work!

AP Calculus

Chapter 1

Section 1-5

May 13-10:02 PM

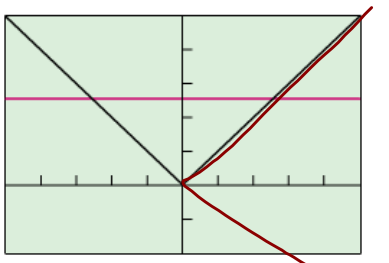
One-to-one Functions

DEFINITION One-to-One Function

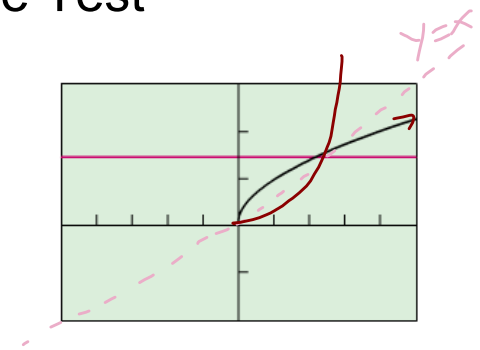
A function $f(x)$ is **one-to-one** on a domain D if $f(a) \neq f(b)$ whenever $a \neq b$.

May 13-10:44 PM

Horizontal Line Test



Not 1 to 1



1 to 1

Inverse

Switch input & output

Aug 26-8:10 AM

Inverse Function: Method to find $f^{-1}(x)$

$$f(x) = 7 - \frac{1}{x}$$

inverse

$y = 7 - \frac{1}{x}$

$x = 7 - \frac{1}{y}$

$\frac{1}{y} = 7 - x$

$y = (7-x)^{-1}$

$f^{-1}(x) = (7-x)^{-1}$

Aug 22-9:21 AM

Inverse Functions

$f(x) = 2(x - 7)^3$

$f^{-1}(x) = \sqrt[3]{\frac{x}{2}} + 7$

$y = 2(x-7)^3$

$x = 2(y-7)^3$

$\sqrt[3]{\frac{x}{2}} + 7 = y$

May 13-10:44 PM

Verifying Inverse Functions

$r(x) = \sqrt[3]{\frac{3}{4\pi}x}$

$V(x) = \frac{4}{3}\pi x^3$

$(V \circ r)(x)$

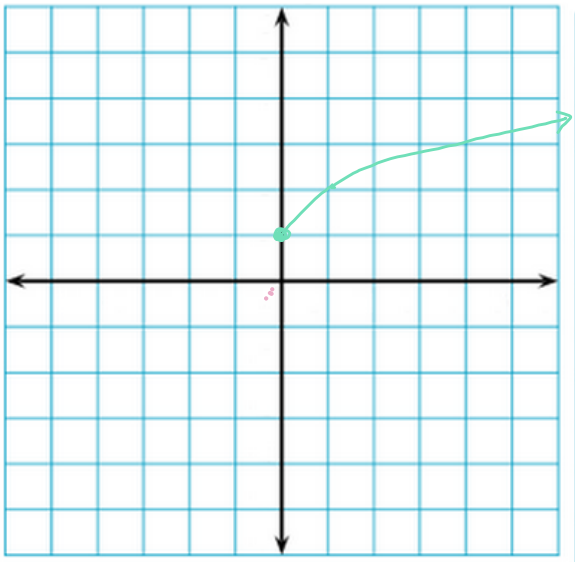
or

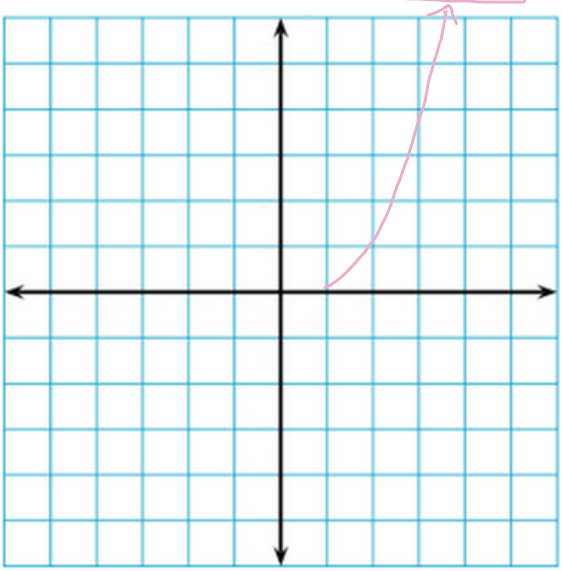
$(r \circ V)(x)$

$(V \circ r)(x) = \frac{4}{3}\pi\left(\sqrt[3]{\frac{3}{4\pi}x}\right)^3 = \frac{4}{3}\pi\left(\frac{3}{4\pi}x\right) = x$

May 13-10:44 PM

