2-2)

Assume that the rocket starts on the ground at rest.

Since there are two accelerations, we need to break the problem up into two intervals, each of which has a constant acceleration. The final values for the first interval will become the initial values for the second interval.

Let x_i be the start of the problem, x_m be where the engine cuts off, and x_f be the highest altitude attained and similarly for the velocities.

First Interval
$x_i = 0$ m
$x_m = ?$
vi = 0 m/s
$v_m = ?$
$a_I = +40$ m/s^2
$t_I = 5$ sec

$x_m = x_i + v_i t + {}^1/_2\, a_1 t^2 = 0 + 0*5 + {}^1/_2*40*5^2 = 500$ m,

at which time the velocity will be

$v_m = v_i + a_I t = 0 + 40*5 = 200$ m/s.

Second Interval
$x_i = 500$ m
$x_m = ?$
vi = 200 m/s
$v_m = 0$ m/s (It stops at the top.)
$a_{II} = -10$ m/s^2
$t_I = ?$

We can use a couple of ways to find the distance traveled during the second interval.
I chose (4).

$v_f^2 = v_m^2 + 2a_{II}(x_f - x_m)$

Re-arranging the relationship above, we get that

$x_f = (v_f^2 – v_m^2)/2a_{II} + x_m = (0^2 - 200^2)/(2*(-10)) + 500=$ 2500 m