2.2

Var	Given value	Units	Description
$speed_{ave}$		$\frac{km}{h}$	average speed
d	147	km	total distance
t	2.25	h	elapsed time

$$speed_{ave} = \frac{d}{t}$$

$$= \frac{147\,km}{2.25\,h}$$

$$= 65.3\,\frac{km}{h}$$ ✓

2.4

Var	Given value	Units	Description
$starttime_A$	3.00	h	start time for A
$starttime_B$	4.00	h	start time for B
$finishtime$	6.00	h	finish time for both A and B
$time_A$		h	time elapsed for A
$time_B$		h	time elapsed for B
$time_{A,s}$		s	time elapsed for A
$time_{B,s}$		s	time elapsed for B
$speed_{ave,A}$	3.0	$\frac{m}{s}$	ave speed of A
$distance_A$		m	distance A goes
$speed_{ave,B}$	4.0	$\frac{m}{s}$	ave speed of B
$distance_B$		m	distance B goes

$$speed_{ave,B} = \frac{distance_B}{time_B}$$

$$time_A = finishtime - starttime_A$$

$$= (6.00\,h) - (3.00\,h)$$

$$= 3.00\,h \quad \checkmark$$

2.4 (continued)

$$time_{A,s} = time_A \rightarrow s$$

$$= (3.00\,h)\left(3600\,\frac{s}{h}\right)$$

$$= 1.08\times10^{4}\,s \quad \checkmark$$

$$time_B = (finishtime - starttime_B)$$

$$= (6.00\,h) - (4.00\,h)$$

$$= 2.00\,h \quad \checkmark$$

$$time_{B,s} = time_B \rightarrow s$$

$$time_{B,s} = time_B \rightarrow s$$

$$= (2.00\,h)\left(3600\,\frac{s}{h}\right)$$

$$= 7.20\times10^{3}\,s \quad \checkmark$$

2.4 (continued)

$$speed_{ave,A} = \frac{distance_A}{time_{A,s}}$$

$$distance_A = time_{A,s}\, speed_{ave,A}$$

$$= (1.08\times10^4\ \text{s})\left(3.0\ \frac{\text{m}}{\text{s}}\right)$$

$$= 3.2\times10^4\ \text{m}$$ ✓

$$speed_{ave,B} = \frac{distance_B}{time_{B,s}}$$

$$distance_B = time_{B,s}\, speed_{ave,B}$$

$$= (7.20\times10^3\ \text{s})\left(4.0\ \frac{\text{m}}{\text{s}}\right)$$

$$= 2.9\times10^4\ \text{m}$$ ✓

No, B goes less distance by 6:00PM.

2.6

Var	Given value	Units	Description
$speed_{ave}$	90.	$\frac{km}{h}$	average speed
d	225	km	distance
t		h	time for trip without stopping

$$speed_{ave} = \frac{d}{t}$$

$$t\, speed_{ave} = d$$

$$t = \frac{d}{speed_{ave}}$$

$$= \frac{225\,km}{90.\,\frac{km}{h}}$$

$$= 2.5\,h$$ ✓

$$3.5\,h - 2.5\,h = 1\,h$$

2.8

Var	Given value	Units	Description
$speed_{ave}$	3.00×10^{8}	$\frac{m}{s}$	speed of light
d_{km}	4.50×10^{9}	km	distance
t		s	time
d		m	distance
t_{min}		min	time

$$d = d_{km} \rightarrow m$$

$$= (4.50\times10^{9}\,km)\left(1000\,\frac{m}{km}\right)$$

$$= 4.50\times10^{12}\,m \quad \checkmark$$

$$speed_{ave} = \frac{d}{t}$$

$$t\,speed_{ave} = d$$

$$t = \frac{d}{speed_{ave}}$$

2.8 (continued)

$$= \frac{4.50\times10^{12}\,\text{m}}{3.00\times10^{8}\,\frac{\text{m}}{\text{s}}}$$

$$= 1.50\times10^{4}\,\text{s} \quad \checkmark$$

$$t_{\text{min}} = t \rightarrow \text{min}$$

$$= (1.50\times10^{4}\,\text{s})\left(0.01666666667\,\frac{\text{min}}{\text{s}}\right)$$

