

## Inverse Functions and Slope

W-up:

Find  $f \circ g(x)$  and  $g \circ f(x)$  using the functions below.

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

$$g(x) = \sqrt[3]{x-1}$$

Functions are inverses *if and only if*

$$f \circ f^{-1}(x) = x \quad \text{and} \quad f^{-1} \circ f(x) = x$$

Inverse functions are the result of switching the  $x$  and  $y$  coordinates resulting in graphs which reflect over the line  $y = x$  (the identity line)

To find an inverse function simply switch the  $x$  and  $y$  and solve the equation for  $y$

EX) Find the inverse of  $f(x) = 3x^3 - 1$

## GRAPHS OF INVERSE FUNCTIONS HAVE RECIPROCAL SLOPES AT INVERTED (switched) POINTS

Given  $f(x) = x^3$  and  $g(x) = \sqrt[3]{x}$

Find  $f'(2)$  and  $g'(8)$

**EX)** It is given that  $h \circ p(x) = x$  and  $h(-4) = 3$  while  $h'(-4) = 9$ .

Find  $p'(3)$

### AP Application

Let  $f$  be the function defined by  $f(x) = 2x + e^x$ . If  $g(x) = f^{-1}(x)$  for all  $x$  and the point  $(0, 1)$  is on the graph of  $f$ , what is the value of  $g'(1)$ ?

- (A)  $\frac{1}{2+e}$       (B)  $\frac{1}{3}$       (C)  $\frac{1}{2}$       (D) 3      (E)  $2+e$