National Aeronautics and Space Administration

LAUNCH INTO MATH

Exercise 4: Maximums, Minimums, and Inequalities

The first 8 1/2 minutes of flight are pretty busy for the Space Launch System (SLS) rocket! Within 10 seconds of launch, the rocket clears the launch tower at Kennedy Space Center. Within 2 minutes, after burning through 3 million lbs. of propellant, the boosters separate from the rocket and fall toward the Atlantic Ocean. After 8½ minutes, the SLS core stage separates from the Orion spacecraft and falls toward the Pacific Ocean. At this point, Orion is orbiting Earth and preparing for the next big push—this time, to the Moon!

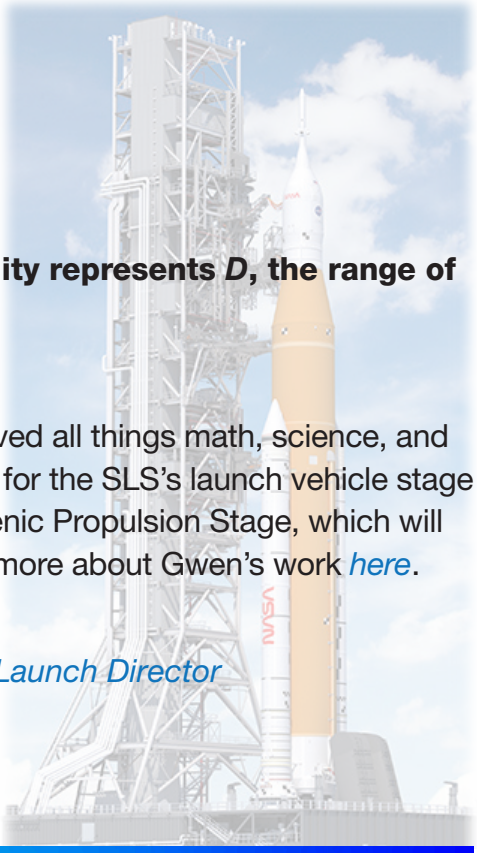
Feel free to use a calculator for these exercises... unless you really love long multiplication and division.

In the Blink of an Eye

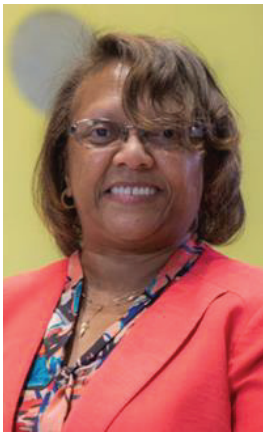
When it comes to rockets, a lot can happen in 8½ minutes. But what can the SLS do in practically no time at all – not a minute, not even a second, but a fraction of a second?

Problem 1: It takes between 100 and 400 milliseconds to blink. The travel speed of the SLS is about 24,500 miles per hour. **At this speed, what is the maximum distance the SLS travels in the blink of an eye? What is the minimum distance?** Round your answers to the nearest hundredth mile.

Travel speed of the SLS: 24,500 miles per hour
Minutes in an hour: 60
Seconds in a minute: 60
Milliseconds in a second: 1,000
Time it takes to blink: 100 to 400 milliseconds



Problem 2: Let's say the SLS is moving at travel speed. **What inequality represents *D*, the range of distances the SLS covers in the blink of an eye?**



Meet the Artemis Team

Growing up in Huntsville, Alabama, Gwen Artis loved all things math, science, and space. Today, Gwen is a senior systems engineer for the SLS's launch vehicle stage adapter (the part that encloses the Interim Cryogenic Propulsion Stage, which will propel the rocket once it's in Earth's orbit). Learn more about Gwen's work *here*.

Additional Resources

Houston, We Have a Podcast episode: *Artemis Launch Director*
How Far Will It Go? Activity
Explore the SLS Web Interactive

Solutions to Exercise 4: Maximums, Minimums, and Inequalities

In the Blink of an Eye

Problem 1: It takes between 100 and 400 milliseconds to blink. The travel speed of the SLS is about 24,500 miles per hour. **At this speed, what is the maximum distance the SLS travels in the blink of an eye? What is the minimum distance?** Round your answers to the nearest hundredth mile.

Measurements:

Travel speed of the SLS: 24,500 miles per hour
Minutes in an hour: 60
Seconds in a minute: 60
Milliseconds in a second: 1,000
Time it takes to blink: 100 to 400 milliseconds

Solution:

Travel speed in minutes: $\frac{24{,}500 \text{ miles}}{1 \text{ hour}} \cdot \frac{1 \text{ hour}}{60 \text{ minutes}} \approx 408.333$ miles per minute

Travel speed in seconds: $\frac{408.333 \text{ miles}}{1 \text{ minute}} \cdot \frac{1 \text{ minute}}{60 \text{ seconds}} \approx 6.806$ miles per second

Travel speed in milliseconds: $\frac{6.806 \text{ miles}}{1 \text{ second}} \cdot \frac{1 \text{ second}}{1{,}000 \text{ milliseconds}} \approx 0.006806$ miles per millisecond

Distance traveled in 100 milliseconds: $\frac{0.006806 \text{ miles}}{1 \text{ millisecond}} \cdot 100 \text{ milliseconds} \approx 0.68$ miles

Distance traveled in 400 milliseconds: $\frac{0.006806 \text{ miles}}{1 \text{ millisecond}} \cdot 400 \text{ milliseconds} \approx 2.72$ miles

Final solution: At travel speed, the SLS travels a minimum distance of 0.68 miles in the blink of an eye. It travels a maximum distance of 2.72 miles in the blink of an eye.

Problem 2: Let's say the SLS is moving at travel speed. **What inequality represents *D*, the range of distance in miles the SLS covers in the blink of an eye?**

Measurements:

Minimum distance: 0.68 miles
Maximum distance: 2.72 miles

Solution:

Since the SLS travels a maximum distance of 2.72 miles in blink of an eye, we know that $D \leq 2.72$.
Since the SLS travels a minimum distance of 0.68 miles in blink of an eye, we know that $D \geq 0.68$.
Since $D \leq 2.72$ and $D \geq 0.68$, then $0.68 \leq D \leq 2.72$.

Final solution: The range of distances the SLS covers in the blink of an eye at travel speed is represented by the inequality: 0.68 miles $\leq D \leq$ 2.72 miles.