$f(x) = 1 + \sqrt{x}$ $f^{-1}(x) = (x - 1)^2$, $x \geq 1$





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Graphing Inverse Functions Parametrically

$$f(x) = \frac{x^3}{4}$$

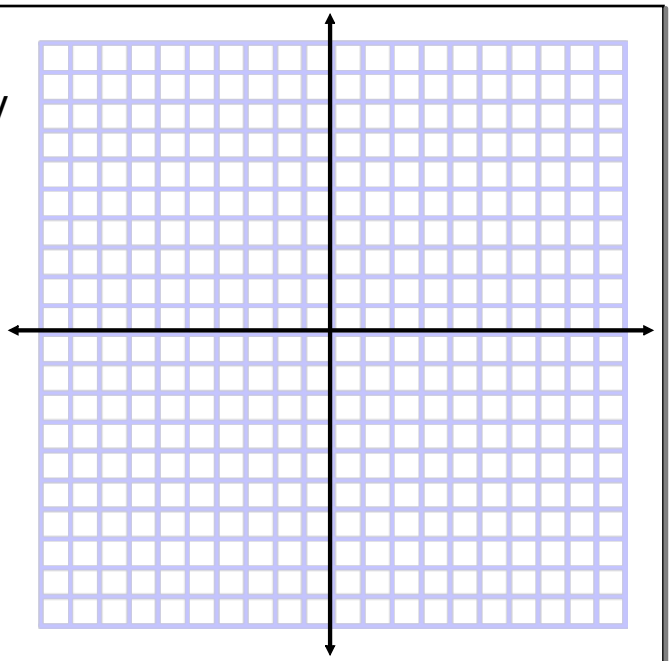
$x_T = -T$

$y_T = \frac{T^3}{4}$

Inv

$x_T = \frac{T^3}{4}$

$y_T = T$



May 13-10:44 PM

Logarithmic Properties

Inverse Properties for a^x and $\log_a x$

1. Base a: $a^{\log_a x} = x, \quad \log_a a^x = x, \quad a > 1, x > 0$
2. Base e: $e^{\ln x} = x, \quad \ln e^x = x, \quad x > 0$

Properties of Logarithms

For any real numbers $x > 0$ and $y > 0$,

1. *Product Rule:* $\log_a xy = \log_a x + \log_a y$
2. *Quotient Rule:* $\log_a \frac{x}{y} = \log_a x - \log_a y$
3. *Power Rule:* $\log_a x^y = y \log_a x$

May 13-10:44 PM

Rewriting Logarithmic Expressions

Rewrite the logarithmic as an exponential

$$\log_3 a = k$$

$$a = 3^k$$

Aug 26-8:46 AM

Solving for Variables in the Exponent

Estimating time

$$2000 = 1100(1.05)^t$$

$$\log_{1.05}\frac{20}{11} = \log_{1.05} 1.05^t$$

$$\log_{1.05}\frac{20}{11} = t$$

Aug 26-8:46 AM

Homework

Page 43

1 - 33 odd, 37, 38

May 13-10:02 PM