Solutions

Marking: **M1** a correct method, **A1** the correct answer, **B1** an independent mark.

Each answer shows the steps, then the **result**.

2.1

$p \to q$: T, F, T, T (rows TT, TF, FT, FF)

$\neg q \to \neg p$: T, F, T, T

the columns match in every row, so the two are equivalent

2.2

(a) some user has no password or has no backup e-mail

(b) every test passes

2.3

converse: if the page does not load, the server is down

contrapositive: if the page loads, the server is not down

the contrapositive

2.4

write them as $2a + 1$ and $2b + 1$ for integers a, b

sum $= 2a + 2b + 2 = 2(a + b + 1)$, which is even

3.1

(a) `not logged_in or not (is_admin or is_owner)` = `not logged_in or (not is_admin and not is_owner)`

(b) $2^3 = \mathbf{8}$

(c) `logged_in` true and at least one of the others true: TTT, TTF, TFT, three rows

(d) yes: `and` binds tighter than `or`, so Python reads it with the brackets of (a)

3.2

(a) if n is even, then $3n + 2$ is even

(b) let $n = 2k$; $3n + 2 = 6k + 2 = 2(3k + 1)$, which is even

(c) it checks one case; the claim is about every integer

3.3

(a) $(o \vee a) \wedge \neg l$: the "or" grouped first, then "and not locked"

(b) Python reads the code as $o \vee (a \wedge \neg l)$; owner, not admin, locked: the rule says no but the code deletes a locked file

(c) `if (owner or admin) and not locked:`

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(d) yes: $2^3 = 8$ rows; with 30 flags $2^{30} \approx 1.07 \times 10^9$ rows, so you must test the boundaries and use reasoning instead