

Objective: Find the inverse of a function model in context.

Concept

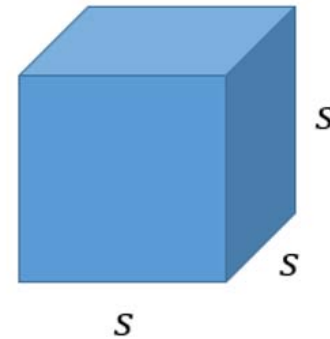
In a context situation, the inverse of a function tells you how to find the value of what was the independent variable in the original function model, given the value of what was the dependent variable.

Function that models the volume of a cube relative to the measure of an edge.

$$V(s) = s^3$$

Inverse Function that models the measure of a cube's edge relative to its volume.

$$s(V) = \sqrt[3]{V}$$



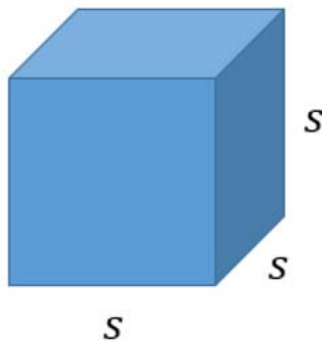
Objective: Find the inverse of a function model in context.

Concept

**Determining Domain and Range of the Inverse Function in a Real-World Applications**

As with all functions and their inverse functions, **the domain of an inverse function is the range of the original function** and **the range of the inverse function is the domain of the original function**.

**Domains may need to be restricted** based on the type of inverse function and so they are reasonable values of the independent variable in the given context.



Original Function:  $V(s) = s^3$

**Domain:** edge measurements greater than 0

**Range:** volume measurements greater than 0

Inverse Function:  $s(V) = \sqrt[3]{V}$

**Domain:** volume measurements greater than 0

**Range:** edge measurements greater than 0



Objective: Find the inverse of a function model in context.

Concept

The procedure for solving a function or equation for another variable is the same as solving an equation in one variable for the value of the variable. The algebra must be done in the reverse order of the order of operations.

**Procedure for Solving a Function or Equation for Another Variable**

**Undo Operations Outside of Parentheses**

1. Undo Addition and Subtraction outside parentheses
2. Undo Multiplication and Division outside parentheses
3. Undo Exponents outside parentheses

**Undo Operations Inside Parentheses**

1. Undo Addition and Subtraction outside parentheses
2. Undo Multiplication and Division outside parentheses
3. Undo Exponents outside parentheses



Objective: Find the inverse of a function model in context.

Ex) The function  $f(A) = 4\sqrt{A} - 6$  models how many feet of fencing  $f$  a farmer needs to buy to make a square holding pen with a 6-foot gap for a gate, where  $A$  is the area of the holding pen in square feet.

a) Write the inverse function to find the area of a square holding pen with a 6-foot gate given the amount of fencing.

$$f(A) = 4\sqrt{A} - 6$$

$$f = 4\sqrt{A} - 6$$

$$f + 6 = 4\sqrt{A}$$

$$\frac{f+6}{4} = \sqrt{A}$$

$$\left(\frac{f+6}{4}\right)^2 = (\sqrt{A})^2$$

$$A = \left(\frac{f+6}{4}\right)^2$$

$$A(f) = \left(\frac{f+6}{4}\right)^2$$

b) Describe the domain and range of the inverse function model. Include restrictions.



domain: feet of fencing a farmer needs to buy to make a square holding pen with a 6-foot gap for a gate, where  $f$  is at least 18 feet.  
 range: the area of the holding pen in square feet, where  $A$  is at least 36 sq. feet

c) Estimate the area of a square holding pen with a 6-foot gate and 128.5 feet of fencing. Round to three decimal places.

$$A(f) = \left(\frac{f+6}{4}\right)^2$$

$$f = 128.5 \text{ feet}$$

$$A(128.5) = \left(\frac{128.5+6}{4}\right)^2 \approx 1130.641 \text{ sq. ft.}$$

The area of a square holding pen with a 6-foot gate and 128.5 feet of fencing is about 1130.64 square feet.



Objective: Find the inverse of a function model in context.

Ex) The function  $h = 62.1\sqrt[3]{t} + 76$  models the shoulder height  $h$  in centimeters of a particular elephant at  $t$  years of age.

a) Write the inverse function to find the age of the elephant in years given its shoulder height in centimeters.

$$h = 62.1\sqrt[3]{t} + 76$$

$$h - 76 = 62.1\sqrt[3]{t}$$

$$\frac{h - 76}{62.1} = \sqrt[3]{t}$$

$$t = \left(\frac{h - 76}{62.1}\right)^3 \rightarrow t(h) = \left(\frac{h - 76}{62.1}\right)^3$$

b) Describe the domain and range of the inverse function model. Include restrictions.



domain: shoulder height in centimeters of a particular elephant, where  $h$  is at least 76 cm.

range: age of the elephant in years, where  $t$  is at least 0 years.

c) Estimate the age, in years and months, of the elephant when its shoulder height is 193.4 centimeters. Round to three decimal places.

$$t(h) = \left(\frac{h - 76}{62.1}\right)^3 \rightarrow t(193.4) = \left(\frac{193.4 - 76}{62.1}\right)^3 \approx 6.756 \dots \text{ years}$$

6 yr and .756... yr  
 $\times \frac{12 \text{ mo}}{\text{yr}}$

The elephant's age is about 6 yr 9.079 months when its shoulder height is 193.4 cm.

$\approx 6 \text{ yr } 9.079 \text{ mo}$