2.14

Var	Given value	Units	Description
Δx_{cw}		m	clockwise distance
t_{cw}	60	s	clockwise time
Δx_{ccw}		m	counterclockwise distance
t_{ccw}	120	s	counterclockwise time
$v_{ccw,ave}$	–4	$\frac{m}{s}$	average counterclockwise velocity
$v_{cw,ave}$	6.0	$\frac{m}{s}$	average clockwise velocity
Δx		m	distance from starting position

$$v_{cw,ave} = \frac{\Delta x_{cw}}{t_{cw}}$$

$$\Delta x_{cw} = t_{cw}\, v_{cw,ave}$$

$$= (60\,\text{s})\left(6.0\,\frac{\text{m}}{\text{s}}\right)$$

$$= 360\,\text{m}$$ ✓

$$v_{ccw,ave} = \frac{\Delta x_{ccw}}{t_{ccw}}$$

$$\Delta x_{ccw} = t_{ccw}\, v_{ccw,ave}$$

2.16

Var	Given value	Units	Description
$v_{ave,\ 1}$	40	$\frac{m}{s}$	starting average velocity
Δx		m	displacement
t_1	180	s	starting time
$v_{ave,\ 2}$		$\frac{m}{s}$	returning average velocity
t_2	150	s	return time

$$3.0\,min\ X\left(60\,\frac{s}{min}\right) = 180\,s$$

$$v_{ave,1} = \frac{\Delta x}{t_1}$$

$$t_1\ v_{ave,1} = \Delta x$$

$$\Delta x = t_1\ v_{ave,1}$$

$$= (180\,s)\left(40\,\frac{m}{s}\right)$$

$$= 7200\,m$$ ✓

2.16 (continued)

$$2.5\,min\ X\left(60\,\frac{s}{min}\right) = 180\,s$$

$$v_{ave,2} = \frac{\Delta x}{t_2}$$

$$= \frac{7200\,\text{m}}{150\,\text{s}}$$

$$= 48\,\frac{\text{m}}{\text{s}}$$ ✓

2.14 (continued)

$$= (120\,\text{s})\left(-4\,\frac{\text{m}}{\text{s}}\right)$$

$$= -480\,\text{m} \quad \checkmark$$

$$\Delta x = \left|\Delta x_{\text{cw}} + \Delta x_{\text{ccw}}\right|$$

$$= \left|(360\,\text{m}) + (-480\,\text{m})\right|$$

$$= 120\,\text{m} \quad \checkmark$$

2.18

Var	Given value	Units	Description
d	4.0	m	distance between floors
v	1.0	$\frac{m}{s}$	elevator speed
Δx_1		m	
t_1	60	s	
Δx_2		m	
t_2	20	s	
Δx_3		m	
t_3	8	s	
Δx		m	total displacement
$floor$			floor number

$$v = \frac{\Delta x_1}{t_1}$$

$$t_1 v = \Delta x_1$$

$$\Delta x_1 = t_1 v$$

$$= (60\,\text{s})\left(1.0\,\frac{\text{m}}{\text{s}}\right)$$

$$= 60.\,\text{m} \quad \checkmark$$

2.18 (continued)

$$-v = \frac{\Delta x_2}{t_2}$$

$$t_2(-v) = \Delta x_2$$

$$\Delta x_2 = t_2(-v)$$

$$= (20\,\text{s})\left(-\left(1.0\,\frac{\text{m}}{\text{s}}\right)\right)$$

$$= -20.\,\text{m}$$ ✓

$$v = \frac{\Delta x_3}{t_3}$$

$$t_3\,v = \Delta x_3$$

$$\Delta x_3 = t_3\,v$$

2.18 (continued)

$$= (8\,\text{s})\left(1.0\,\frac{\text{m}}{\text{s}}\right)$$

$$= 8.0\,\text{m} \quad \checkmark$$

$$\Delta x = \Delta x_1 + \Delta x_2 + \Delta x_3$$

$$= (60.\,\text{m}) + (-20.\,\text{m}) + (8.0\,\text{m})$$

$$= 48.\,\text{m} \quad \checkmark$$

$$\textit{floor} = \frac{\Delta x}{d}$$

$$= \frac{48.\,\text{m}}{4.0\,\text{m}}$$

$$= 12. \quad \checkmark$$