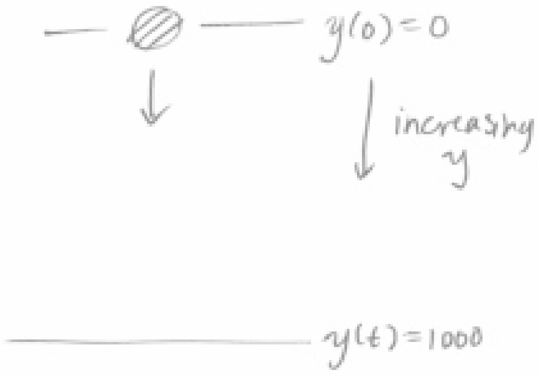
#1 - section 3.4:



model: if $v(t)$ = velocity of object, and $y(t)$ = height, then $v = y'$

and: mass · accelleration = net force

$$\Rightarrow \quad my'' = mg - by'$$

or $\boxed{mv' = mg - bv}$

$\Rightarrow \quad 5v' = 5(9.8) - 50v \quad \Rightarrow \quad v' = 9.8 - 10v$

$\Rightarrow \quad v' + 10v = 9.8 \quad \Rightarrow$ let $\mu(t) = e^{\int 10 dt} = e^{10t}$

$\Rightarrow \quad (e^{10t}v)' = 9.8e^{10t} \quad \Rightarrow \quad e^{10t}v = 0.98e^{10t} + C$

$\boxed{v = 0.98 + Ce^{-10t}}$. Since $v(0) = 0$

$\Rightarrow \quad 0.98 + C = 0 \quad \Rightarrow \quad C = -0.98$

$y' = v(t) = 0.98 - 0.98e^{-10t}$

$\Rightarrow \quad y(t) = 0.98t - 0.098e^{-10t} + C$

and since $y(0) = 0 \quad \Rightarrow \quad C = 0.098$, so $\boxed{y(t) = 0.98t - 0.098e^{-10t} + 0.098}$

Find t so that $y = 1000$:

$1000 = 0.98t - 0.098e^{-10t} + 0.098$

$\Rightarrow \quad 999.902 = 0.98t - 0.098e^{-10t}$

$\Rightarrow \quad \frac{999.902}{0.98} = t - \frac{1}{10}e^{-10t}$.

→ for t near 1000, e^{-10t} is negligible, so we can approximate $e^{-10t} \approx 0 \Rightarrow t \approx \frac{999.902}{0.98} \approx$ $\boxed{1020 \text{ seconds}}$