Name: ______________________ Pre-Calculus

Date: ______________ Per: ______ Unit 2: Functions & Their Graphs

Quiz 2-4: Function Operations, Compositions, and Inverses

Given $f(x) = x^2 + 3x - 10$, $g(x) = 6 - x^3$, and $h(x) = 2x + 1$, find each function and state its domain.

1. $(f+h)(x)$

$(x^2+3x-10)+(2x+1)$

2. $(h-g)(x)$

$(2x+1)-(6-x^3)$

3. $(f \cdot g)(x)$

$(x^2+3x-10)\cdot(6-x^3)$

$= 6x^2+18x-60-x^5-3x^4+10x^3$

4. $\left(\dfrac{h}{f}\right)(x)$

5. $(f \circ h)(x)$

$(2x+1)^2+3(2x+1)-10$

$= 4x^2+4x+1+6x+3-10$

6. $(h \circ g)(x)$

$2(6-x^3)+1$

7. Given $f(x)=\sqrt{x+3}$ and $g(x)=\sqrt{x-6}$, find $(f \cdot g)(x)$ and state its domain.

$\sqrt{x+3}\cdot\sqrt{x-6} = \sqrt{(x+3)(x-6)}$

8. Given $f(x)=\dfrac{x+1}{2}$ and $g(x)=\dfrac{1}{x}$, find $(f+g)(x)$ and state its domain.

$\dfrac{x+1}{2}+\dfrac{1}{x} = \dfrac{x^2+x}{2x}+\dfrac{2}{2x}$

9. Given $f(x)=x^2-4$ and $g(x)=\sqrt{x+1}$, find $(f \circ g)(x)$ and state its domain.

$(\sqrt{x+1})^2-4$

$= x+1-4$

10. Given $h(x) = -(x+5)^3+2$, find two functions, f and g, such that $(f \circ g)(x) = h(x)$.

1. x^2+5x-9

D: $\mathbb{R}$

2. x^3+2x-5

D: $\mathbb{R}$

3. $-x^5-3x^4+10x^3+6x^2+18x-60$

D: $\mathbb{R}$

4. $\dfrac{2x+1}{x^2+3x-10}$

D: $\{x \mid x \neq -5, 2\}$

5. $4x^2+10x-6$

D: $\mathbb{R}$

6. $-2x^3+13$

D: $\mathbb{R}$

7. $\sqrt{x^2-3x-18}$

D: $\{x \mid x \geq 6\}$

8. $\dfrac{x^2+x+2}{2x}$

D: $\{x \mid x \neq 0\}$

9. $x-3$

D: $\{x \mid x \geq -1\}$

10. $f(x) = -x^3+2$

$g(x) = x+5$

Given $f(x) = |2-5x|$, $g(x) = \dfrac{x^2}{x+2}$, and $h(x) = -\sqrt[3]{x}+7$, evaluate each function.

11. $(f-g)(-6)$

$f(-6) = |2+30| = 32$

$g(-6) = \frac{36}{-4} = -9$

12. $(g \cdot h)(8)$

$g(8) = \frac{64}{10} = \frac{32}{5}$

$h(8) = -\sqrt[3]{8}+7 = 5$

13. $\left(\frac{g}{f}\right)(4)$

$g(4) = \frac{16}{6} = \frac{8}{3}$

$f(4) = |2-20| = 18$

14. $(f \circ h)(-1)$

$h(-1) = -\sqrt[3]{-1}+7 = 8$

$f(8) = |2-5(8)|$

11.	41
12.	32
13.	$\frac{4}{27}$
14.	38

Given $f(x)$, find $f^{-1}(x)$. State any restrictions in the domain.

15. $f(x) = -(x-1)^2+3;\ x \geq 1$

$x = -(y-1)^2+3$

$x-3 = -(y-1)^2$

$-x+3 = (y-1)^2$

$\sqrt{-x+3} = y-1$

16. $f(x) = \dfrac{x-6}{x+2}$

$x = \frac{y-6}{y+2}$

$xy+2x = y-6$

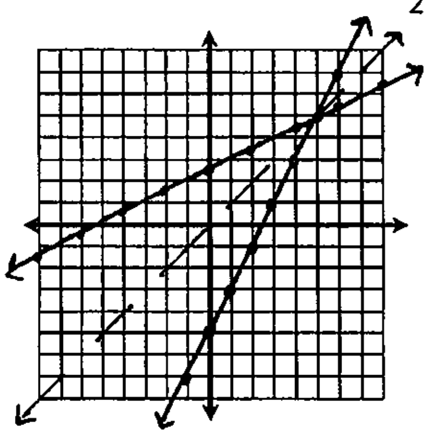
$xy-y = -2x-6$

$y(x-1) = -2x-6$

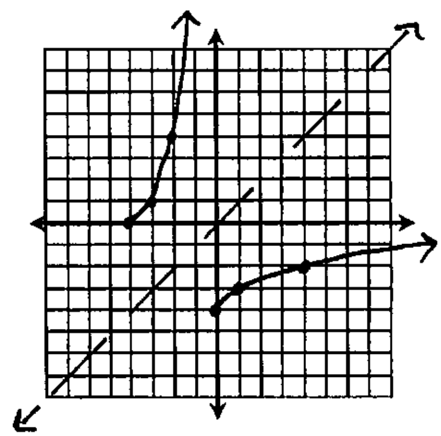
15.	$f^{-1}(x) = \sqrt{-x+3}-1$; $x \leq$
16.	$f^{-1}(x) = \frac{-2x-6}{x-1}$; $x \neq 1$

Verify graphically that $f(x)$ and $g(x)$ are inverse functions.

