Name: ____ Period: __________ Date: _______________

Unit 1 TEST Functions and Relations

Evaluate each function.

1. $f(x) = \frac{2x^2 - 10}{x - 15}$ $\quad f(5) = ?$

2. $f(x) = \frac{x^2 + 2x - 2}{\sqrt{x^2 - 2}}$ $\quad f(2) = ?$

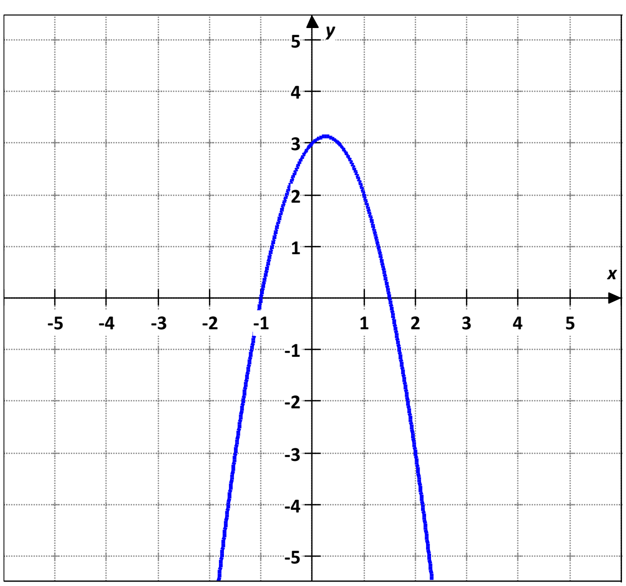
State the domain of each function. Write in interval notation.

3. $g(x) = \frac{x^2}{x - 7}$

4. $h(x) = \frac{\sqrt{x - 12}}{x - 3}$

Use the graph of each function to approximate its y –intercept and x –intercept. Then find the y –intercept and x –intercept algebraically.

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



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Name: ____ Period: __________ Date: _______________

Unit 1 TEST Functions and Relations

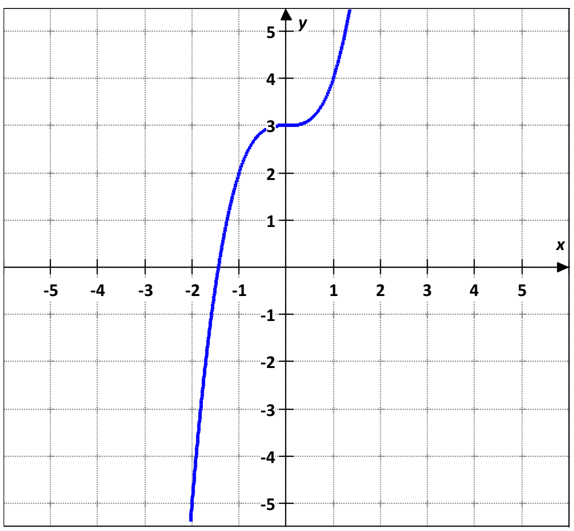
Determine whether the following are even, odd, or neither.

6. $f(x) = 5x^3 - 4x^2 + 4$

7. $h(x) = x^6 - x^4 + 2$

Use the graph of the function to describe its end behavior. Support the conjecture numerically.

8. $f(x) = x^3 + 3$



Find the average rate of change of each function on the given interval.

