Next Generation Spacecraft – Orion

Background

Exploration provides the foundation of our knowledge, technology, resources, and inspiration. It seeks answers to fundamental questions about our existence, responds to recent discoveries and puts in place revolutionary techniques and capabilities to inspire our nation, the world, and the next generation. Through NASA, we touch the unknown, we learn and we understand. As we take our first steps toward sustaining a human presence in the solar system, we can look forward to far-off visions of the past becoming realities of the future.

The Vision for Space Exploration includes returning the space shuttle safely to flight, completing the International Space Station, developing a new exploration vehicle and all the systems needed for embarking on extended missions to the Moon, Mars, and beyond.

Orion is the vehicle NASA is developing to carry a new generation of explorers back to the Moon and later to Mars. Orion will succeed the space shuttle as NASA's primary vehicle for human space exploration. Figure 1 shows some components of the Orion spacecraft.

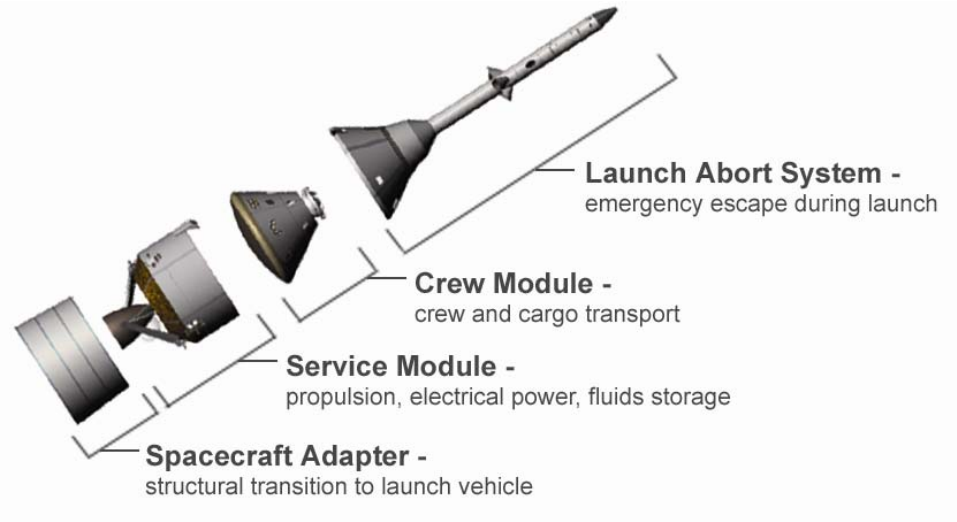

Figure 1: Components of the Orion spacecraft (NASA concept)

Orion will use an improved, larger blunt-body capsule, much like the shape of the Apollo capsule (Figure 2). With an outside diameter of 5 meters, the Orion crew module will have more than two and a half times the volume of an Apollo capsule.

During Orion's planning process, NASA studied several different kinds of entry vehicles and rockets. Although Apollo-era researchers were consulted, NASA did not set out to make the Orion spacecraft

identical to the Apollo spacecraft. Ultimately, this design was found to meet the requirements while being the most effective within the safety goals.

For more information about Orion and the Vision for Space Exploration, visit www.nasa.gov.

NASA concept of the Orion crew module

Apollo capsule

Figure 2: Shape comparison of the Orion crew module and the Apollo capsule (not to scale)

Instructional Objectives

- You will decompose a larger geometric shape into smaller parts.
- You will apply the proper area formulas for various geometric shapes.
- You will estimate the area of a complex geometric shape using decomposition methods.

Problem

The Orion spacecraft will replace the space shuttle as NASA's spacecraft for human space exploration. The vehicle is designed to accommodate four to six astronauts traveling into space. This activity focuses on the Orion crew module, one of four functional modules of the Orion spacecraft. You will find the areas of the largest vertical and horizontal cross-sections. This information will provide you with a sense of the room within the crew module. You will also be asked how many crew modules could fit in your classroom. This might be extended to larger areas such as the gymnasium or cafeteria.

1. To get a sense of the room inside the crew module, find the area, in square meters (m^2), for the largest vertical cross-section (Figure 3; Figure 4). Show how you would decompose, or break the figure into smaller parts, to estimate the total vertical area. You may use a calculator. Record your information in the table provided (Table 1). Please round your answer to three decimal places.

