2) 1. $p \rightarrow (\sim q)$
   2. $\sim p$
   $\therefore$ q

4) 1. $p \rightarrow (\sim q)$
   2. $\sim q$
   $\therefore$ p

12) We want to check $[(p \rightarrow (\sim q)) \wedge (\sim p)] \rightarrow q$

p	q	$\sim p$ ②	$\sim q$	$p \rightarrow (\sim q)$ ①	①∧②	(①∧②) $\rightarrow$ q
T	T	F	F	F	F	T
T	F	F	T	T	F	T
F	T	T	F	T	T	T
F	F	T	T	T	T	F

The argument is invalid

The instance which causes the argument to be invalid
is when p and q are both false   (this is called a <u>counterexample</u>
— but you don't need to know this for the test)

4) We want to check $[(p \rightarrow (\sim q)) \wedge (\sim q)] \rightarrow p$

p	q	$\sim q$ ②	$p \rightarrow (\sim q)$ ①	①∧②	[①∧②] $\rightarrow$ p
T	T	F	F	F	T
T	F	T	T	T	T
F	T	F	T	F	T
F	F	T	T	T	F

The argument is invalid.
The counterexample is when p and q are both false

22)
t: you watch television
b: you read books
w: you are wise

Argument:
1. t → (~b)
2. b → w
∴ t → (~w)

We care about the sentence [① ∧ ②] → ∴.

Truth table

t	b	w	(~b)	t→(~b) ①	b→w ②	~w	t→(~w) ③	①∧②	(①∧②)→③
T	T	T	F	F	T	F	F	F	T
T	T	F	F	F	F	T	T	F	T
T	F	T	T	T	T	F	F	T	F
T	F	F	T	T	T	T	T	T	T
F	T	T	F	T	T	F	T	T	T
F	T	F	F	T	F	T	T	F	T
F	F	T	T	T	T	F	T	T	T
F	F	F	T	T	T	T	T	T	T

The argument is invalid, with the counterexample being when t and w are true, with b being false.

24) See Ex 4a on Lecture Guide 1.5

26)
h: you can afford health insurance
u: you are unemployed
p: you are a politician

Argument:
1. h → (~u)
2. p → h
∴ p → (~u)

We care about [① ∧ ②] → ∴.

Truth table

p	h	u	~u	h→(~u) ①	p→h ②	①∧②	p→(~u) ③	(①∧②)→③
T	T	T	F	F	T	F	F	T
T	T	F	T	T	T	T	T	
T	F	T	F	T	F	F	F	
T	F	F	T	T	F	F	T	
F	T	T	F	F	T	F	T	
F	T	F	T	T	T	T	T	
F	F	T	F	T	T	T	T	
F	F	F	T	T	T	T	T	

Therefore, the argument is valid

28) See Ex 4b on Lecture Guide 1.5

30) a: Someone is an artist   Argument: 1. $a \rightarrow (\sim l)$
     l: Someone is a lawyer   2. $l \rightarrow (\sim m)$
     m: Someone is a musician $\therefore$ $a \rightarrow (\sim m)$

We care about $[① \wedge ②] \rightarrow \therefore$

a	l	m	$\sim l$	$\sim m$	① $a \rightarrow (\sim l)$	② $l \rightarrow (\sim m)$	③ $a \rightarrow (\sim m)$	$① \wedge ②$	$(① \wedge ②) \rightarrow ③$
T	T	T	F	F	F	F	F	F	T
T	T	F	F	T	F	T	T	F	T
T	F	T	T	F	T	T	F	T	F
T	F	F	T	T	T	T	T	T	T
F	T	T	F	F	T	F	T	F	T
F	T	F	F	T	T	T	T	T	T
F	F	T	T	F	T	T	T	T	T
F	F	F	T	T	T	T	T	T	T

The argument is invalid, with the counterexample being when a and m are true, but l is false