9. $f(x) = \dfrac{3x+4}{x-1}$ $\quad [0; -1]$

10. $f(x) = x^3 + 2x - 1$ $\quad [-1; 1]$

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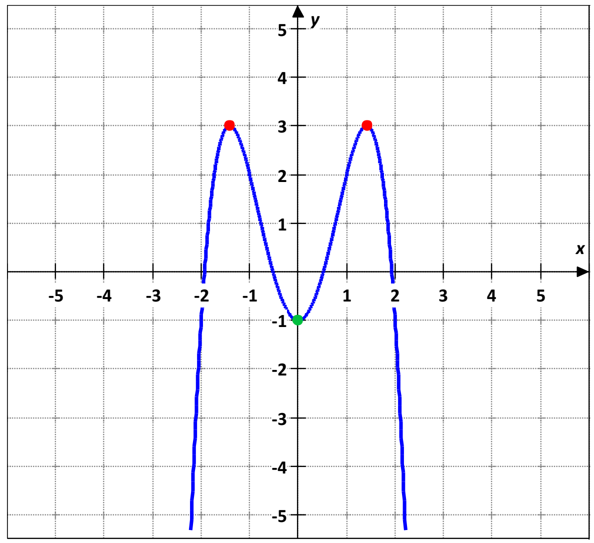
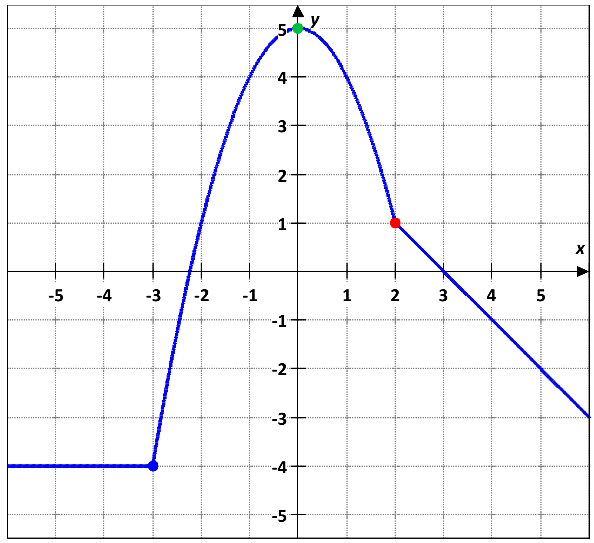
Unit 1 TEST Functions and Relations

Approximate the critical points of each function.

11.



12.



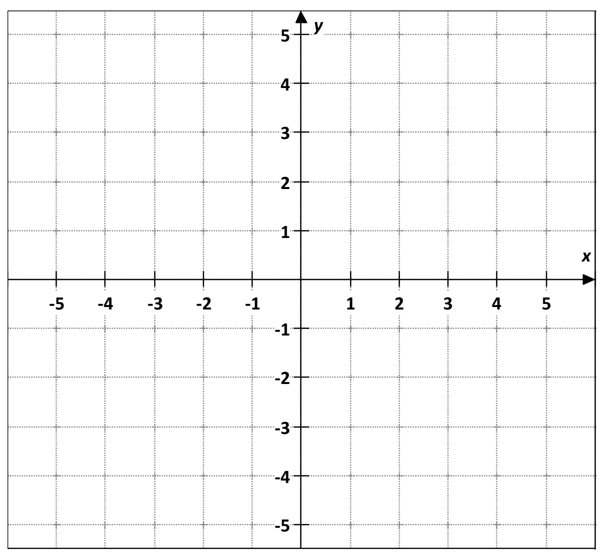
Given the parent function and a description of the transformation, write the equation of the transformed function $f(x)$.

13. **Square Root Function**
Reflected in the x-axis
Translated 10 units up

14. **Absolute value-**
Translated 2 units up
Translated 3 units left

Use the graph of parent function to graph the function. Find the domain and the range of the new function.

15. $h(x) = -(x-1)^2 + 2$



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Unit 1 TEST Functions and Relations

16. Find each function value.

The tables give some selected ordered pairs for functions f and g

x	-1	0	2	3
$g(x)$	1	0	4	9

x	2	4	6	9
$f(x)$	3	5	7	10

$(f \circ g)(2) = ?$
$(g \circ f)(2) = ?$

17. $f(x) = \dfrac{2+x}{6} \quad g(x) = \dfrac{1}{x}$

$(f \circ g)(2) = ? \quad D_{f \circ g} = ?$

18. $f(x) = \dfrac{x^2+1}{2} \quad g(x) = x + 2$

$(g \circ f)(1) = ? \quad D_{g \circ f} = ?$

Show algebraically that f and g are inverse functions.

