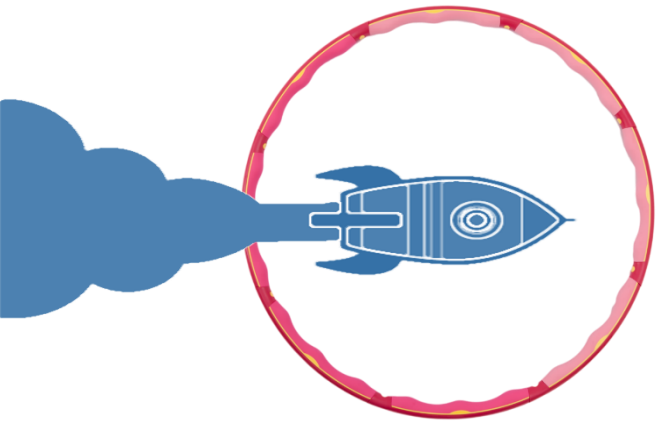


Rockets to the Rescue!

Elementary/Middle School

Hey rocket scientists! We need to write down our results whenever we perform science experiments!		
Use your protractor:	Did it reach Mars? Circle one	How far did it go? (Use the tape on the floor)
Let's launch it at **20 degrees.**	Yes or No	_____ feet
Let's launch it at **30 degrees**.	Yes or No	_____ feet
Let's launch it at **45 degrees**.	Yes or No	_____ feet
Let's launch it at **60 degrees**.	Yes or No	_____ feet
Let's launch it at **70 degrees**.	Yes or No	_____ feet
Let's launch it at **90 degrees**.	Yes or No	_____ feet

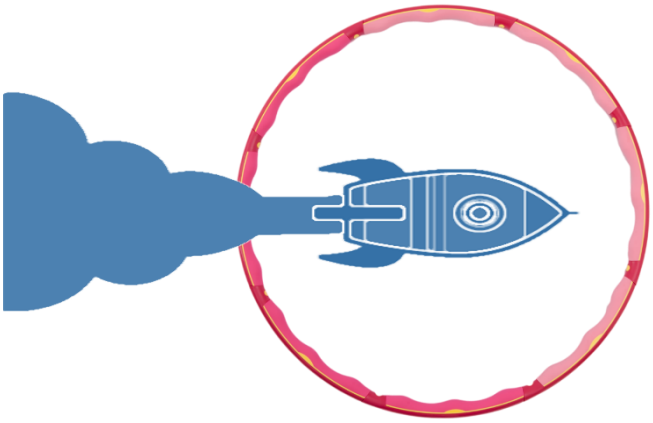
Try to launch your rocket with the same force!

What **angle** launched your rocket the **farthest**? _____

What **angle** launched your rocket straight **upwards**? _____

Did you reach Mars and save Mark Watney? _____

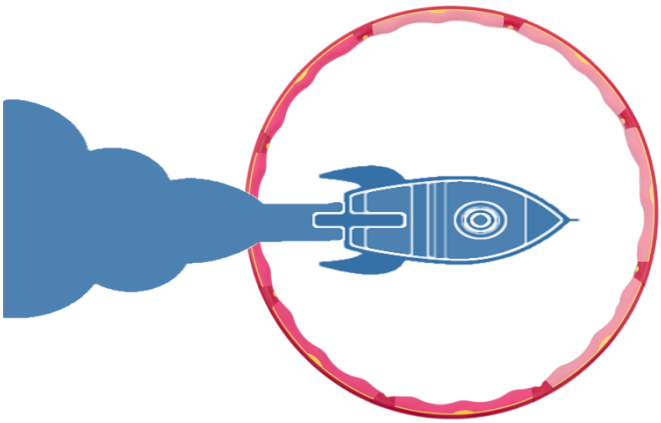
If you reached Mars, which launch **angle** worked the best? _____



Rockets to the Rescue!

Middle School

Hey rocket scientists! We need to write down our results whenever we perform science experiments!		
Use your protractor	Did it reach Mars? Circle one	How far did it go? (Use the tape on the floor)
Let's launch it at **20 degrees.**	Yes or No	_____ feet
Let's launch it at **30 degrees**.	Yes or No	_____ feet
Let's launch it at **45 degrees**.	Yes or No	_____ feet
Let's launch it at **60 degrees**.	Yes or No	_____ feet
Let's launch it at **70 degrees**.	Yes or No	_____ feet
Let's launch it at **90 degrees**.	Yes or No	_____ feet



Rockets to the Rescue!

High School

Hey rocket scientists! Record your data and write down your conclusions, below.		
Select different angles to launch your rocket. Try to launch your rocket with the same force every time.		
Launch Angles	**Distance Traveled**	**Comments**
_____ degrees	Trial 1: _____ Trial 2: _____ Trial 3: _____	
_____ degrees	Trial 1: _____ Trial 2: _____ Trial 3: _____	
_____ degrees	Trial 1: _____ Trial 2: _____ Trial 3: _____	
_____ degrees	Trial 1: _____ Trial 2: _____ Trial 3: _____	
_____ degrees	Trial 1: _____ Trial 2: _____ Trial 3: _____	

Critical Thinking Questions

1. Explain how forcing air into the rocket propels the rocket forward.
2. Relate Newton's laws of motion to your rocket launch.
3. Why do some of the angles reach Mars and some of them do not?
4. From launch to recovery, name as many forces that are acting on the rocket.
5. What angle propels the rocket the farthest? Why is this angle advantageous, compared to a 0 or 90 degree launch?
6. If fins were added to the outside of the rocket, how would they affect the flight?

What is your rocket's velocity?

(You will need a ruler and a stopwatch for this section).

1. How did you find the average velocity of your rocket?

2. Measure the length of your rocket _____ mm

3. Measure the mass of your rocket _____ mg

4. How many fins does your rocket have? _____
    a. Where did you place them? Why?
    b. How does the placement of the fins affect the stability of the flight?

5. Fill out the table, below. Launch your rocket four times and record your data.

		Trial 1	Trial 2	Trial 3	Trial 4	**Averages**
20 degrees	Time (seconds)					
	Distance (meters)					
45 degrees	Time (seconds)					
	Distance (meters)					
80 degrees	Time (seconds)					
	Distance (meters)					

6. What is the average **velocity** of your rocket? Please show your math.
    a. 20 degrees:
    b. 45 degrees:
    c. 80 degrees:

7. Your rocket has been selected to carry three astronauts in the capsule of your rocket. How would the trajectory change?

8. With the astronauts onboard, would the rocket's velocity change? Why or why not?

Relating Velocity, Distance, Altitude, and Time

9. Which launch angle had the:
    a. Longest time of flight? _____
    b. Shortest time of flight? _____

10. What launch angle propelled your rocket the
    a. Farthest distance?
    b. Shortest distance?

11. Did your rocket's design contribute to a successful or unsuccessful mission?

12. How would you improve your rocket's design?

13. Draw a sketch of your rocket, including the placement of the fins.