	Example	Symbols	How to Read It
Conditional	Use the given hypothesis and conclusion.	If $m\angle A = 15$, then $\angle A$ is acute.	$p \rightarrow q$	If p, then q.
Converse	Exchange the hypothesis and the conclusion.	If $\angle A$ is acute, then $m\angle A = 15$.	$q \rightarrow p$	If q, then p.
Inverse	Negate both the hypothesis and the conclusion of the conditional.	If $m\angle A \neq 15$, then $\angle A$ is not acute.	$\sim p \rightarrow \sim q$	If not p, then not q.
Contrapositive	Negate both the hypothesis and the conclusion of the converse.	If $\angle A$ is not acute, then $m\angle A \neq 15$.	$\sim q \rightarrow \sim p$	If not q, then not p.

Below are the truth values of the related statements above. **Equivalent statements** have the same truth value.

Statement	Example	Truth Value
Conditional	If $m\angle A = 15$, then $\angle A$ is acute.	True
Converse	If $\angle A$ is acute, then $m\angle A = 15$.	False / True
Inverse	If $m\angle A \neq 15$, then $\angle A$ is not acute.	False / True
Contrapositive	If $\angle A$ is not acute, then $m\angle A \neq 15$.	True

A conditional and its contrapositive are equivalent statements. They are either both true or both false. The converse and inverse of a statement are also equivalent statements.

4. What are the converse, inverse, and contrapositive of the conditional statement below? What are the truth values of each? If a statement is false, give a counterexample.

If a vegetable is a carrot, then it contains beta carotene.

True

Converse: If a vegetable contains beta carotene, then it is a carrot.

False.

Sweet potatoes.

Inverse: If a vegetable is not a carrot, then it does not contain beta carotene.

False.

Squash.

Contrapositive: If a vegetable does not contain beta carotene, then it is not a carrot.

True.

Name

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