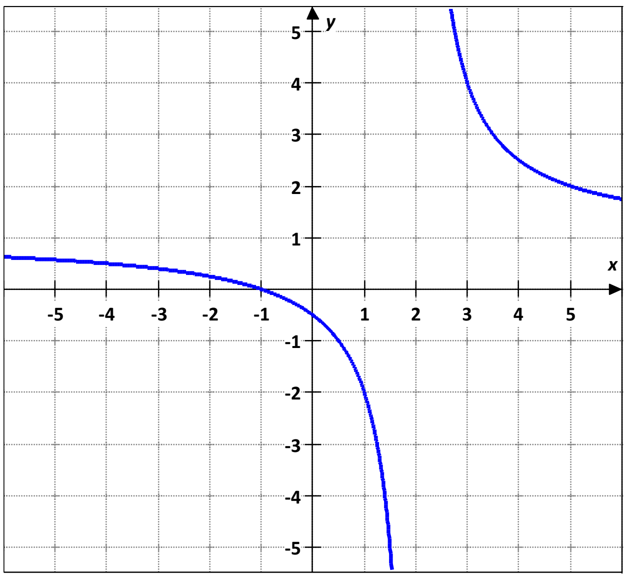
19. $f(x) = 2x - 3 \qquad g(x) = \dfrac{x+3}{2}$

Name: ____ Period: __________ Date: _______________

Unit 1 TEST Functions and Relations

Determine whether each function has an inverse function. If it does, find the inverse function and state any restrictions on its domain.

20. $f(x) = \dfrac{x+1}{x-2}$



Name: ____ Period: __________ Date: _______________

Unit 1 TEST Functions and Relations

ANSWERS

Evaluate each function.

1. $f(x) = \dfrac{2x^2 - 10}{x - 15}$ $\quad f(5) = ?$

$f(5) = \dfrac{2 * 5^2 - 10}{5 - 15}$

$f(5) = \dfrac{2 * 25 - 10}{-10}$

$f(5) = \dfrac{50 - 10}{-10}$

$f(5) = \dfrac{40}{-10}$

$f(5) = -4$

2. $f(x) = \dfrac{x^2 + 2x - 2}{\sqrt{x^2 - 2}}$ $\quad f(2) = ?$

$f(2) = \dfrac{2^2 + 2 * 2 - 2}{\sqrt{2^2 - 2}}$

$f(2) = \dfrac{4 + 4 - 2}{\sqrt{2}}$

$f(2) = \dfrac{6}{\sqrt{2}} * \dfrac{\sqrt{2}}{\sqrt{2}} = \dfrac{6\sqrt{2}}{2}$

$f(2) = 3\sqrt{2}$

State the domain of each function. Write in interval notation.

3. $g(x) = \dfrac{x^2}{x - 7}$

$x - 7 \neq 0$

$x \neq 7$

$\textbf{Domain} = (-\infty, 7) \cup (7, \infty)$

4. $h(x) = \dfrac{\sqrt{x - 12}}{x - 3}$

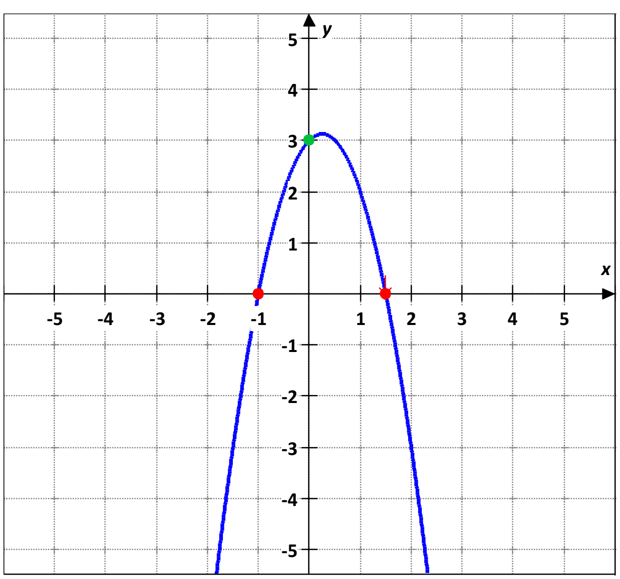
$x - 3 \neq 0$

$x \neq 3$

$\textbf{Domain} = (-\infty, 3) \cup (3, \infty)$

Use the graph of each function to approximate its y –intercept and x –intercept. Then find the y –intercept and x –intercept algebraically.

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



y –intercept

Graphically

$f(x) = -2x^2 + x + 3$ $\quad$ **y – intercept = 3**

Algebraically y -intercept occurs where $x = 0$.

