The answers for the MC questions

> # D,B,C,D,A,C,A,F,A,F

Long Answer, Question 1

> # 1a
> restart;
> t2 := solve(-h2 = -g*t^2/2,t)[1];
> \[
t2 := \frac{\sqrt{2 g h2}}{g}
\]

> # 1b
> t1 := solve(-h1 = v0*t-g*t^2/2,t)[1];
> \[
t1 := \frac{v0 + \sqrt{v0^2 + 2 g h1}}{g}
\]

> # 1c
> solve(t1=t2,v0);
> \[
- \frac{g (h1 - h2) \sqrt{2}}{2 \sqrt{2 g h2}}
\]

> # 1d. For the plot, let's use g=-9.8 m/s^2, h2=10 m, v0=4.9 m/s, and h1=3 m > plot([-9.8*t,4.9-9.8*t],t=0..1.429);
> # 1e. The will not have the same velocity when they
> reach the ground. As can be seen from the above graph,
> the velocity plots are parallel to each other and will
> never cross. Both rocks experience the same constant
> acceleration, but one starts with an initial velocity
> and the other starts at rest. There will never be a time
> that they have the same velocity (until they hit the
> ground, of course!).
>

**Long Answer, Question 2**

> restart;
> # 2a. \( \cos(30) = 0.866, \sin(30) = 0.5 \)
> \[\text{theta} := 30.0/180*\pi; \]
> \[\theta := 0.1666666667\pi \]
> \[\text{x0 := 3; vx0 := 0; ax0 := evalf((1.0)*cos(theta));} \]
> \[x0 := 3 \]
> \[vx0 := 0 \]
> \[ax0 := 0.8660254037 \]
> \[x(t) := x0 + vx0*t + (1/2)*ax0*t^2; \]
> \[x(t) := 3 + 0.4330127018t^2 \]
> \[vx(t) := diff(x(t), t); \]
> \[vx(t) := 0.8660254036t \]
> \[ax(t) := diff(vx(t), t); \]
> \[ax(t) := 0.8660254036 \]
> > # 2b.
> > y0 := 4; vy0 := -7; ay0 := evalf(1.0*sin(theta)); \]
> \[y0 := 4 \]
> \[vy0 := -7 \]
> \[ay0 := 0.5000000002 \]
> \[y(t) := y0 + vy0*t + (1/2)*ay0*t^2; \]
> \[y(t) := 4 - 7t + 0.25000000001t^2 \]
> \[vy(t) := diff(y(t), t); \]
> \[vy(t) := -7 + 0.5000000002t \]
> \[ay(t) := diff(vy(t), t); \]
> \[ay(t) := 0.5000000002 \]
> # 2c
> t1 := solve(vy(t)=0,t);
> t1 := 13.99999999
>
> # 2d
> y1 := evalf(subs(t=t1,y(t)));
> y1 := -44.99999999
>
> x1 := evalf(subs(t=t1,x(t)));
> x1 := 87.87048942
>
> # 2e. Never. The acceleration is constant and equal to 1 m/s^2.