7(a)	$v=\frac{1}{3}\left(2t^2-11t+12\right)\Rightarrow\frac{\mathrm{d}v}{\mathrm{d}t}=\frac{1}{3}\left(4t-11\right)$
	$\frac{1}{3}\left(4\times2-11\right)=-1\,\mathrm{m\,s^{-2}}$
7(b)	Attempt to integrate
	$s=\frac{1}{3}\left(\frac{2t^3}{3}-\frac{11t^2}{2}+12t\right)(+c)$
	[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 $\left[2.625+\lvert-1.125\rvert=\right]3.75$ 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

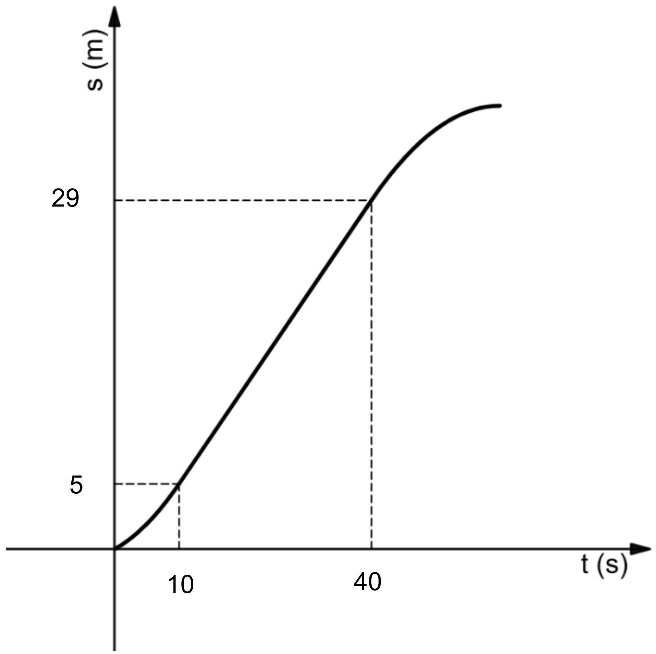
3(b)(i)	Change in KE $=\pm\left(\frac{1}{2}\times 1400\times 20^2-\frac{1}{2}\times 1400\times 15^2\right)$ $\left[=\pm(280000-157500)=\pm 122500\right]$ **OR** Work done against resistance $=\pm 800\times 175$ $[=\pm 140000]$
	Work done by engine $=\frac{1}{2}\times 1400\times 20^2-\frac{1}{2}\times 1400\times 15^2+800\times 175$
	Av power $\times(\textit{their}\,10)=\frac{1}{2}\times 1400\times 20^2-\frac{1}{2}\times 1400\times 15^2+800\times 175$
	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 $\times(\textit{their}\,10)\Rightarrow$ 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)	$\textit{their}\,26250=800v$
	Speed = 32.8125 or $\frac{525}{16}$ m s^{-1}

4(a)	[Height gained by P (s_P) =]$30t - \frac{1}{2}gt^2$ [Height lost by Q (s_Q) =]$10t - \frac{1}{2}gt^2$
	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)	$[v_P =] \pm\left(30 - \frac{3}{4}g\right)[= \pm 22.5]$ $[v_Q =] \pm\left(10 - \frac{3}{4}g\right)[= \pm 2.5]$ **OR** $[v_P =] \pm\sqrt{30^2 - 2g \times 19.6875}[= \pm 22.5]$ $[v_Q =] \pm\sqrt{10^2 - 2g \times (19.6875 - 15)}[= \pm 2.5]$
	$0.1 \times 22.5 + 0.4 \times 2.5 = (0.1 + 0.4) \times v_{PQ}$
	$v_{PQ} = 6.5$
	$v^2 = their\,6.5^2 + 2g \times their\,19.6875$ **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}]
	$\dfrac{1}{2}\times 8(T-40)=80$ OR $\dfrac{1}{2}\times 8\times t=80$ $[\Rightarrow t=20]$ 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. $\mathrm{F}(16) - \mathrm{F}\left(\mathit{their}\frac{16}{9}\right) - \left[\mathrm{F}\left(\mathit{their}\frac{16}{9}\right) - [\mathrm{F}(0)]\right]$ OR $\mathrm{F}(16) - \mathrm{F}\left(\mathit{their}\frac{16}{9}\right) + \left\|\mathrm{F}\left(\mathit{their}\frac{16}{9}\right) - [\mathrm{F}(0)]\right\|$ OR $\mathrm{F}(16) - 2\times\mathrm{F}\left(\mathit{their}\frac{16}{9}\right)$
	$\frac{928}{9}$ m

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7(b)	For integration
	$v = 0.8t - 0.3t^2 + 7.5$
	$v = -9.6 \Rightarrow 0.3t^2 - 0.8t - 17.1 = 0$
	$t = 9\left[\text{or} -\frac{19}{3}\right]$
	$s = 0.4t^2 - 0.1t^3 + 7.5t(+c)$
	At $t = 9\ s_X = 3\times9^{\frac{3}{2}} - 6\times9 = 27$
	At $t = 9\ s_Y = 0.4\times9^2 - 0.1\times9^3 + 7.5\times9 = 27$