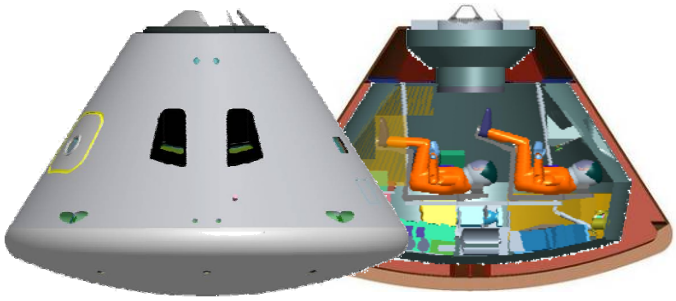

Figure 3: Vertical cross-section of the Orion crew module (NASA Concept)

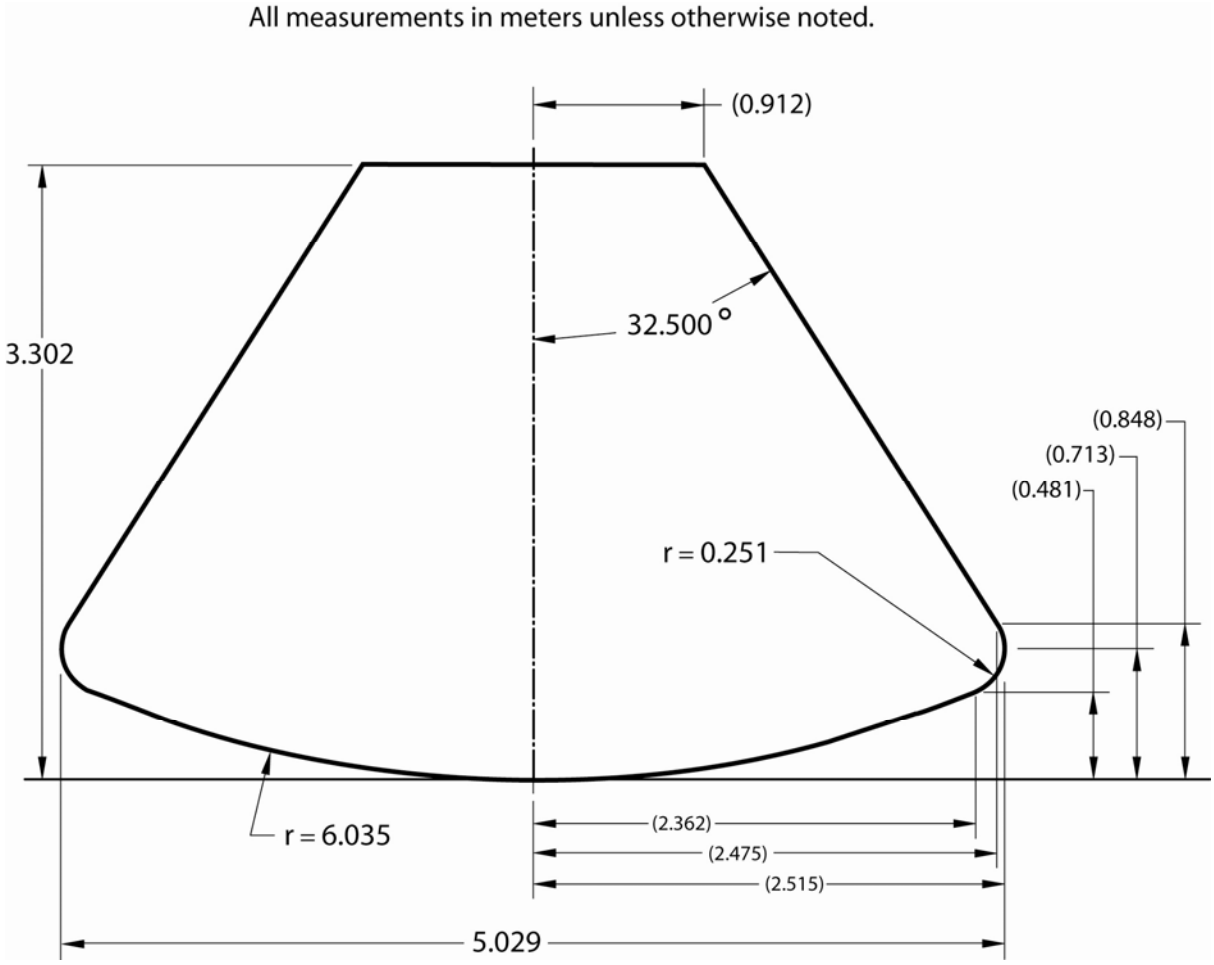

Figure 4: Largest vertical cross-section of the Orion crew module

Table 1: Vertical Cross-Section Area Data

Figure	Area Formula	Area Formula with Values	Area (m^2)
		Total Area:	

2. If the actual largest vertical cross-sectional area of the crew module is 11.665 m^2, how far off was your estimate? Express your answer in terms of a percent (percent error). Please round your answer to the nearest percent.

