Warm Up

1) For all positive values of s, t and h, which of the following is equivalent to $\frac{(s^2)^3 t^2 (t)^3}{h^{-2}}$?

A. $s^5 t^6 h^2$
B. $s^6 t^5 h^2$
C. $s^6 t^6 h^2$
D. $\frac{s^5 t^6}{h^2}$
E. $\frac{s^6 t^5}{h^2}$

$$\frac{(s^2)^3 t^2 (t)^3}{h^{-2}} = \frac{s^6 t^5}{h^{-2}} = s^6 t^5 h^2$$

2) $(\sqrt[5]{-32})^4$

$(-2)^4 = 16$

Homework Questions

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$C = 60x + 750$

$x(t) = 50t$

$C(x(t))$

$C(x(5))$

$60(50t) + 750$

$3000(5) + 750$

$3000t + 750$

$\$15,750$

$f(x) = 9 - x \quad g(x) = x^2 + x \quad h(x) = x - 2$

15 $g(h(x))$

$(x-2)^2 + (x-2)$

$x^2 - 4x + 4 + x - 2$

$x^2 - 3x + 2$

16 $g(h(f(x)))$

$((9-x)-2)^2 + ((9-x)-2)$

$(7-x)^2 + 7 - x$

$49 - 14x + x^2 + 7 - x$

$x^2 - 15x + 56$

DLT

6.4 Inverse Functions

★ What does it mean to be an inverse?

★ How do I find an inverse?

★ What is the horizontal line test?

Plot these points.

1	5
0	3
-1	1
-2	-1

$y = x$

Plot these points.

5	1
3	0
1	-1
-1	-2

What is an inverse relation?

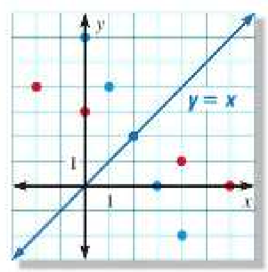
<u>Inverse relation</u>- interchanges the input and output values of the original relation.

Original relation

x	0	1	2	3	4
y	6	4	2	0	−2

Inverse relation

x	6	4	2	0	−2
y	0	1	2	3	4



The graph of an inverse relation is a *reflection* of the graph of the original relation. The line of reflection is $y = x$. To find the inverse of a relation given by an equation in x and y, switch the roles of x and y and solve for y.

Find an inverse relation.

$f(x)=2x+4$

a) y=2x+4

$x = 2y+4$
$-4 \quad\; -4$

$\frac{x-4}{2} = \frac{2y}{2}$

$\frac{x-4}{2} = y$

$y = \frac{x-4}{2}$

$f^{-1}(x) = \frac{x-4}{2}$

b) y=-4x+1

$x = -4y+1$
$-1 \quad\; -1$

$\frac{x-1}{-4} = \frac{-4y}{-4}$

$\frac{x-1}{-4} = y$ or $y = \frac{x-1}{-4}$

Steps:

1) Write original relatior

2) Switch x and y.

3) Solve for y.

What is an inverse function?

READING
The symbol -1 in f^{-1} is not to be interpreted as an exponent. In other words, $f^{-1}(x) \neq \frac{1}{f(x)}$.

KEY CONCEPT *For Your Notebook*

Inverse Functions

Functions f and g are inverses of each other provided:

$$f(g(x)) = x \quad \text{and} \quad g(f(x)) = x$$

The function g is denoted by f^{-1}, read as "f inverse."

$\cancel{f^{-1}(x) = \frac{1}{f(x)}}$

f^{-1}

g^{-1}

Verify that functions are inverses.

$f(x)= 3x-2 \quad f^{-1}(x)=\frac{x + 2}{3}$

$f(f^{-1}(x)) = \cancel{3}\left(\frac{x+2}{\cancel{3}}\right) - 2$

$= x + 2 - 2$

$= x$

$f^{-1}(f(x)) = \frac{(3x-\cancel{2}) \cancel{+2}}{3}$

$= \frac{\cancel{3}x}{\cancel{3}}$

$= x$

$f(f^{-1}(x))=x$

and

$f^{-1}(f(x))=x$

TOYO

Verify that functions are inverses.