$f(0) = -2 * 0^2 + 0 + 3$

$f(0) = 3$ $\quad$ **y – intercept = 3**

x –intercept

Graphically

x – intercepts $\quad -1$, *and* 1.5

Algebraically

$f(x) = 0$

$-2x^2 + x + 3 = 0$

$2(x + 1)(x - 1.5) = 0$

$x = -1 \quad and \quad x = 1.5$

The zeros of f are -1 *and* 1.5

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Name: ____ Period: ___________ Date: ________________

Unit 1 TEST Functions and Relations

Determine whether the following are even, odd, or neither.

6. $f(x) = 5x^3 - 4x^2 + 4$

$f(-x) = 5(-x)^3 - 4(-x)^2 + 4$
$f(-x) = -5x^3 - 4x^2 + 4$

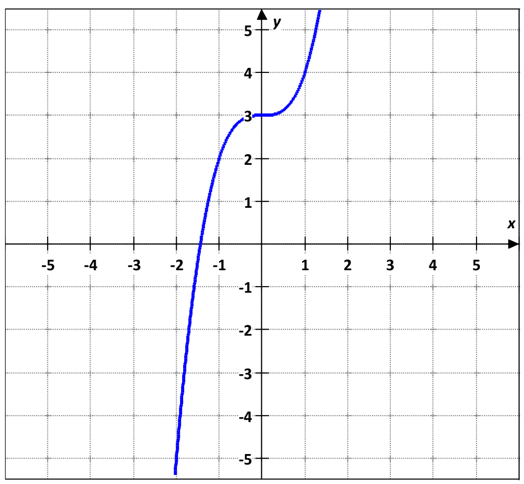
$f(-x) \neq -f(x) \quad f(-x) \neq f(x)$
The function is neither

7. $h(x) = x^6 - x^4 + 2$

$h(-x) = (-x)^6 - (-x)^4 + 2$
$h(-x) = x^6 - x^4 + 2$
$h(-x) = h(x)$
The function is even

Use the graph of the function to describe its end behavior. Support the conjecture numerically.

8. $f(x) = x^3 + 3$



From the graph, it appears that:

$f(x) \to -\infty$ as $x \to -\infty$ and $f(x) \to \infty$ as $x \to \infty$

The table supports this conjecture.

x	-10^4	-10^3	0	10^3	10^4
y	-10^{12}	-10^9	3	10^9	10^{12}

Find the average rate of change of each function on the given interval.

9. $f(x) = \dfrac{3x+4}{x-1}$ $\quad [0; -1]$

$$\frac{f(x_2) - f(x_1)}{x_2 - x_1} = \frac{f(-1) - f(0)}{-1 - 0} =$$
$$= \frac{\frac{3*(-1)+4}{(-1)-1} - \frac{3*0+4}{0-1}}{-1-0} =$$
$$= \frac{\frac{-3+4}{-2} - \frac{4}{-1}}{-1} =$$
$$= \frac{\frac{1}{-2} + 4}{-1} = -\frac{7}{2}$$

The average rate of change on the interval $[0; -1]$ is $-\frac{7}{2}$.

10. $f(x) = x^3 + 2x - 1$ $\quad [-1; 1]$

$$\frac{f(x_2) - f(x_1)}{x_2 - x_1} = \frac{f(1) - f(-1)}{1 - (-1)} =$$
$$= \frac{1^3 + 2*1 - 1 - ((-1)^3 + 2*(-1) - 1)}{2} =$$
$$= \frac{1 + 2 - 1 - (-1 - 2 - 1)}{2} =$$
$$= \frac{2 + 1 + 2 + 1}{2} = \frac{6}{2} = 3$$

The average rate of change on the interval $[-1; 1]$ is 3

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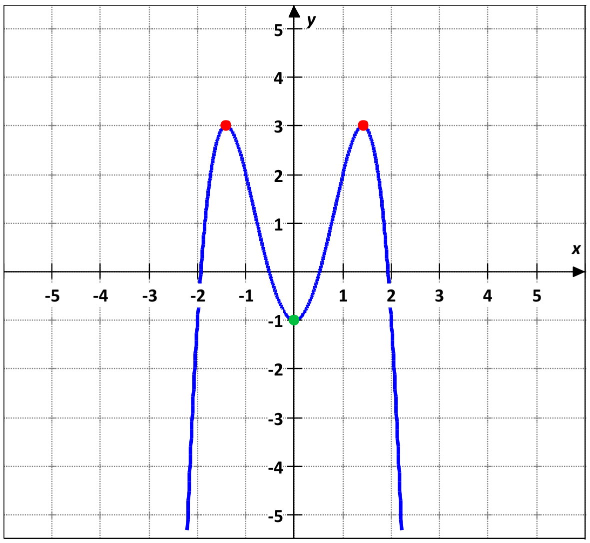
Unit 1 TEST Functions and Relations

