

10. 
$$\begin{array}{l} p \rightarrow q \\ \sim p \\ \hline \sim q \end{array}$$

The invalid argument form above is known as:

- a) Modus Tollens  
**b) Denying the Antecedent**  
 c) Modus Ponens

V. For the arguments below, use the valid argument forms to show how the conclusion follows from the premises by a series of valid inferences. In other words, in the space on the right, construct a proof in which you add the line or lines necessary to demonstrate the proper valid inferences. Be sure to cite the lines from which each inference follows and give its justification. Each is worth four marks.

1. 
$$\begin{array}{l} P \rightarrow (Q \vee R) \\ \sim Q \cdot P \\ \hline R \end{array}$$

1.  $P \rightarrow (Q \vee R)$   
 2.  ~~$\sim Q \cdot P$~~   
 3.  ~~$\sim Q$~~  2 simp  
 4.  ~~$P$~~  2 sim  
 5.  $Q \vee R$  2, 3  $\wedge P$   
 6.  $R$  5, 3  $DS$

4

2. 
$$\begin{array}{l} P \rightarrow Q \\ \sim Q \vee R \\ \sim R \\ \hline \sim P \end{array}$$

1.  $P \rightarrow Q$   
 2.  $\sim Q \vee R$   
 3.  $\sim R$   
 4.  $\sim Q$   $DS, 2, 3$   
 $\sim P$  1, 4  $\wedge P$

4  $\sim Q \vee R$

$$\frac{Q \vee R}{\sim R} \wedge \frac{Q \vee R}{R}$$

3. 
$$\begin{array}{l} A \cdot E \\ E \rightarrow (A \rightarrow B) \\ \hline B \end{array}$$

1.  ~~$A \cdot E$~~   
 2.  ~~$E \rightarrow (A \rightarrow B)$~~   
 3.  $A$  simp  
 4.  $E$  simp  
 5.  $A \rightarrow B$  2, 4  $\wedge P$   
 6.  $B$   $\wedge P$  3, 5

4

7

13