Ex 1: $f(x)= x+4$ $\cancel{g(x)}$ $f^{-1}(x)$ $=x-4$

$f(f^{-1}(x))$

$(x-4)+4$

x

$f^{-1}(f(x))$

$(x+4)-4$

x

Find the inverse of the given function. Then verify that your result and the original function are inverses.

Ex 2: $f(x)= 2x-1$

$y=2x-1$

$x=2y-1$

$\frac{x+1}{2}=\frac{2y}{2}$

$y=\frac{x+1}{2}$

Ex 3: $f(x)=-3x+1$

Find the inverse.

$f(x)= 2x^3+1$

$Y = 2x^3 + 1$

$X = 2Y^3 + 1$

$-1 \qquad -1$

$\frac{X-1}{2} = \frac{2Y^3}{2}$

$\sqrt[3]{\frac{X-1}{2}} = \sqrt[3]{Y^3}$

$Y = \sqrt[3]{\frac{X-1}{2}}$

$$y = \sqrt[5]{\frac{x-3}{2}}$$

$$(x)^5 = \left(\sqrt[5]{\frac{y-3}{2}}\right)^5$$

$$2 \cdot x^5 = \frac{y-3}{\cancel{2}} \cdot \cancel{2}$$

$$2x^5 = y-3$$

$$2x^5 + 3 = y$$

or

$$y = 2x^5 + 3$$

① $y = -\frac{2}{5}(x+1)^4 - 4$

$x = -\frac{2}{5}(y+1)^4 - 4$

$+4 \qquad +4$

$-\frac{5}{2}(x+4) = -\frac{5}{2}\left(-\frac{2}{5}(y+1)^4\right)$ $\quad \frac{-10}{-10}$

$\sqrt[4]{-\frac{5}{2}(x+4)} = \sqrt[4]{(y+1)^4}$

$\sqrt[4]{-\frac{5}{2}(x+4)} = y+1$

$-1 \qquad -1$

$\sqrt[4]{-\frac{5}{2}(x+4)} - 1 = y$

$y = \sqrt[4]{-\frac{5}{2}(x+4)} - 1$

4) $y = -4(x-1)^{2/3} + 2$

$x = -4(y-1)^{2/3} + 2$

$-2 \qquad\qquad\qquad -2$

$\frac{x-2}{-4} = \frac{\cancel{-4}(y-1)^{2/3}}{\cancel{-4}}$

$\left(\frac{x-2}{-4}\right)^{3/2} = \left((y-1)^{\cancel{2/3}}\right)^{\cancel{3/2}}$

$\left(\frac{x-2}{-4}\right)^{3/2} = y-1$

$+1 \qquad\qquad +1$

$\left(\frac{x-2}{-4}\right)^{3/2} + 1 = y$

$y = \left(\frac{x-2}{-4}\right)^{3/2} + 1$

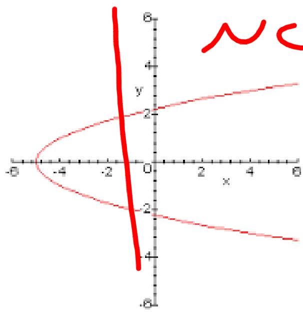
TOYO

Find the inverse.

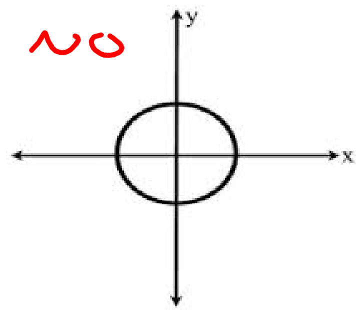
$$f(x)= 2x^5+3$$

How do we determine if an equation is a function from a graph?

