

SPINOFFS

Spinoffs are relatively short learning modules inspired by the LTAs. They can be easily implemented to support student learning in courses ranging from prealgebra through calculus. The Spinoffs typically give students an opportunity to use mathematics in a real world context.

LTA - SPINOFF 19A

Bubbles

LTA - SPINOFF 19B

Designing the Scott Carpenter
Space Analog Station

LTA - SPINOFF 19C

Carbon Dioxide Buildup in the
Scott Carpenter Space Analog Station

Jeanne Bowman - AMATYC Writing Team Member
University of Cincinnati, Cincinnati, **Ohio**

Peg Greene - AMATYC Writing Team Member
Florida Community College at Jacksonville, Jacksonville, **Florida**

Dennis Chamberland - NASA Scientist/Engineer
Kennedy Space Center, **Florida**

Gus Koerner - NASA Scientist/Engineer
Kennedy Space Center, **Florida**



Project Grant Team

John S. Pazdar
Project Director
Capital Community College
Hartford, Connecticut

Patricia L. Hirschy
Principal Investigator
Asnuntuck Community College
Enfield, Connecticut

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Peter A. Wursthorn
Principal Investigator
Capital Community College
Hartford, Connecticut

SPINOFF 19B

Designing the Scott Carpenter Space Analog Station

When engineers design a structure like the Scott Carpenter Space Analog Station they have to be sure that it is strong enough for conditions both on land and underwater. One of the things the engineer checks is the Station's load on the soil.

- 1) The approximate weight of the structure and contents is 26,291 pounds. There are four legs on the Station. If the weight is equally distributed on each of the four legs, to the nearest pound what is the weight on each leg?
- 2) The circular footpad on the bottom of the leg is made of 3/8 inch steel, 24 inches in diameter. Find the area of one of the footpads to the nearest square inches
- 3) To find the load on the soil the engineer divides the weight on the leg by the area of the footpad on the bottom of the leg.

$$\text{Load} = \frac{\text{weight on leg}}{\text{area of footpad}} = \frac{\text{_____ lb}}{\text{_____ sq in}}$$

So the load is _____ psi.

The engineer also needs to look at the stress that the leg itself places on the top surface of the footpad. In these calculations the engineer makes the assumption that the leg makes "flat, full contact" with the footpad. The leg is a metal pipe 0.32 inches thick with a diameter of 4 inches. It has inch-long notches on opposite sides of the leg. The engineer first needs to determine the area of the leg that is actually touching the footpad (the shaded area in Figure 1 below).

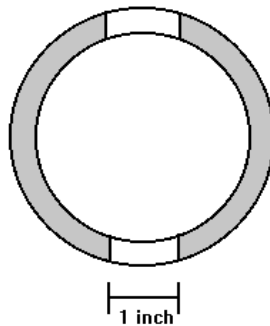


Figure 1

- 4) Find R_o , the outer radius of the pipe.
- 5) Find R_i , the inner radius of the pipe.

- 6) Before the notches are cut out what is the area of a cross-section of the pipe?
- 7) To simplify calculations the engineer approximates the area of the notches by assuming they are rectangles. So these notches are approximately _____ inches long and _____ inches wide. The area of one notch is _____ square inches. There are two notches so the total area of the notches is _____ square inches.
- 8) The area of the shaded region (the part of the leg in contact with the footpad) is _____
- 9) To find the stress that the leg places on the top surface of the footpad, the engineer divides the weight on the leg in pounds (which you found in Exercise 1) by the area of the part of the leg that is touching the footpad.

$$\text{Stress} = \frac{\text{weight on the leg}}{\text{area of the part touching the footpad}} = \frac{\text{_____ lb}}{\text{_____ sq in}}$$

$$= \text{_____ psi}$$