Mark scheme for Support Worksheet – Topic 2, Worksheet 1

1 See diagram.

[2]

2 **a** The average speed is the total distance travelled divided by the time taken and so is $\frac{40}{5.0} = 8.0 \text{ m s}^{-1}$ [1]

b the average velocity is the change in displacement divided by the time taken: the change in displacement has magnitude $\sqrt{20^2 + 20^2} = 20\sqrt{2}$ m and so the average velocity has magnitude $\frac{20\sqrt{2}}{5.0} = 5.7 \text{ m s}^{-1}$; directed northeast [2]

3 For both cases we refer to simple harmonic oscillations:

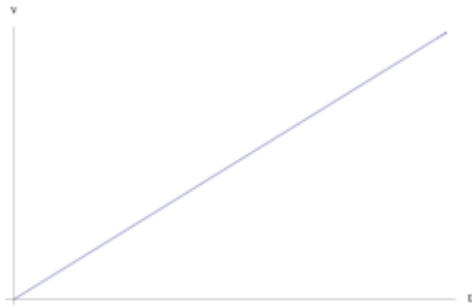
a at the extremes of the oscillations $v = 0$ but $a \neq 0$ [1]

b at the equilibrium position in the oscillations, $v \neq 0$ but $a = 0$ [1]

4 Use $s = \frac{u+v}{2} \times t = \frac{4.0+6.0}{2} \times 4.0 = 20 \text{ m}$ [1]

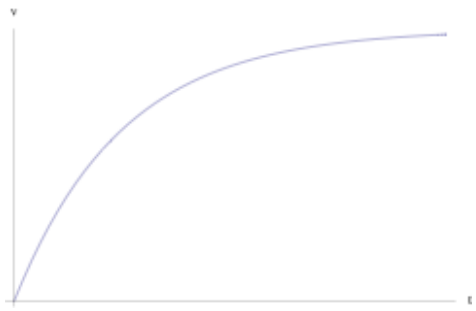
5 See diagrams.

a



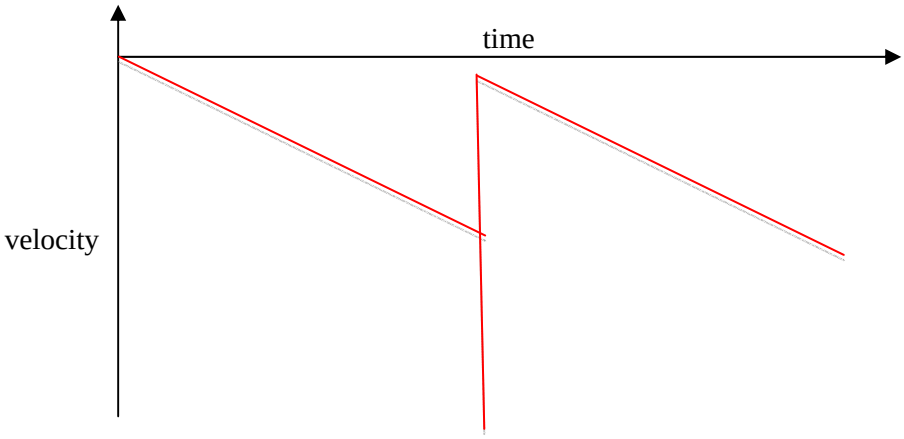
[1]

b



[1]

6 See diagram.



[2]

7 The mass of the body is $m = \frac{24}{9.8} = 2.45$ kg and so the new weight is $W = 2.45 \times 2.2 = 5.4$ N [1]

8 The peg supports the rod of weight W so the force it exerts on the string is W upwards, choice **C**. [1]

9 The tension force has components $T_x = T\sin\theta$ and $T_y = T\cos\theta$. Therefore $F = T\sin\theta$ and $W = T\cos\theta$. Solving for T from the first equation gives $\frac{F}{\sin\theta} = T$ and so substituting in the second gives $W = \frac{F}{\sin\theta}\cos\theta$ and so $F = W\tan\theta$, choice **D**. [1]

10 The total mass of the system is 12 kg and the net force is 24 N which means that the acceleration is $\frac{24}{12} = 2.0$ m s^{-2}; the net force on the 4.0 kg is the tension and so $T = ma = 4.0 \times 2.0 = 8.0$ N [2]

11 The acceleration would be the same but now $T = Ma = 8.0 \times 2.0 = 16$ N [1]

12 The total mass of the system is 12 kg, and the net force on the system is $36 - 8 - 16 = 12$ N. The acceleration is therefore $\frac{12}{12} = 1.0$ m s^{-2}; the net force on the 4.0 kg mass is $T - 8$ and so $T - 8 = 4.0 \times 1.0 \Rightarrow T = 12$ N [2]