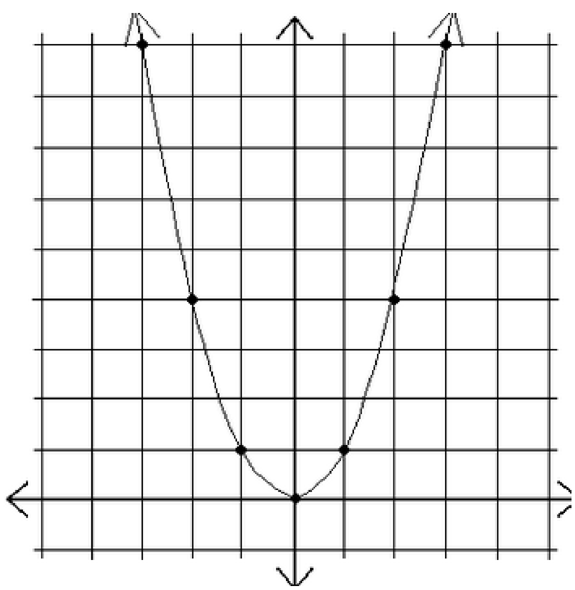
NO



NO



Yes



Horizontal Line Test

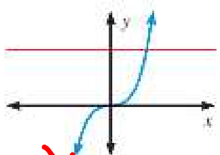
HORIZONTAL LINE TEST You can use the graph of a function f to determine whether the inverse of f is a function by applying the *horizontal line test*.

KEY CONCEPT *For Your Notebook*

Horizontal Line Test

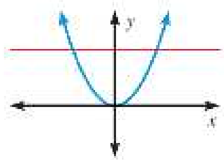
The inverse of a function f is also a function if and only if no horizontal line intersects the graph of f more than once.

Inverse is a function



Yes

Inverse is not a function



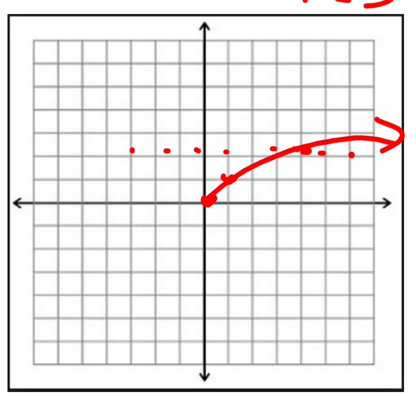
No

Horizontal Line Test

Graph: $f(x)=\sqrt{x}$

x	y
0	0
1	1
4	2

Yes



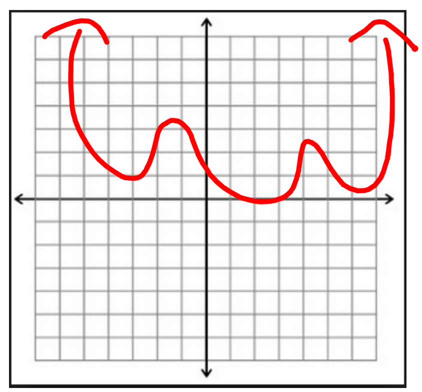
Horizontal Line Test

Graph: $f(x)=x^2$

Horizontal Line Test

Graph: $f(x)=x^6$

NO



*

Find the inverse.

TICKET PRICES The average price P (in dollars) for a National Football League ticket can be modeled by

$$P = 35t^{0.192}$$

where t is the number of years since 1995. Find the inverse model that gives time as a function of the average ticket price.

*Do not switch variables.

$$\frac{P}{35} = \frac{\cancel{35} \cdot t^{0.192}}{\cancel{35}}$$

$$\left(\frac{P}{35}\right)^{\frac{1}{0.192}} = \left(t^{0.192}\right)^{\frac{1}{0.192}}$$

$$\frac{0.192}{0.192} = 1$$

Inverse function $t = \left(\frac{P}{35}\right)^{\frac{1}{0.192}}$

In what year will the average ticket price be $58?

$$t = \left(\frac{58}{35}\right)^{\frac{1}{0.192}}$$

$$t = 13.88$$

Quick ✓

★ What does it mean to be an inverse?

★ How do I find an inverse?

★ What is the horizontal line test?

Homework

★ Page 442 #3-12 multiples of 3, 16-20 even, 30-36 even, 47, 48

★ Inverse half sheet (let's try one)