1. a)Consider an object A thrown vertically with velocity 40m/s [up] and an object B that is thrown 1.03 seconds after object A. At what velocity [up] must be the object B thrown in order to reach its maximum height at the same instant as the object A?

Object A: $t_{hmax} = \frac{v_{fy} - v_{iy}}{a_y} = \frac{0 - 40}{-9.8} = 4.0816\,s$

Object B: $t_{hmax} = 4.0816 - 1.03 = 3.0516\,s$

* this is zero as the object stops at h_{max}

$v_f = v_i + at \Rightarrow \vec{v}_{iy} = \vec{v}_{fy} - at$

$= 0 - (-9.8)(3.0516)$

$\doteq 29.91\ m/s \quad \therefore \vec{v}_{iyB} = 3.0 \times 10^{1}\ m/s\,[up]$

b) How does the maximum height of object A compare to the maximum height of object B?

object A: $h_{max} = \frac{v_{fy}^2 - v_{iy}^2}{2a_y} = \frac{0^2 - 40^2}{2(-9.8)} \doteq 81.6\ m$

object B: $h_{max} = \frac{0^2 - 29.91^2}{2(-9.8)} \doteq 45.6\ m$

$\frac{h_{max}A}{h_{max}B} = \frac{81.6}{45.6} \doteq 1.8$ $\therefore$ The maximum height of object A is 1.8 times greater than h_{max} of object B.

c) How would your answer from a) change if the object B was thrown at an angle above the horizontal?

→ $\vec{v}_i$ can be at any angle θ as long as $\vec{v}_{iy} = 29.91\ m/s$ the overall answer will not change.

→ $\vec{v}_{ix_B}$ does not affect the answer.