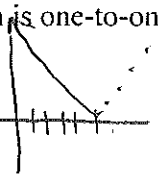
MAC1105 College Algebra
3.6 Practice Problems

1. Determine if each function is one-to-one.

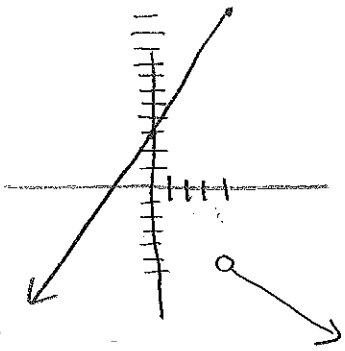
a. $f(x)=|x-5|; x\geq 5$

one-to-one

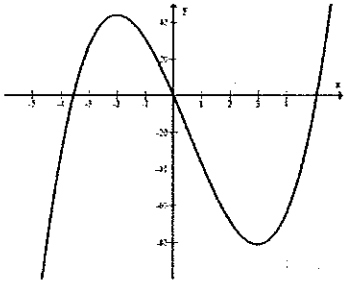


b. $f(x)=\begin{cases} 2x+3 & x\leq 4 \\ -x-2 & x>4 \end{cases}$

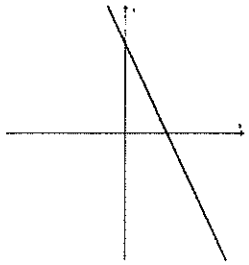
not one-to-one



c. not a one-to-one function



d. one to one function



2. Find $f\circ g$ and $g\circ f$ determine whether each pair of functions f and g are inverses of each other. $f(x)=2x-5$ and $g(x)=\frac{x+5}{2}$

$(fog)(x)=2\left(\frac{x+5}{2}\right)-5=x+5-5=x$

$(gof)(x)=\frac{2x-5+5}{2}=\frac{2x}{2}=x$

Since $(fog)(x)=x$ and $(gof)(x)=x$

f and g are inverses of each other

The following functions are one-to-one. For each function **a.** Find an equation for $f^{-1}(x)$, the inverse function. **b.** Verify that your equation is correct by showing that $f(f^{-1}(x))=x$ and $f^{-1}(f(x))=x$. Use these directions for problems 3-5.

3. $f(x)=3x+4$

$y=3x+4$

$x=3y+4$

$-4 \quad -4$

$\frac{x-4}{3}=\frac{3y}{3}$

$\frac{x-4}{3}=y$

$f^{-1}(x)=\frac{x-4}{3}$

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

$=3\left(\frac{x-4}{3}\right)+4$

$=x-4+4$

$=x$

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

$=\frac{3x+4-4}{3}$

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

$=x$

4. $f(x)=x^3-5$

$y=x^3-5$

$x=y^3-5$

$+5 \quad +5$

$x+5=y^3$

$\sqrt[3]{x+5}=\sqrt[3]{y^3}$

$\sqrt[3]{x+5}=y$

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

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

$=(\sqrt[3]{x+5})^3-5$

$=x+5-5$

$=x$

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

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

$=\sqrt[3]{x^3-5+5}$

$=\sqrt[3]{x^3}$

$=x$

5. $f(x)=\frac{3x+1}{x-7}$

$y=\frac{3x+1}{x-7}$

$x=\frac{3y+1}{y-7}$

$x(y-7)=3y+1$

$xy-7x=3y+1$

$xy-3y=7x+1$

$\frac{y(x-3)}{x-3}=\frac{7x+1}{x-3}$

$y=\frac{7x+1}{x-3}$

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

$(f\circ f^{-1})(x)=\frac{3\left(\frac{7x+1}{x-3}\right)+1}{\frac{7x+1}{x-3}-7}=\frac{3(7x+1)+x-3}{7x+1-7(x-3)}$

Multiply numerator & denominator by $x-3$ to cancel fractions

$=\frac{21x+3+x-3}{7x+1-7x+21}=\frac{22x}{22}=x$

$(f^{-1}\circ f)(x)=\frac{7\left(\frac{3x+1}{x-7}\right)+1}{\frac{3x+1}{x-7}-3}=\frac{7(3x+1)+x-7}{3x+1-3(x-7)}$

$=\frac{21x+7+x-7}{3x+1-3x+21}=\frac{22x}{22}=x$

Evaluate the indicated functions without finding an equations for the function. Use these directions for problems 6-9. $f(x)=3x+7$ $g(x)=x+3$ $h(x)=2x^2+5x-7$

6. $(f\circ g)(3)$

$=f(g(3))$

$=f(3+3)$

$=f(6)$

$3(6)+7$

$=18+7$

$=25$

7. $f^{-1}(4)$

$f(x)=4$

$3x+7=4$

$-7 \quad -7$

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

$x=-1$

8. $g^{-1}(4)$

$g(x)=4$

$x+3=4$

$-3 \quad -3$

$x=1$

9. $g(f[h(1)])$

$=g(f(2(1)^2+5(1)-7))$

$=g(f(2+5-7))$

$=g(f(0))$

$=g(3(0)+7)$

$=g(7)$

$=7+3$

$=10$