Notes for 4.1 Inverse Functions (pp. 390 – 398)

Name:
Date:
Instructor:

Topics: One-to-One Functions, Inverse Functions

I. Inverse Functions and One – to – One Functions (pp.390 – 392)

Recall:
Inverses of arithmetic are addition and subtraction, multiplication and division, etc.
A function takes a value of the domain, *x*, and operates on it using the function formula, then gives you an answer that is in the range, *y* .

To find an inverse of the function, we want to "undo" the function and have the range value, *y*, give back its answer, *x*, in the domain.

Ex. $f(x) = 5x$ and $g(x) = \frac{x}{5}$

For f(6) = 5 * 6 = 30 and g(30) = $\frac{30}{5}$ = 6. These two functions are inverses of each other.

How to determine whether a function is one-to-one: (p. 391)

1. Work several examples and see if one *y* value is determined by more than one *x* value.

Ex.. Determine whether the function defined by $f(x) = \sqrt{25 - x^2}$ is one-to-one.
Substituting 3 and –3
f(3) = and f(-3) =

Since these answers are the same positive 4, then this function is not 1 – 1.

2. Use the Horizontal Line Test on the graph. This is very similar to the Vertical Line Test that determines whether the graph is a function or not. It states that any horizontal line passes through the graph in only one place at any part of the graph.

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II. Finding the Inverse Function (pp. 394 – 397)

If a function is a one – to – one function, then it has an inverse.

To find the inverse of a function, you: (p. 394)
1. Write the function using the variable *y* instead of the *f(x)* label.
2. Interchange the *x* and *y* in the equation. (This will do it generically for all the values of *x* and *y)* instead of you having to do them one at a time from the TABLE.)
3. Solve for the new y.
4. Write the answer using the $f^{-1}(x)$ notation.

Ex. $f(x) = x^3 + 1$

$y = x^3 + 1$ (replace the f(x) with y)

$x = y^3 + 1$ (interchange the x and y)

(solve for the new y)

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

Ex. Write the equation for the inverse of $f(x)$ in the form of $f^{-1}(x)$ for

$f(x) = 3x - 4$

III. The graph of the inverse is a reflection of the original function round the line $y = x$.

IV. Summary of Important Facts about Inverses: (p. 397)

1. If f is 1 – 1, the f^{-1} exists.
2. The domain of f is equal to the range of f^{-1}, and the range of f is equal to the domain of f^{-1}. (This is because you interchange all the x and y values.)
3. If a point (a, b) lies on the graph of f, then (b, a) lies on the graph of f^{-1}, so the graphs of f and f^{-1} are reflections of each other across the line $y = x$.
4. To find the equation for f^{-1}, replace $f(x)$ with y, interchange x and y, and solve for the new y. This gives you the inverse.

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Assignment:
Text: pp. 398 – 401 #3 – 25 odd, 33 – 51 odd, 53a, 57a, 59a, 63 – 73 odd