17. $f(x) = 2x-5$ and $g(x) = \dfrac{x+5}{2}$



18. $f(x) = \sqrt{x}-4$ and $g(x) = (x+4)^2;\ x \geq -4$



Determine algebraically using compositions whether functions f and g are inverse functions.

19. $f(x) = 2x^3-6$ and $g(x) = \sqrt[3]{\dfrac{x+6}{2}}$

$(f \circ g)(x) = 2\left(\sqrt[3]{\frac{x+6}{2}}\right)^3 - 6$

$= 2\left(\frac{x+6}{2}\right) - 6 = x+6-6 = \boxed{x}$

$(g \circ f)(x) = \sqrt[3]{\frac{2x^3-6+6}{2}} = \sqrt[3]{\frac{2x^3}{2}} = \sqrt[3]{x^3} = \boxed{x}$

Inverses? ☑ yes ☐ no

20. $f(x) = \dfrac{4}{x} - 2$ and $g(x) = \dfrac{4}{x-2}$

$(f \circ g)(x) = \frac{4}{\frac{4}{x-2}} - 2$

$= x-2-2 = \boxed{x-4}$

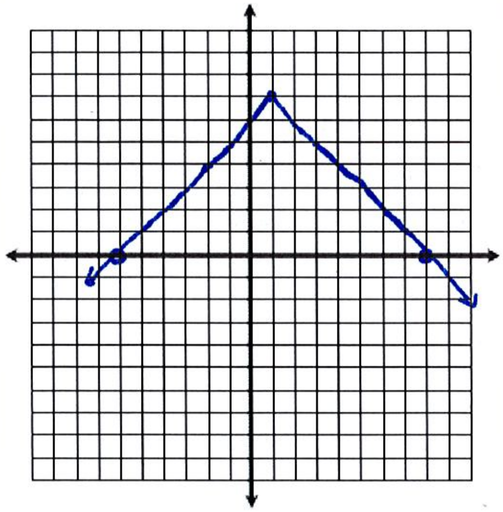
Inverses? ☐ yes ☑ no

Name: Control

Math 3 Functions Section 2 Study Guide

1

$f(x) = -|x-1| + 7$



Parent Function: $y = |x|$

Transformations:
- reflection over x
- right 1
- up 7

Domain:	**Range:**
$(-\infty, \infty)$	$(-\infty, 7]$
***x*-intercept(s):**	***y*-intercept(s):**
$(8,0), (-6,0)$	$(0,6)$

Extrema: $(1,7)$

Increasing Interval(s): $(-\infty, 1)$

Decreasing Interval(s): $(1, \infty)$

End Behavior:
As $x \to -\infty$, $y \to \infty$
As $x \to \infty$, $y \to -\infty$

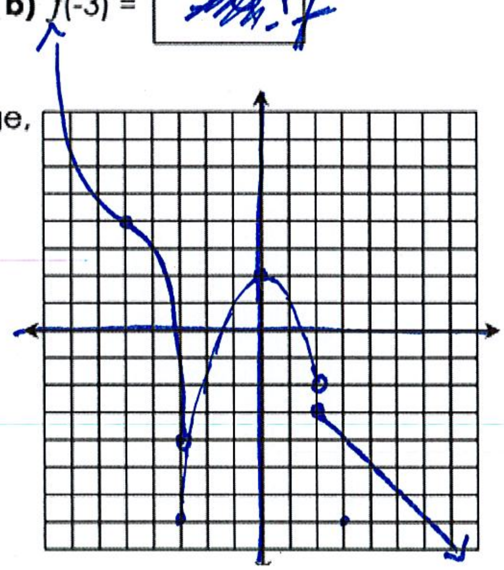
Use the following piecewise function for questions 7-8: $f(x) = \begin{cases} -(x+5)^3 + 4 & \text{if } x < -3 \\ -x^2 + 2 & \text{if } -3 \le x < 2 \\ -1 - x & \text{if } x \ge 2 \end{cases}$

7. Evaluate for each value:

a) $f(-7) = \boxed{12}$

b) $f(-3) = \boxed{-7}$

8. Graph, then give the domain, range, and identify the location and type of any discontinuities.



Domain: $(-\infty, \infty)$

Range: $(-\infty, \infty)$

Discontinuities:
$x = -3$ jump
$x = 2$ jump