3. Find the area, in square meters (m^2), for the largest horizontal cross-section (Figure 5; Figure 6). Show how you would decompose, or break the figure into smaller parts, to estimate the total horizontal area. You may use a calculator to evaluate the formulas. Record your information in the table provided (Table 2). Round your answer to three decimal places.

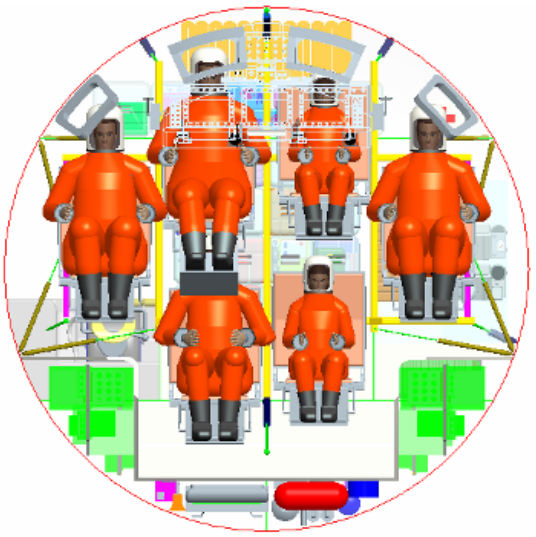

Figure 5: Horizontal cross-section of the Orion crew module (NASA Concept)

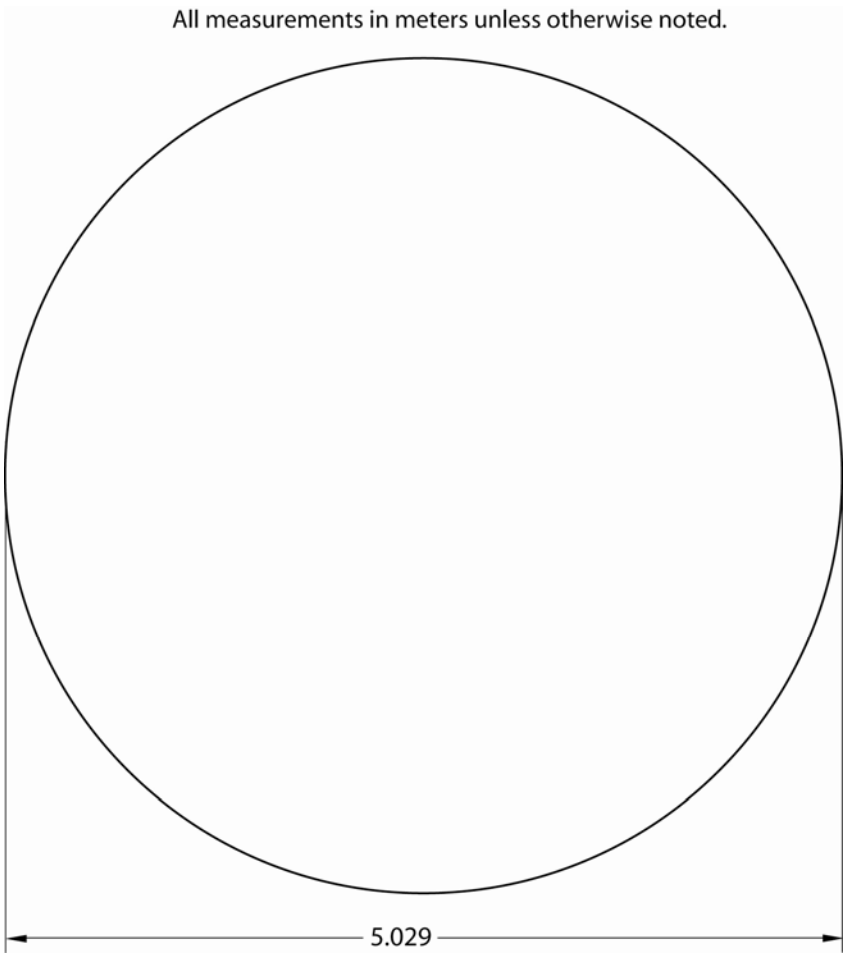

Figure 6: Largest horizontal cross-section of the Orion crew module

Table 2: Horizontal Cross-Section Area Data

Figure	Area Formula	Area Formula with Values	Area (m^2)
		Total Area:	

Use $\pi = 3.142$

4. If lined up side by side, how many of the largest horizontal cross-sections of the Orion crew module (Figure 6) do you think would fit in your classroom? Explain your answer.

5. Would the largest vertical cross-section of the Orion crew module (Figure 4) fit in your classroom? Explain your answer.