7(a)	$v=\frac{1}{3}\left(2t^2-11t+12\right)\Rightarrow \frac{\mathrm{d}v}{\mathrm{d}t}=\frac{1}{3}\left(4t-11\right)$
	$\frac{1}{3}\left(4\times 2-11\right)=-1\,\text{m s}^{-2}$
7(b)	Attempt to integrate
	$s=\frac{1}{3}\left(\frac{2t^3}{3}-\frac{11t^2}{2}+12t\right)\left(+c\right)$
	[P changes direction when] $t = 1.5$
	Attempt to evaluate their $\frac{1}{3}\left(\frac{2t^3}{3}-\frac{11t^2}{2}+12t\right)$ for $t = 0$ to $t = 1.5$ **and** $t = 1.5$ to $t = 3$
	Total distance is $\left[2.625+\left\lvert-1.125\right\rvert=\right]$ 3.75 m

7(c)	Attempt to evaluate their s for $t = 0$ to $t = 4$
	$\int_0^4 v\,\mathrm{d}t = \frac{8}{9} > 0$ so, no P does not return to O

1	Any method to find x, or a or getting an equation relating x and a For example: $\frac{x}{2} = 40$ or $x = 2 \times 40$ or $x = 40 \times 2 + \frac{1}{2}(0)2^2$ or $\frac{x-0}{4-6} = -40$ or $x = \frac{1}{2} \times a \times 4^2$
	$x = 80$
	$a = 10$

3(a)	$175 = \frac{1}{2}(15+20)t$
	Time = 10 s

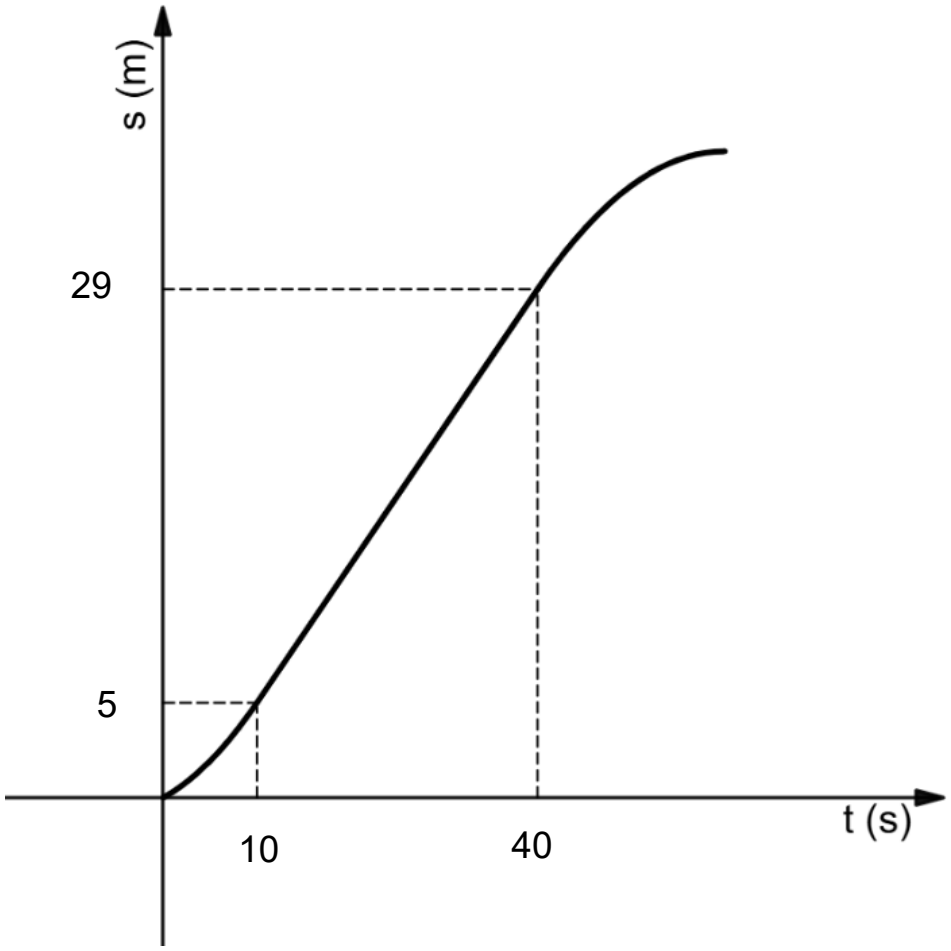
3(b)(i)	Change in KE $= \pm\left(\frac{1}{2}\times 1400\times 20^2 - \frac{1}{2}\times 1400\times 15^2\right)$ $\left[= \pm(280000-157500) = \pm 122500\right]$ **OR** Work done against resistance $= \pm 800\times 175\ \left[= \pm 140000\right]$
	Work done by engine $= \frac{1}{2}\times 1400\times 20^2 - \frac{1}{2}\times 1400\times 15^2 + 800\times 175$
	Av power $\times$ (*their* 10) $= \frac{1}{2}\times 1400\times 20^2 - \frac{1}{2}\times 1400\times 15^2 + 800\times 175$
	Average power = 26250 W
	Special case for using N2L Maximum 2 marks
	$20^2 = 15^2 + 2\times a\times 175 \Rightarrow a = 0.5$; $DF - 800 = 1400\times 0.5 \Rightarrow DF = 1500$
	$DF\times 175 =$ Average power $\times$ (*their* 10) $\Rightarrow$ Average power $= 26250$ W **OR** $P = 1500\times 15 = 22500$ and $P = 1500\times 20 = 30000$ so Average power $= \frac{1}{2}(22500+30000) = 26250$ W

