2.1
CONDITIONAL STATEMENTS

- CONDITIONAL STATEMENT
  - has 2 parts \( \text{hypothesis} \) & \( \text{conclusion} \)
  - written in \textbf{if-then} form
  - hypothesis \( \text{if} \) part
  - conclusion \( \text{then} \) part

For example...
\textbf{If it is raining, then the flowers are watered.}
\textbf{hypothesis}
\textbf{conclusion}
Example 1
Rewrite the conditional statement in if-then form.

a) **All sharks have a boneless skeleton.**
   If an animal is a shark, then it has a boneless skeleton.

b) **Complementary angles have a sum of 90.**
   If angles are complementary, then they have a sum of 90.

c) **Three points are collinear if there is a line containing them.**
   If there is a line containing three points, then they are collinear.

The **negation** of a statement is the **opposite** of the original statement.
For example...
Statement: *The house is white.*
Negation: *The house is not white.*

Statement: *The puppy is not hyper.*
Negation: *The puppy is hyper.*
Conditional statements can be true or false.

To show that it is true, you must prove that the conclusion is true EVERY TIME the hypothesis is true.

To show that it is false, you need to give ONLY ONE counterexample.

For example...
If \( x^2 = 16 \), then \( x = 4 \).
The counterexample is \( x = -4 \).

Example 2
Write a counterexample to show the following conditional is false.

a) If a number is odd, then it is divisible by 3.

\[ \begin{array}{cccccc}
29 & 5 & 7 & 13 & 17 \\
\end{array} \]

b) Angles that are supplementary must make a linear pair.
The **converse** of a conditional statement occurs by *switching* the hypothesis and the conclusion.

For example...

Statement: *If you see lightning, then you hear thunder.*

Converse: *If you hear thunder, then you see lightning.*

The **inverse** of a conditional statement occurs by *negating* the hypothesis and the conclusion.

For example...

Statement: *If you see lightning, then you hear thunder.*

Inverse: *If you don't see lightning, then you don't hear thunder.*
The **contrapositive** of a conditional statement occurs by *switching and negating* the hypothesis and the conclusion.

For example...

**Statement:** *If you see lightning, then you hear thunder.*

**Contrapositive:** *If you don't hear thunder, then you don't see lightning.*

---

**ALL TOGETHER**

<table>
<thead>
<tr>
<th>Original</th>
<th>If $\angle A = 30^\circ$, then $\angle A$ is acute.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inverse</td>
<td>If $\angle A \neq 30^\circ$, then $\angle A$ is not acute.</td>
</tr>
<tr>
<td>Converse</td>
<td>If $\angle A$ is acute, then $m\angle A = 30^\circ$.</td>
</tr>
<tr>
<td>Contrapositive</td>
<td>If $\angle A$ is not acute, then $m\angle A \neq 30^\circ$.</td>
</tr>
</tbody>
</table>
Example 3
For the conditional statement write the
   a) converse
   b) inverse
   c) contrapositive

If an animal is a fish, then it can swim.
   a) If an animal can swim, then it is a fish.
   b) If an animal is not a fish, then it cannot swim.
   c) If an animal cannot swim, then it is not a fish.

Example 4
For the conditional statement write the
   a) converse
   b) inverse
   c) contrapositive

Adjacent angles have a common side.
   a) If angles are adjacent, then they have a common side.
   b) If angles are not adjacent, then they don’t have a common side.
   c) If two angles do not have a common side, they are not adjacent.
Example 5
For the conditional statement write the
a) converse
b) inverse  
  If an angle doesn’t measure 30°, 
  then it is not acute
  
c) contrapositive
  An angle that measures 30° is acute.
  If an angle measures 30 degrees then it is acute
  a) If an angle is acute, then it measures 30°.
  
c) If an angle is not acute, then it does not measure 30°.

A conditional statement and its contrapositive are either both true or both false.

The converse and inverse are also either both true or both false.

Two statements that are both true or both false are called equivalent statements.
| Postulate 5 | Through any two points there exists exactly one line. |
| Postulate 6 | A line contains at least two points. |
| Postulate 7 | If two lines intersect, then their intersection is exactly one point. |
| Postulate 8 | Through any three noncollinear points there exists exactly one plane. |
| Postulate 9 | A plane contains at least three noncollinear points. |
| Postulate 10 | If two points lie in a plane, then the line containing them lies in the plane. |
| Postulate 11 | If two planes intersect, then their intersection is a line. |