Advanced Algebra **10-3 HW: Compositions & Function Inverses** **Mrs. Dunphy**

Instructions: Do all work on your own paper. SHOW YOUR WORK clearly for each problem.

Problems 1-3: Suppose $f(x)=\frac{x}{2}$, $g(x)=x-3$, and $h(x)=\sqrt{x}$. Find a REAL number or an expression in x for each of the compositions below.

1. a) $f(g(8))$ b) $f(g(-5))$ c) $f(g(x))$

2. a) $f(h(4))$ b) $f(h(-4))$ c) $f(h(x))$

3. a) $h(g(2))$ b) $h(g(x))$ c) $h(h(x))$

Problems 4-6: Determine if the given functions are inverses. *You might want to review the definition of function inverses from your notes.*

4. $f(x)=2x-3,\ g(x)=\frac{x+3}{2}$

5. $f(x)=\frac{x+6}{3},\ g(x)=3x-6$

6. $f(x)=\frac{1}{x+1},\ g(x)=\frac{1}{x}+1$

Problems 7-11: Write the domain of each function $f(x)$, then find its inverse, $f^{-1}(x)$. Write the domain of the inverse, then state whether it qualifies as the true inverse of $f(x)$.

7. $f(x)=\sqrt[3]{x}$

8. $f(x)=x^4$

9. $f(x)=-4x+1$

10. $f(x)=\sqrt{x}$

11. $f(x)=x^2$

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Instructions: Do all work on your own paper. SHOW YOUR WORK clearly for each problem.

Problems 1-3: Suppose $f(x)=\frac{x}{2}$, $g(x)=x-3$, and $h(x)=\sqrt{x}$. Find a REAL number or an expression in x for each of the compositions below.

1. a) $f(g(8))$ $5/2$ b) $f(g(-5))$ -4 c) $f(g(x))$ $\frac{x-3}{2}$

2. a) $f(h(4))$ 1 b) $f(h(-4))$ non real c) $f(h(x))$ $\frac{\sqrt{x}}{2}$

3. a) $h(g(2))$ non real b) $h(g(x))$ $\sqrt{x-3}$ c) $h(h(x))$ $\sqrt[4]{x}$

$\sqrt{\sqrt{x}}=\sqrt[4]{x}$

Problems 4-6: Determine if the given functions are inverses. *You might want to review the definition of function inverses from your notes.*

4. $f(x)=2x-3,\ g(x)=\frac{x+3}{2}$ yes, inverses

5. $f(x)=\frac{x+6}{3},\ g(x)=3x-6$ yes, inverses

6. $f(x)=\frac{1}{x+1},\ g(x)=\frac{1}{x}+1$ no, not inverses

Problems 7-11: Write the domain of each function $f(x)$, then find its inverse, $f^{-1}(x)$. Write the domain of the inverse, then state whether it qualifies as the true inverse of $f(x)$.

7. $f(x)=\sqrt[3]{x}$ yes

8. $f(x)=x^4$ no

9. $f(x)=-4x+1$ yes

10. $f(x)=\sqrt{x}$ no

11. $f(x)=x^2$ no

10-3 HW Solutions

$f(x)=\frac{x}{2}$ $g(x)=x-3$ $h(x)=\sqrt{x}$

① a) $f(g(8))=\frac{5}{2}$

$g(8)=8-3=5$

$f(5)=\frac{5}{2}$

b) $f(g(-5))=-4$

$g(-5)=-5-3=-8$

$f(-8)=\frac{-8}{2}=-4$

c) $f(g(x))=\frac{x-3}{2}$

$f(x-3)=\frac{x-3}{2}$

② $f(h(4))=1$

$h(4)=\sqrt{4}=2$

$f(2)=\frac{2}{2}=1$

$f(h(-4))$

$h(-4)=\sqrt{-4}\ \therefore$

non real!

$f(h(x))=\frac{\sqrt{x}}{2}$

$f(\sqrt{x})=\frac{\sqrt{x}}{2}$

③ $h(g(2))=$

$g(2)=2-3=-1$

$h(-1)=\sqrt{-1}$

non real

$h(g(x))=\sqrt{x-3}$

$h(x-3)=\sqrt{x-3}$

$h(h(x))=\sqrt[4]{x}$

$h(\sqrt{x})=\sqrt{\sqrt{x}}$

$=\sqrt[4]{x}$

④ $f(x)=2x-3$ $g(x)=\frac{x+3}{2}$

$y=2x-3$

$x=2y-3$

$\frac{x+3}{2}=\frac{2y}{2}$

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

$y=\frac{x+3}{2}$

$x=\frac{y+3}{2}$

$2x=y+3$

$2x-3=y$

$f^{-1}(x)=2x-3$

INVERSES!

⑤ $f(x)=\frac{x+6}{3}$ $g(x)=3x-6$

$y=\frac{x+6}{3}$

$x=\frac{y+6}{3}$

$3x=y+6$

$3x-6=y$

$f^{-1}(x)=3x-6$

$y=3x-6$

$x=3y-6$

$\frac{x+6}{3}=\frac{3y}{3}$

$y=\frac{x+6}{3}$

$f^{-1}(x)=\frac{x+6}{3}$

INVERSES!

⑥ $f(x)=\frac{1}{x+1}$ $g(x)=\frac{1}{x}+1$

$y=\frac{1}{x+1}$

$x=\frac{1}{y+1}$

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

$y+1=\frac{1}{x}$

$-1 \quad -1$

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

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

does not match!

$y=\frac{1}{x}+1$

$x=\frac{1}{y}+1$

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

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

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

does not match!

⑦ a) {all reals}

b) $x^3=f^{-1}(x)$

c) {all reals}

d) true inverses

⑧ a) {all reals}

b) $\sqrt[4]{x}=f^{-1}(x)$

c) $\{x: x\geq 0\}$

d) NOT true inverses

⑨ a) {all reals}

b) $y=-4x+1$

$x=-4y+1$

$\frac{x-1}{-4}=\frac{-4y}{-4}$

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

c) {all reals}

d) true inverses

⑩ $f(x)=\sqrt{x}$

a) $\{x: x\geq 0\}$

b) $f^{-1}(x)=x^2$

c) {all reals}

d) NOT true inverses

⑪ $f(x)=x^2$

a) {all reals}

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

c) $\{x: x\geq 0\}$

d) NOT true inverses