AP Calculus AB – Worksheet 122 **Derivative of Inverse Functions**

1. Let $f(x)=x^3-5x^2-8$ and let g be the inverse function of f. $f'(x)=3x^2-10x$
   (a) Find $f(1)$ and $f'(1)$. $f(1)=-12$ $f'(1)=-7$
   (b) Find $g(-12)$ and $g'(-12)$. $g(-12)=1$ $g'(-12)=\frac{1}{f'(1)}=-\frac{1}{7}$

2. Let f be the function defined by $f(x)=x^3+7x+2$. If $g(x)=f^{-1}(x)$ and $f(1)=10$, what is the value of $g'(10)$?
   $f'(x)=3x^2+7$ $f'(1)=10$
   $g'(10)=\frac{1}{f'(g^{-1}(10))}=\frac{1}{f'(1)}=\frac{1}{10}$

3. Let f be the function defined by $f(x)=x^5+3x^3+7x+2$. If $g(x)=f^{-1}(x)$ and $f(1)=13$, what is the value of $g'(13)$? $f'(x)=5x^4+9x^2+7$ $f'(1)=21$
   $g'(13)=\frac{1}{f'(1)}=\frac{1}{21}$

4. Let f be the function defined by $f(x)=7x^3+(\ln x)^3$. If $g(x)=f^{-1}(x)$ and $f(1)=7$, what is the value of $g'(7)$?
   $f'(x)=21x^2+3(\ln x)^2\cdot\frac{1}{x}$ $f'(1)=21$
   $g'(7)=\frac{1}{f'(1)}=\frac{1}{21}$

5. Let f be the function defined by $f(x)=x^7+2x+9$. The point $(1,12)$ is on the graph of f. If $g(x)=f^{-1}(x)$, find $g'(12)$. $f'(x)=7x^6+2$ $f'(1)=9$
   $g'(12)=\frac{1}{9}$

6. Find the equation of the tangent line to the inverse of $f(x)=x^5+2x^3+x-4$ at the point $(-4,0)$.
   $f'(x)=5x^4+6x^2+1$ $f'(0)=1$ $g'(-4)=\frac{1}{1}$ $y-0=1(x-(-4)) \Rightarrow y=x+4$

7. Find the equation of the tangent line to the inverse of $f(x)=7x+\sin(2x)$ at the point $(0,0)$.
   $f'(x)=7+2\cos(2x)$ $f'(0)=9$ $g'(0)=\frac{1}{9}$ $y=\frac{1}{9}x$

8. Find the equation of the tangent line to the inverse of $f(x)=x^3+8x+\cos(3x)$ at the point $(1,0)$.
   $f'(x)=3x^2+8-3\sin(3x)$ $f'(0)=8$ $g'(1)=\frac{1}{8}$ $y=\frac{1}{8}(x-1)$

9. The functions f and g are differentiable. Given that $g(x)=f^{-1}(x)$, $f(1)=3$, and $f'(1)=-5$, find $g'(3)$. $g'(3)=\frac{1}{f'(f^{-1}(3))}=\frac{1}{f'(1)}=-\frac{1}{5}$

10. The functions f and g are differentiable. Given that $g(x)=f^{-1}(x)$, $f(2)=4$, $f(4)=-6$, $f'(2)=7$, and $f'(4)=11$, find $g'(4)$.

    $g'(4)=\frac{1}{f'(f^{-1}(4))}=\frac{1}{f'(2)}=\frac{1}{7}$