Solutions

2.1

- $\neg q \to \neg p$ ✓.

2.2

- $\exists x\, \neg P(x)$; $\forall x\, \neg P(x)$ ✓.

2.3

- $\neg r \wedge \neg s$ ✓.

3.1

- (i) Contraposition: n even $\Rightarrow n = 2k \Rightarrow 3n + 2 = 6k + 2$ even ✓.
- (ii) Contradiction: $\sqrt{2} = p/q$ lowest terms $\Rightarrow p^2 = 2q^2 \Rightarrow p$ even $\Rightarrow q$ even $\Rightarrow$ terms not lowest – absurd ✓.
- (iii) Contrapositive of the conclusion: $x \neq 0$ and $y \neq 0 \Rightarrow xy \neq 0$ – negates the premise directly ✓.
- Strategy named before each proof, per the course rule ✓.

3.2

- Modus ponens table: only row $p = T, q = T$ satisfies both premises; $q = T$ there ✓.
- Second: row $p = F, q = T$ satisfies $p \to q$ and q but p fails – invalid ✓.
- The invalid shape is affirming the consequent; a truth-table row is the proof of invalidity ✓.

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