LESSON MAKER PRO

# Reverse the Rule

*Find expressions that undo functions.*

**HIGH SCHOOL · PC.F.D.28.a**

**PC.F.D.28.a** "Given that a function has an inverse, write an expression for the inverse of the function."

NAME _____ DATE _____

## FINDING AN INVERSE

A function has an inverse function when each output comes from at most one input. To find an inverse expression, write y = f(x), switch x and y, then solve for y. The inputs of the inverse are the outputs of the original function.

## WORKED EXAMPLE

Find the inverse of $f(x) = 7x + 5$.

1. Write $y = 7x + 5$.
2. Switch x and y: $x = 7y + 5$.
3. Subtract 5: $x - 5 = 7y$.
4. Divide by 7: $y = (x - 5)/7$.

**Answer: $f^{-1}(x) = (x - 5)/7$**

## PRACTICE 6 problems

**1** Find $f^{-1}(x)$ if $f(x) = 2x + 6$.

**ANSWER** _____

**2** Find $g^{-1}(x)$ if $g(x) = (x - 8)/11$.

**ANSWER** _____

**3** Find $h^{-1}(x)$ if $h(x) = -6x + 1$.

**ANSWER** _____

**4** Find $p^{-1}(x)$ if $p(x) = x^2 + 16$ for $x \geq 0$.

**ANSWER** _____

**5** Find $q^{-1}(x)$ if $q(x) = \text{sqrt}(x + 10)$ for $x \geq -10$.

**ANSWER** _____

**6** Find $r^{-1}(x)$ if $r(x) = 1/(x + 2)$ for $x \neq -2$.

**ANSWER** _____

## APPLY IT Show your work

**1** A rideshare trip costs $14 to start, plus $2 per mile. The cost is $C(x) = 2x + 14$, where $x$ is the distance in miles and $x \geq 0$. Write $C^{-1}(x)$, an expression for the distance based on the total cost in dollars.

WORK SPACE

**ANSWER** _____

**2** A music platform pays a producer 3/4 of a beat's list price plus a $6 promotion bonus. The producer's earnings are $E(x) = 3x/4 + 6$, where $x$ is the list price in dollars and $x \geq 0$. Write $E^{-1}(x)$, an expression for the list price based on the earnings.

WORK SPACE

**ANSWER** _____

## CHALLENGE One step up

Find the inverse of $f(x) = (2x + 1)/(x - 6)$, where $x \neq 6$. State the value excluded from the inverse's domain.

WORK SPACE AND ANSWER

**ANSWER KEY**

# Reverse the Rule



## PART 1 · PRACTICE

| # | PROBLEM | ANSWER |
|---|---|---|
| 1 | Find $f^{-1}(x)$ if $f(x) = 2x + 6$. | **$f^{-1}(x) = (x - 6)/2$** |
| 2 | Find $g^{-1}(x)$ if $g(x) = (x - 8)/11$. | **$g^{-1}(x) = 11x + 8$** |
| 3 | Find $h^{-1}(x)$ if $h(x) = -6x + 1$. | **$h^{-1}(x) = (1 - x)/6$** |
| 4 | Find $p^{-1}(x)$ if $p(x) = x^2 + 16$ for $x \geq 0$. | **$p^{-1}(x) = \text{sqrt}(x - 16)$** |
| 5 | Find $q^{-1}(x)$ if $q(x) = \text{sqrt}(x + 10)$ for $x \geq -10$. | **$q^{-1}(x) = x^2 - 10$, for $x \geq 0$** |
| 6 | Find $r^{-1}(x)$ if $r(x) = 1/(x + 2)$ for $x \neq -2$. | **$r^{-1}(x) = 1/x - 2$, for $x \neq 0$** |

## PART 2 · APPLY IT

1. **$C^{-1}(x) = (x - 14)/2$, for $x \geq 14$** Switch the cost and distance variables, then solve $x = 2y + 14$ for $y$. A trip costs at least \$14.
2. **$E^{-1}(x) = 4(x - 6)/3$, for $x \geq 6$** Solve $x = 3y/4 + 6$ for $y$ by subtracting 6 and multiplying by 4/3. Earnings are at least \$6.

## CHALLENGE

**$f^{-1}(x) = (6x + 1)/(x - 2)$, where $x \neq 2$**

Accept algebraically equivalent expressions. For the fourth problem, the inverse's domain is $x \geq 16$; for the fifth and sixth problems, the stated domain restrictions are required for the inverse expressions to be defined.