

Patriots Over Syria

On June 8, 2012, Iran launches an intermediate range ballistic missile (IRBM) at Israel having a WMD warhead. Israel is protected along its borders by US Patriot missile batteries.

At $t = 0$ seconds, one of the US Patriot missile batteries detects the incoming IRBM warhead at a height of 220,000 ft and having a vertical downward velocity of 4107 ft / second.

Case I: If a Patriot missile can be launched no sooner than 15 seconds after detection, determine the altitude and time (in seconds) after launch the Patriot can intercept the incoming IRBM warhead.

Case II: If the *minimum altitude* the IRBM can be intercepted is 2 miles, determine the latest time a Patriot can be launched to intercept an IRBM.



Include an Excel graph of both missiles' altitude vs. time in seconds showing where they intersect (the time and the height) for both the early and late launch cases.

Remember all ballistic motion (simplified) is governed by the equation:

$$h(t) = (-1/2)g*t^2 + V_0*t + S_0$$

Where:

$h(t)$ is the height at any time t (seconds)

$g = 32.2 \text{ ft/sec}^2$ [acceleration due to gravity]

V_0 = is the initial velocity (ft/sec, downwards is -, + is upwards)

S_0 is the initial height (ft) at time $(t) = 0$ seconds.

Present your solution work in a neat, word-processed format with no handwriting. Include this sheet as the cover page. Explicitly identify the answer!