

Quadratic Equations NASA Space Launch

Name _____

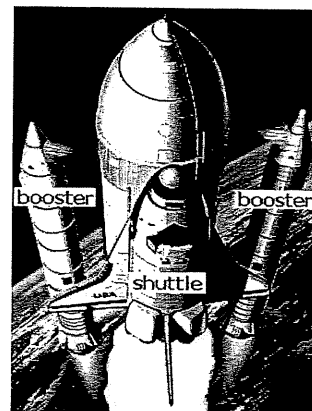
Partner name _____

Period _____ Date _____

You are a scientist working for NASA as they prepare for a shuttle launch.

When a space shuttle is launched, two powerful rocket boosters help give the shuttle enough lift to get it off the ground. A few minutes after lift-off, the boosters detach from the shuttle to reduce its weight. The boosters then fall back to Earth, so it is important for NASA to ensure that they land in uninhabited areas. Specifically, NASA wants the boosters to "splashdown" in the ocean to prevent serious damage, so that they can re-use the boosters.

It is your responsibility to tell the board of directors whether to proceed with the launch as planned—that is, you need to determine whether the boosters will land in the ocean (good) or in a highly populated coastal town (bad).



What you know:

The vertical position of the boosters is modeled by the equation (describes the path of the boosters) is :

$$h(t) = at^2 + bt + c$$

1.

Your groups equation:

$h(t)$ is the height (in feet) of the boosters above the ground,
 t is the time (in seconds) since the boosters were released from the shuttle. ordered pair (time, height)

- The boosters move at a constant horizontal speed of **5000 feet per second** toward the ocean.
- The ocean is 150 miles (_____ feet) away from the point of release. (1 mi = 5280 ft)

What you need to find out:

(It will be easiest if you find the answers to these questions in this order)

- What time will the boosters reach the maximum height? (think formula to find vertex: $t = \frac{-b}{2a}$)

- What is the highest point reached by the boosters? (use what you found from #1 and the equation)

3. How much time will pass between the boosters being released and their splashdown (if in water) or their crash (if on land). (solve for t: either star method or quadratic formula)

Quadratic formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

4. What is the *horizontal* distance traveled by the boosters during that time?
(**time** x **horizontal speed** = **distance**)

5. Will the boosters land in the ocean or on land?

What you need to present to the board of directors:

1. Write the standard, factored (intercept), and vertex forms of the equation for the shuttle's vertical position. Show all your work!!!

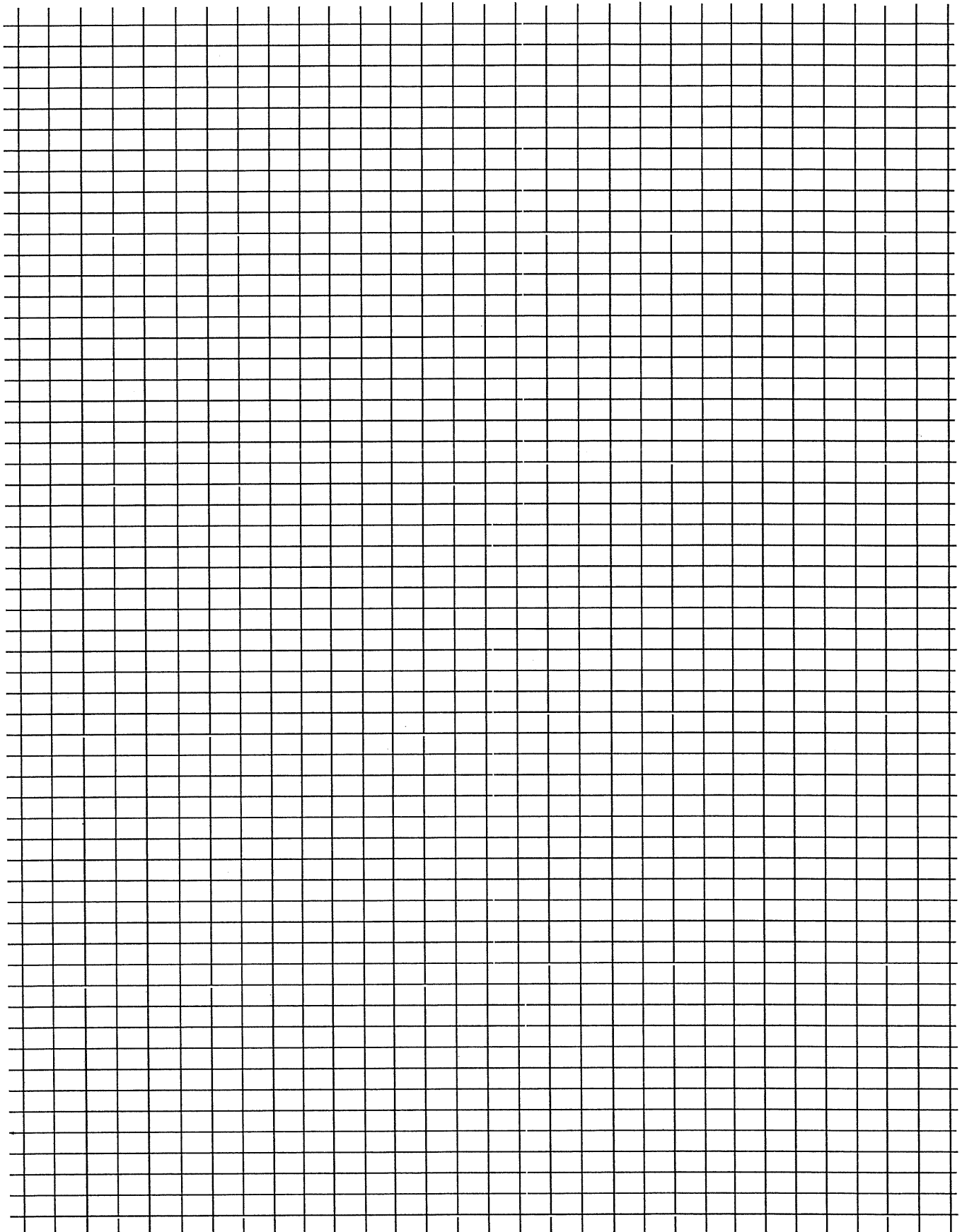
Standard: _____

Factored: _____

Vertex: _____

2. Write a clear recommendation to the board of directors about whether it is safe to proceed with the launch as planned.

3. Draw a graph of the booster's vertical height as time passes, showing time of release and time of crash / splashdown. Be creative and neat in your drawing!!



How it will be graded:

"What you need to find out" (20 pts.)	<u>Possible Points</u>	<u>Earned Points</u>
1. The highest point and the time at which they reach that point	5	
2. The amount of time before landing / splashdown	5	
3. The horizontal distance traveled by the boosters after release	5	
4. Whether the boosters will land in the ocean or on land	5	
"What you need to present to the board" (20 pts.)		
1. Standard, factored, and vertex form.	10	
2. Clear recommendation to the board.	5	
3. Graph showing height vs. time.	5	
GROUP EVALUATIONS (10 points)	10	
Total Points Earned	50	