

2.2

Analyze Conditional Statements

Day 1:

Goal

- Write definitions as conditional statements.

Conditional statement-a logical statement that has two parts, *a hypothesis and a conclusion*

*When a conditional state is written in if-then form the "if" part contains the hypothesis and the "then" part contains the conclusion

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Example:

If **it is raining**, then **there are clouds in the sky**.

Hypothesis

Conclusion

EXAMPLE 1 Rewrite a statement in if-then form

Rewrite the conditional statement in if-then form.

- a. All birds have feathers.
- b. Two angles are supplementary if they are a linear pair.



More examples:

c) All whales are mammals.

d) Three points are collinear if there is a line containing them.

More examples:

e) All 90 degree angles are right angles.



f) $2x + 7 = 1$, because $x = -3$.



g) When $n=9$, $n^2 = 81$.



h) Tourists at the Alamo are in Texas.



Negation-the opposite statement

Statement 1 The ball is red.

Negation 1 The ball is *not* red.

Statement 2 The cat is *not* black.

Negation 2 The cat is black.

Verifying Statements *Conditional statements can be true or false. _

- Prove TRUE-You must show the conclusion is true everytime the hypothesis is true.

- Prove FALSE: need to *give only one COUNTEREXAMPLE*

- Converse- exchange the hypothesis and the conclusion

- Inverse- negate both the hypothesis and the conclusion

- Contrapositive- First write the converse then negate both the hypothesis and the conclusion

Conditional statement If $m\angle A = 99^\circ$, then $\angle A$ is obtuse.	
Converse If $\angle A$ is obtuse, then $m\angle A = 99^\circ$.	
Inverse If $m\angle A \neq 99^\circ$, then $\angle A$ is not obtuse.	
Contrapositive If $\angle A$ is not obtuse, then $m\angle A \neq 99^\circ$.	

EXAMPLE 2**Write four related conditional statements**

Write the if-then form, the converse, the inverse, and the contrapositive of the conditional statement “Guitar players are musicians.” Decide whether each statement is *true* or *false*.

Solution

*A conditional statement and its contrapositive are either both true or both false. Similarly, the converse and inverse of a conditional statement are either both true or both false.

Pairs of statements such as these are called *equivalent statements*

- Equivalent statements- When statements are either both true or both false.

*Definitions can be written as a conditional statement in If-then form or as its converse.

--Both the conditional statement and its converse are true

Conditional statement If $m\angle A = 99^\circ$, then $\angle A$ is obtuse.	
Converse If $\angle A$ is obtuse, then $m\angle A = 99^\circ$.	
Inverse If $m\angle A \neq 99^\circ$, then $\angle A$ is not obtuse.	
Contrapositive If $\angle A$ is not obtuse, then $m\angle A \neq 99^\circ$.	

READ DIAGRAMS

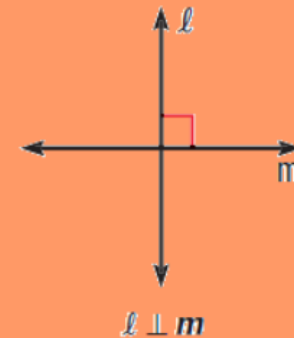
In a diagram, a red square may be used to indicate a right angle or that two intersecting lines are perpendicular.

KEY CONCEPT*For Your Notebook***Perpendicular Lines**

Definition If two lines intersect to form a right angle, then they are **perpendicular lines**.

The definition can also be written using the converse: If two lines are perpendicular lines, then they intersect to form a right angle.

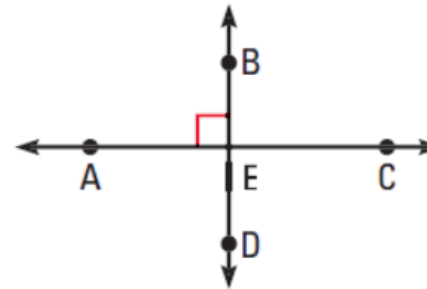
You can write “line l is perpendicular to line m ” as $l \perp m$.



EXAMPLE 3 Use definitions

Decide whether each statement about the diagram is true. Explain your answer using the definitions you have learned.

- $\overleftrightarrow{AC} \perp \overleftrightarrow{BD}$
- $\angle AEB$ and $\angle CEB$ are a linear pair.
- \overrightarrow{EA} and \overrightarrow{EB} are opposite rays.



Solution

- This statement is *true*. The right angle symbol in the diagram indicates that the lines intersect to form a right angle. So you can say the lines are perpendicular.
- This statement is *true*. By definition, if the noncommon sides of adjacent angles are opposite rays, then the angles are a linear pair. Because \overrightarrow{EA} and \overrightarrow{EC} are opposite rays, $\angle AEB$ and $\angle CEB$ are a linear pair.
- This statement is *false*. Point E does not lie on the same line as A and B , so the rays are not opposite rays.

*When a conditional statement and its converse are both true, you can write them as a single *biconditional statement*.

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Biconditional statement—contains the phrase "if and only if" "if and only if" is abbreviated "iff"

*Any valid definition can be written as a biconditional statement.

EXAMPLE 4 Write a biconditional

Write the definition of perpendicular lines as a biconditional.

Solution

Definition If **two lines intersect to form a right angle**, then **they are perpendicular**.

Converse If **two lines are perpendicular**, then **they intersect to form a right angle**.

Biconditional **Two lines are perpendicular** if and only if **they intersect to form a right angle**.

Day 1 Assignment:

2.2 WS

LESSON
2.2**Practice***For use with pages 79–85***Rewrite the conditional statement in if-then form.**

- 1.** It is time for dinner if it is 6 P.M.
- 2.** There are 12 eggs if the carton is full.
- 3.** An obtuse angle is an angle that measures more than 90° and less than 180° .
- 4.** The car runs when there is gas in the tank.

Write the converse, inverse, and contrapositive of each statement.

5. If you like hockey, then you go to the hockey game.

6. If x is odd, then $3x$ is odd.

Decide whether the statement is *true* or *false*. If false, provide a counterexample.

- 7.** The equation $4x - 3 = 12 + 2x$ has exactly one solution.

- 8.** If $x^2 = 36$, then x must equal 18 or -18 .

- 9.** If $m\angle A = 122^\circ$, then the measure of the supplement of $\angle A$ is 58° .

- 10.** Two lines intersect in at most one point.

Rewrite the biconditional statement as a conditional statement and its converse.

15. Two lines are perpendicular if and only if they intersect to form right angles.

16. A point is a midpoint of a segment if and only if it divides the segment into two congruent segments.

Decide whether the statement is a valid definition.

- 17.** If a number is divisible by 2 and 3, then it is divisible by 6.

- 18.** If two angles have the same measure, then they are congruent.

- 19.** If two angles are not adjacent, then they are vertical angles.

In Exercises 20–22, use the information in the table to write a definition for each type of saxophone.

Instrument	Frequency (cycles per second)	
	Lower limit (Hz)	Upper limit (Hz)
E-flat baritone saxophone	69	415
B-flat tenor saxophone	103	622
E-flat alto saxophone	138	830

20. E-flat baritone saxophone

21. B-flat tenor saxophone

22. E-flat alto saxophone

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In Exercises 23 and 24, use the information in the table above and the answers to Exercise 20–22.

23. If the frequency of a saxophone was 95 Hz, what could you conclude?

24. If the frequency of a saxophone was 210 Hz, what could you conclude?

Day 2 Assignment:

p. 82 (3-27 mult of 3, 40-55)