Solutions

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

2.1

- when waves overlap, the resultant displacement is the **(vector) sum** of the individual displacements

2.2

- neighbouring nodes are $\lambda/2$ apart

2.3

- amplitude $= 2A$
- intensity $= 4\times$ that of one wave ($I \propto A^2$)

2.4

- any one: a stationary wave does **not transfer energy** along its length; its amplitude **varies** (zero at nodes); the nodes are fixed

2.5

- node-to-node is $\lambda/2$, so $\lambda = 2 \times 16$ mm $=$ **32** mm

3.1 C

- a node to the nearest antinode is $\lambda/4$

3.2

(a) node spacing $= \lambda/2 = 0.30$ m

- $\lambda =$ **0.60** m

(b) $v = f\lambda$

$$v = (250\text{ Hz})(0.60\text{ m}) = \mathbf{150}\text{ m s}^{\mathbf{-1}}$$

3.3

(a) incident microwaves **reflect** off the sheet and travel back the **opposite way**

- incident and reflected waves have the same frequency and **superpose**
- always out of phase → **nodes**; always in phase → **antinodes**

(b) node spacing $= \lambda/2 = 25$ mm

- $\lambda = 50$ mm $= 0.050$ m

$$f = \frac{c}{\lambda} = \frac{3.0 \times 10^8\text{ m s}^{-1}}{0.050\text{ m}} = \mathbf{6.0 \times 10^9}\text{ Hz}$$

- region: **microwaves**

3.4

- any two: a node has **zero** displacement, an antinode has **maximum** amplitude; a node never moves; points either side of a node are in **antiphase**