3(b)(ii)	*their* $26250 = 800v$
	Speed = 32.8125 or $\frac{525}{16}$ m s^{-1}

4(a)	[Height gained by P $\left(s_P\right)$=]$30t-\frac{1}{2}gt^2$ [Height lost by Q $\left(s_Q\right)$=]$10t-\frac{1}{2}gt^2$
	Meet when $30t-\frac{1}{2}gt^2=10t-\frac{1}{2}gt^2+15$
	$t=\frac{3}{4}$ or 0.75
	Height = 19.6875 m or $\frac{315}{16}$ m

4(b)	$\left[v_P =\right]\pm\left(30-\frac{3}{4}g\right)\left[=\pm 22.5\right]$ $\left[v_Q =\right]\pm\left(10-\frac{3}{4}g\right)\left[=\pm 2.5\right]$ **OR** $\left[v_P =\right]\pm\sqrt{30^2-2g\times 19.6875}\left[=\pm 22.5\right]$ $\left[v_Q =\right]\pm\sqrt{10^2-2g\times(19.6875-15)}\left[=\pm 2.5\right]$
	$0.1\times 22.5+0.4\times 2.5=(0.1+0.4)\times v_{PQ}$
	$v_{PQ}=6.5$
	$v^2=their\,6.5^2+2g\times their 19.6875$ **OR** $0=their\,6.5^2+2(-g)s \quad\Rightarrow s=2.1125,$ height above ground $=2.1125+19.6875=21.8$ hence $v^2=0^2+2g\times 21.8$
	Speed = 20.9 ms^{-1} or $2\sqrt{109}$ ms^{-1}

6	Acceleration = 0 when $\left[2(t+1)^{-\frac{1}{2}}-1=0 \Rightarrow (t+1)^{\frac{1}{2}}=2\right]$ $t=3$
	For attempt at integration of $(a=)2(t+1)^{-\frac{1}{2}}-1$
	$[v=]\dfrac{2}{-\frac{1}{2}+1}(t+1)^{-\frac{1}{2}+1}-t[+c]=4(t+1)^{\frac{1}{2}}-t[+c]$
	$v=0$ at $t=0 \Rightarrow\ c=-4$ $\left[\Rightarrow v=4(t+1)^{\frac{1}{2}}-t-4\right]$
	Attempt to integrate *their* v, which has come from integration
	$[s=]\dfrac{4}{\frac{1}{2}+1}(t+1)^{\frac{1}{2}+1}-\dfrac{1}{1+1}t^{1+1}-4t[+k]=\dfrac{8}{3}(t+1)^{\frac{3}{2}}-\dfrac{1}{2}t^2-4t[+k]$
	$=\left(\dfrac{8}{3}\times 4^{\frac{3}{2}}-\dfrac{1}{2}\times 3^2-4\times 3\right)-\left(\dfrac{8}{3}-0-0\right)$ **OR** evaluate k from using $s=0$ when $t=0$ **AND** substitute $t=$ *their* 3
6	Distance $=\dfrac{13}{6}$m or 2.17m

3(a)	Velocity at $t = 10$ is 8 [m s^{-1}]
	$\frac{1}{2} \times 8(T - 40) = 80$ OR $\frac{1}{2} \times 8 \times t = 80 \ [\Rightarrow t = 20]$ and $T = their\, t + 40$
	Total time = 60 s
3(b)	Distance after 10 s = 55 m
	Distance after 40 s = 295 m
	

7(a)	For an attempt at differentiation
	$v = \frac{9}{2}t^{\frac{1}{2}} - 6$
	$v = 0 \Rightarrow t = \frac{16}{9}$
	$\left(3\times16^{\frac{3}{2}} - 6\times16\right) - \left(3\times\left(\frac{16}{9}\right)^{\frac{3}{2}} - 6\times\frac{16}{9}\right)\left[= \frac{896}{9}\right]$ Or $\left(3\times\left(\frac{16}{9}\right)^{\frac{3}{2}} - 6\times\frac{16}{9}\right) - 0\left[= -\frac{32}{9}\right]$
	For both i.e. $\mathrm{F}(16) - \mathrm{F}\left(their\ \frac{16}{9}\right) - \left[\mathrm{F}\left(their\ \frac{16}{9}\right) - \left[\mathrm{F}(0)\right]\right]$ OR $\mathrm{F}(16) - \mathrm{F}\left(their\ \frac{16}{9}\right) + \left\lvert\mathrm{F}\left(their\ \frac{16}{9}\right) - \left[\mathrm{F}(0)\right]\right\rvert$ OR $\mathrm{F}(16) - 2\times\mathrm{F}\left(their\ \frac{16}{9}\right)$
	$\frac{928}{9}$ m

7(b)	For integration
	$v = 0.8t - 0.3t^2 + 7.5$
	$v = -9.6 \Rightarrow 0.3t^2 - 0.8t - 17.1 = 0$
	$t = 9 \left[\text{or} -\frac{19}{3} \right]$
	$s = 0.4t^2 - 0.1t^3 + 7.5t \left(+c \right)$
	At $t = 9\, s_X = 3 \times 9^{\frac{3}{2}} - 6 \times 9 = 27$
	At $t = 9\, s_Y = 0.4 \times 9^2 - 0.1 \times 9^3 + 7.5 \times 9 = 27$