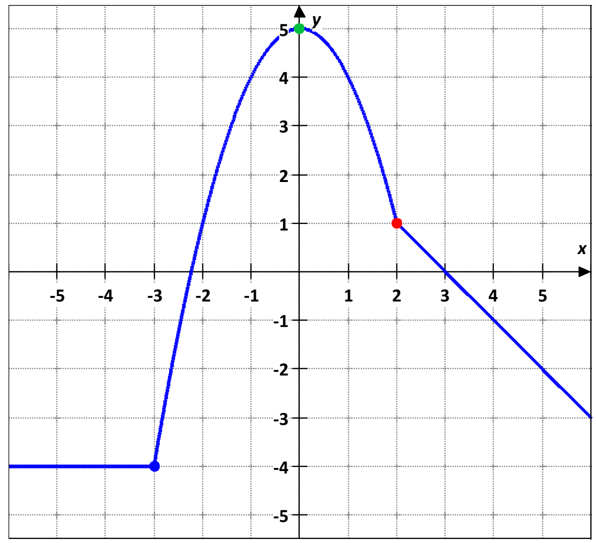
Approximate the critical points of each function.

11.



Relative minimum $(\mathbf{0}; -\mathbf{1})$
Absolute maximum $(-\mathbf{1.4}; \mathbf{3})$ and $(\mathbf{1.4}; \mathbf{3})$
No absolute minima.

12.



Relative minimum $(-\mathbf{3}; -\mathbf{4})$
Absolute maximum $(\mathbf{0}; \mathbf{5})$
A point of inflection $(\mathbf{2}; \mathbf{1})$
No absolute minima.

Given the parent function and a description of the transformation, write the equation of the transformed function $f(x)$.

13. **Square Root Function**
Reflected in the x-axis
Translated 10 units up

$f(x) = -\sqrt{x} + 10$

14. **Absolute value-**
Translated 2 units up
Translated 3 units left

$f(x) = |x + 3| + 2$

Use the graph of parent function to graph the function. Find the domain and the range of the new function.

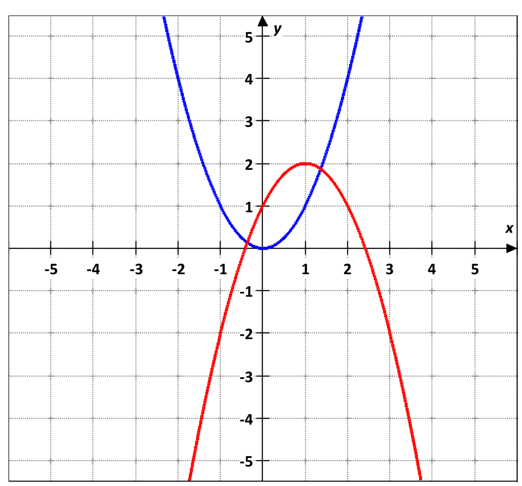
15. $h(x) = -(x-1)^2 + 2$

$h(x) = -(x-1)^2 + 2$ (red arrow)

Parent function $f(x) = x^2$ (blue arrow)

Transformation:
Reflected in the x axis
Translated 2 units up
Translated 1 unit right

$D = (-\infty, \infty)$
$R = (-\infty, \infty)$



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Unit 1 TEST Functions and Relations

