

## Topic: 2.1 Conditional Statements

1. A conditional statement is in the form 'If  $P$ , then  $Q$ .' This may written as:

$$P \rightarrow Q$$

Where  $P$  is called a hypothesis, and  $Q$  is some claim. For example: 'If students do the exploration lab, then class will go by faster'. What is the hypothesis and conclusion?

2. Write your own conditional statement as a full sentence. Identify the hypothesis and conclusion.
3. For the purposes of logic, if a statement is sometimes true, it will be considered false since a counterexample exists. A counterexample means you assumed the hypothesis is true, but the counterexample turned out false. i.e. We arrive at the conclusion:

$$P \rightarrow \neg Q$$

Which means 'If  $P$ , then not  $Q$ .' Write an example of a true statement, and false statement. For the false statement provide at least one counterexample.

4. State whether these statements are true, or false. If false, provide a counterexample.
  - 'If today is Monday, then tomorrow is Tuesday.'
  - 'If you divide a number by itself, then you always get one.'
  - 'If tomorrow is Monday, then it is currently the weekend.'
5. The converse of a statement is when the hypothesis and conclusion are swapped. Symbolically the converse reads, 'If  $Q$ , then  $P$ ' or rather:

$$Q \rightarrow P$$

Find the converse of the statement you wrote from Q3, or ones from Q5.

6. The inverse of a statement is when the hypothesis and conclusion are negated. Negation basically means opposite, or not. Symbolically the converse reads, 'If not  $P$ , then not  $Q$ ' or rather:

$$\neg P \rightarrow \neg Q$$

Find the converse of the statement you wrote from Q3, or ones from Q5.

7. The contrapositive of a statement is when the hypothesis and conclusion are swapped and negated. Symbolically the converse reads, 'If not  $Q$ , then not  $P$ ' or rather:

$$\neg Q \rightarrow \neg P$$

Find the contrapositive of the statement you wrote from Q3, or ones from Q5.

8. There are special statements called bi-conditional statements which are true both forwards and backwards. One of the conditional statements in Q5.) is bi-conditional. Which one is it?