22. Let a function f be defined as $f(x) = x^2 - 2x - 3$ for $x \geq 1$. Let $g(x)$ be the inverse function of $f(x)$ and note that $f(3) = 0$. The value of $g'(0) =$

$g(0)=3$

$f(x) = x^2 - 2x - 3 \quad , \; x \geq 1$

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

$g'(0) = ?$

Inverse functions:

$\underbrace{g(f(x))}_{\text{composition}} = x$ also $f(g(x)) = x$

composition → use chain rule when taking deriv.

$g'(f(x)) \cdot f'(x) = 1$

OR

$f'(g(x)) \cdot \boxed{g'(x)} = 1$

Deriv of Inv Functions

$$\boxed{g'(x) = \frac{1}{f'(g(x))}}$$

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$g'(0) = \dfrac{1}{f'(g(0))}$

$g(0) = 3$

$g'(0) = \dfrac{1}{f'(3)}$

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

$f'(x) = 2x - 2$

$f'(3) = 4$

$g'(0) = \frac{1}{4}$

. If $f(x) = \sqrt{x^2 - 4}$ and $g(x) = 3x - 2$, then the derivative of $f(g(x))$ at $x = 3$ is

(A) $\frac{7}{\sqrt{5}}$ (B) $\frac{14}{\sqrt{5}}$ (C) $\frac{18}{\sqrt{5}}$ (D) $\frac{15}{\sqrt{21}}$ (E) $\frac{30}{\sqrt{21}}$

. Let $f(x) = (2x+1)^3$ and let g be the inverse function of f. Given that $f(0) = 1$, what is the value of $g'(1)$?

(A) $-\frac{2}{27}$ (B) $\frac{1}{54}$ (C) $\frac{1}{27}$ (D) $\frac{1}{6}$ (E) 6

$$\lim_{h \to 0} \frac{\ln(4+h) - \ln(4)}{h} \text{ is}$$

(A) 0 (B) $\frac{1}{4}$ (C) 1 (D) e (E) nonexistent