16. Find each function value.

The tables give some selected ordered pairs for functions f and g

x	-1	0	2	3
$g(x)$	1	0	4	9

x	2	4	6	9
$f(x)$	3	5	7	10

$(f\circ g)(2)=?$
$(g\circ f)(2)=?$

$(f\circ g)(2)=?$
$(f\circ g)(2)=f(g(2))=f(4)=\mathbf{5}$

$(g\circ f)(2)=?$
$(g\circ f)(2)=g(f(2))=g(3)=\mathbf{9}$

17. $f(x)=\dfrac{2+x}{6}\qquad g(x)=\dfrac{1}{x}$

$(f\circ g)(2)=?\quad D_{f\circ g}=?$

$(f\circ g)(x)=f(g(x))$

$f(g(x))=\dfrac{2+g(x)}{6}$

$f(g(x))=\dfrac{2+\frac{1}{x}}{6}$

$f(g(x))=\dfrac{\frac{2x+1}{x}}{6}$

$f(g(x))=\mathbf{\dfrac{2x+1}{6x}}$

$(f\circ g)(2)=\dfrac{2*2+1}{6*2}$

$(f\circ g)(2)=\mathbf{\dfrac{5}{12}}$

18. $f(x)=\dfrac{x^2+1}{2}\qquad g(x)=x+2$

$(g\circ f)(1)=?\quad D_{g\circ f}=?$

$(g\circ f)(x)=g(f(x))$

$g(f(x))=f(x)+2$

$g(f(x))=\dfrac{x^2+1}{2}+2$

$g(f(x))=\dfrac{x^2+1+4}{2}$

$g(f(x))=\mathbf{\dfrac{x^2+5}{2}}$

$(g\circ f)(1)=\dfrac{1^2+5}{2}$

$(g\circ f)(1)=\dfrac{6}{2}$

$(g\circ f)(1)=\mathbf{3}$

Show algebraically that f and g are inverse functions.

19. $f(x)=2x-3\qquad g(x)=\dfrac{x+3}{2}$

$f(g(x))=2*g(x)-3$

$f(g(x))=2*\dfrac{x+3}{2}-3$

$f(g(x))=x+3-3$

$f(g(x))=\mathbf{x}$

$g(f(x))=\dfrac{f(x)+3}{2}$

$g(f(x))=\dfrac{2x-3+3}{2}$

$g(f(x))=\dfrac{2x}{2}$

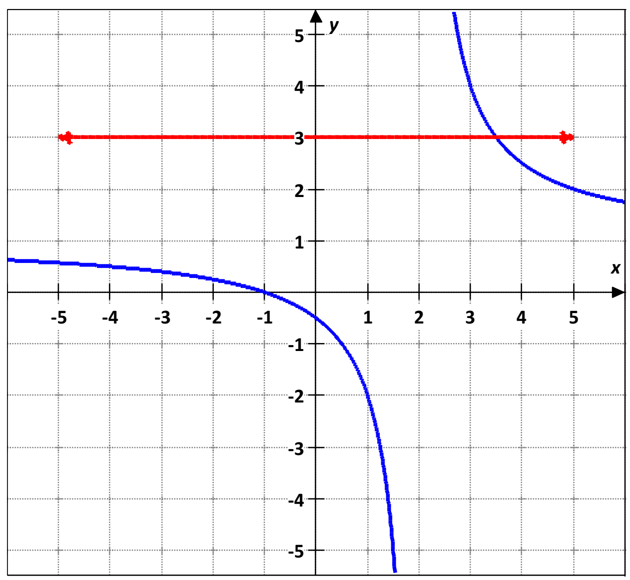
$g(f(x))=\mathbf{x}$

Name: ____ Period: __________ Date: _______________

Unit 1 TEST Functions and Relations

Determine whether each function has an inverse function. If it does, find the inverse function and state any restrictions on its domain.

20. $f(x) = \dfrac{x+1}{x-2}$



$f(x) = \dfrac{x+1}{x-2} \quad x \neq 2$

$D = (-\infty, 2) \cup (2, \infty) \qquad R = (-\infty, 1) \cup (1, \infty)$

$y = \dfrac{x+1}{x-2}$

$x = \dfrac{y+1}{y-2}$

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

$xy - 2x = y + 1$

$xy - y = 2x + 1$

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

$y = \dfrac{2x+1}{x-1}$

$f^{-1}(x) = \dfrac{2x+1}{x-1} \quad x \neq 1$

$D = (-\infty, 1) \cup (1, \infty) \qquad R = (-\infty, 2) \cup (2, \infty)$

$f(x) = \dfrac{x+1}{x-2}$ is a one − to − one function.

Therefore the inverse of $f(x) = \frac{x+1}{x-2}$ is a function.