$$= 250.\,\text{min} \quad \checkmark$$

2.10

Var	Given value	Units	Description
$speed$	50.	$\frac{km}{h}$	ave speed for whole trip
d		km	distance whole trip
t	9.0	h	time whole trip
$speed_{1\ st}$	45	$\frac{km}{h}$	ave speed 1st half
$d_{1\ st}$		km	distance 1st half
$t_{1\ st}$		h	time 1st half
$speed_{2\ nd}$		$\frac{km}{h}$	ave speed 2nd half
$d_{2\ nd}$		km	distance 2nd half
$t_{2\ nd}$		h	time 2nd half

$$speed = \frac{d}{t}$$

$$t\ speed = d$$

$$d = t\ speed$$

$$= (9.0\,h)\left(50.\ \frac{km}{h}\right)$$

$$= 4.5\times10^{2}\,km$$ ✓

2.10 (continued)

$$d_{1\text{st}} = \frac{d}{2}$$

$$= \frac{4.5\times10^{2}\,\text{km}}{2}$$

$$= 2.2\times10^{2}\,\text{km} \quad \checkmark$$

$$d_{2\text{nd}} = \frac{d}{2}$$

$$= \frac{4.5\times10^{2}\,\text{km}}{2}$$

$$= 2.2\times10^{2}\,\text{km} \quad \checkmark$$

$$speed_{1\text{st}} = \frac{d_{1\text{st}}}{t_{1\text{st}}}$$

$$t_{1\text{st}}\, speed_{1\text{st}} = d_{1\text{st}}$$

$$t_{1\text{st}} = \frac{d_{1\text{st}}}{speed_{1\text{st}}}$$

$$= \frac{2.2\times10^{2}\,\text{km}}{45\,\frac{\text{km}}{\text{h}}}$$

2.10 (continued)

$$= 4.9\,\text{h} \quad \checkmark$$

$$t_{2\text{nd}} = t - t_{1\text{st}}$$

$$= (9.0\,\text{h}) - (4.9\,\text{h})$$

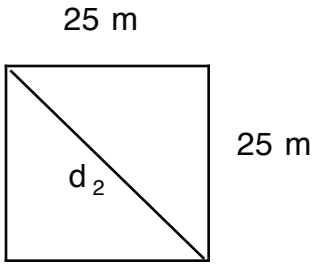
$$= 4.1\,\text{h} \quad \checkmark$$

$$speed_{2\text{nd}} = \frac{d_{2\text{nd}}}{t_{2\text{nd}}}$$

$$= \frac{2.2 \times 10^{2}\,\text{km}}{4.1\,\text{h}}$$

$$= 54.\,\frac{\text{km}}{\text{h}} \quad \checkmark$$

2.12



Var	Given value	Units	Description
$speed_1$	5.0	$\frac{m}{s}$	ave speed of jogger 1
d_1		m	distance for jogger 1
t		s	time for both joggers
d_2		m	distance for jogger 2
L	25	m	length of gym
$speed_2$		$\frac{m}{s}$	ave speed of jogger 2

2.12 (continued)

$$d_1 = L + L$$

$$= (25\,\text{m}) + (25\,\text{m})$$

$$= 50\,\text{m}$$ ✓

$$speed_1 = \frac{d_1}{t}$$

$$t\,speed_1 = d_1$$

$$t = \frac{d_1}{speed_1}$$

$$= \frac{50\,\text{m}}{5.0\,\frac{\text{m}}{\text{s}}}$$

$$= 10.\,\text{s}$$ ✓

$$d_2 = \sqrt{L^2 + L^2}$$

$$= \sqrt{(25\,\text{m})^2 + (25\,\text{m})^2}$$

$$= 35.35533906\,\text{m}$$ ✓

2.12 (continued)

$$speed_2 = \frac{d_2}{t}$$

$$= \frac{35.35533906\,\text{m}}{10.\,\text{s}}$$

$$= 3.5\,\frac{\text{m}}{\text{s}}$$ ✓