LESSON MAKER PRO

Undo the Function

Find an expression that takes each output back to its input.

HIGH SCHOOL · F.BF.4a

F.BF.4a "Find inverse functions. Write an expression for the inverse of a simple, invertible function f(x). Understand that an inverse function can be obtained by expressing the dependent variable of one function as the independent variable of..."

NAME _____ DATE _____

REVERSE THE STEPS

An inverse function takes an output of a function and returns the original input. To find an inverse, write f(x) as y, switch x and y, then solve for y. The original function must give each input a different output so the inverse has only one answer for each input.

WORKED EXAMPLE

Find the inverse of $f(x) = 13x + 17$.

1. Write $y = 13x + 17$.
2. Switch x and y: $x = 13y + 17$.
3. Subtract 17: $x - 17 = 13y$.
4. Divide by 13: $y = (x - 17)/13$.

Answer: $f^{-1}(x) = (x - 17)/13$

PRACTICE 6 problems

1 Find the inverse of $f(x) = 3x + 5$.

ANSWER _____

2 Find the inverse of $f(x) = (x - 4)/2$.

ANSWER _____

3 Find the inverse of $f(x) = 9 - 2x$.

ANSWER _____

4 Find the inverse of $f(x) = 5x/4 + 1$.

ANSWER _____

5 Find the inverse of $f(x) = x/6 - 3$.

ANSWER _____

6 For $f(x) = 4/(x - 1)$, find the inverse and state its domain.

ANSWER _____

APPLY IT Show your work

1 Concert tickets cost $12 each, plus a $6 fee for the whole order. The cost of x tickets is C(x) = 12x + 6, where x is a whole number. Write an inverse expression for the number of tickets bought, then find how many tickets cost $42.

WORK SPACE

ANSWER _____

2 A travel weather app converts a temperature of x degrees Celsius to degrees Fahrenheit using F(x) = 9x/5 + 32. Write an inverse expression that converts Fahrenheit to Celsius. Then use it to convert 68°F to Celsius.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Find the inverse of $f(x) = (x - 2)^2 + 1$ for $x \geq 2$. State the inverse's domain and explain why you use the positive square root.

WORK SPACE AND ANSWER

ANSWER KEY

Undo the Function

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find the inverse of f(x) = 3x + 5.	**$f^{-1}(x) = (x - 5)/3$**
2	Find the inverse of f(x) = (x - 4)/2.	**$f^{-1}(x) = 2x + 4$**
3	Find the inverse of f(x) = 9 - 2x.	**$f^{-1}(x) = (9 - x)/2$**
4	Find the inverse of f(x) = 5x/4 + 1.	**$f^{-1}(x) = 4(x - 1)/5$**
5	Find the inverse of f(x) = x/6 - 3.	**$f^{-1}(x) = 6(x + 3)$**
6	For f(x) = 4/(x - 1), find the inverse and state its domain.	**$f^{-1}(x) = 1 + 4/x$; domain: $x \neq 0$**

PART 2 · APPLY IT

1. **$C^{-1}(x) = (x - 6)/12$; 3 tickets** Subtract the order fee, then divide by the price per ticket. $C^{-1}(42) = (42 - 6)/12 = 3$.
2. **$F^{-1}(x) = 5(x - 32)/9$; 20°C** Subtract 32 from the Fahrenheit temperature, then multiply by 5/9. $F^{-1}(68) = 5(68 - 32)/9 = 20$.

CHALLENGE

$f^{-1}(x) = 2 + \text{sqrt}(x - 1)$, with domain $x \geq 1$. The positive square root is needed because the original domain makes $x - 2$ nonnegative.

Accept algebraically equivalent inverse expressions. In the challenge, accept an explanation that the inverse must return values of at least 2.