

Use Algebraic Notation AND Show All of Your Work

Determine whether each relation is a function. (Circle the correct response.)

Give the domain and range for each relation.

[4, 6, 6 pts]

1. $\{(4,5), (6,7), (8,8)\}$

Function OR Not a Function

Domain Set: $\{4, 6, 8\}$

Range Set: $\{5, 7, 8\}$

[4, 6, 6 pts]

2. $\{(3,4), (3,5), (4,4), (4,5)\}$

Function OR Not a Function

Domain Set: $\{3, 4\}$

Range Set: $\{4, 5\}$

For $g(x) = 2x^2 + 3x - 1$, find the indicated function values.

[5 pts]

2. $g(0) = 2(0)^2 + 3(0) - 1$

$g(0) = 2 \cdot 0 + 0 - 1$

$g(0) = -1$

$g(0) = -1$

[8 pts]

3. $g(-4) = 2(-4)^2 + 3(-4) - 1$

$g(-4) = 2 \cdot 16 + (-12) - 1$

$g(-4) = 32 - 12 - 1$

$g(-4) = 20 - 1$

$g(-4) = 19$

$g(-4) = 19$

[10 pts]

4. $g(5a) = 2(5a)^2 + 3(5a) - 1$

$g(5a) = 2(25a^2) + 15a - 1$

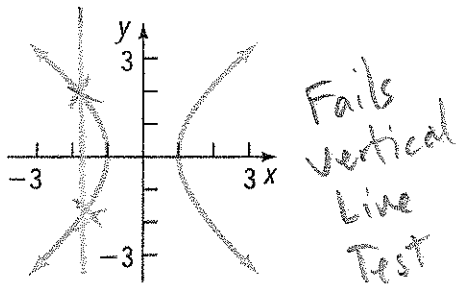
$g(5a) = 50a^2 + 15a - 1$

$g(5a) = 50a^2 + 15a - 1$

Identify graphs in which y is a function of x .

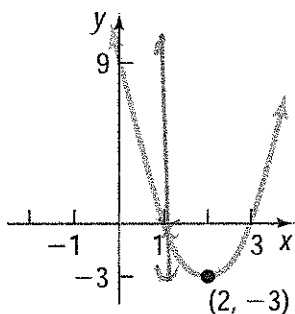
[6 pts each]

5.



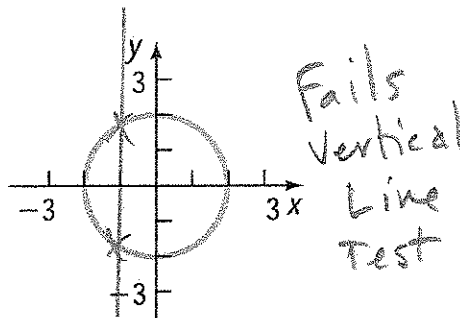
Function OR Not a Function

6.



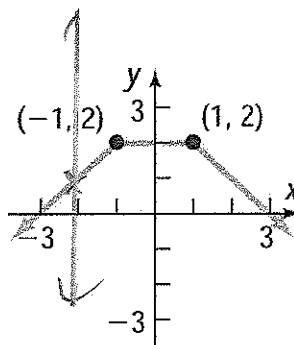
Function OR Not a Function

7.



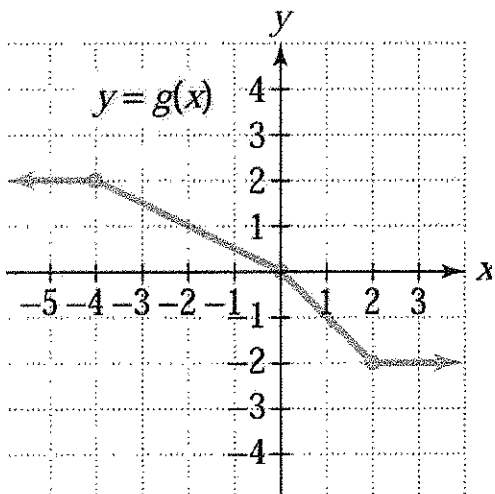
Function OR Not a Function

8.



Function OR Not a Function

Use the graph of g to find the following values. [6 pts each]



9. $g(-4)$

$g(-4) = 2$

10. $g(2)$

$g(2) = -2$

11. For what value of x is $g(x) = 1$?

$x = -2$

12. For what value of x is $g(x) = -1$?

$x = 1$

[8, 8 pts]

13. (a) Explain how to determine whether a relation is a function.

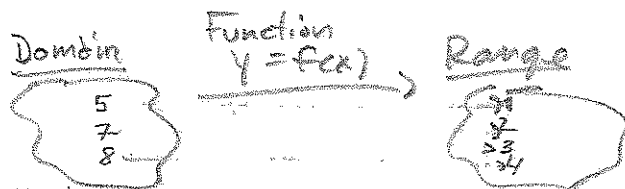
check that each domain element corresponds to exactly one range element. That is, no two ordered pairs in a function can have the same first component and different second components.

Vertical Line Test

If any vertical line intersects a graph (of a relation) in more than one point, the graph does not define y as a function of x .

(b) What is a function?

A function is a correspondence from a first set, called the domain, to a second set, called the range, such that each element in the domain corresponds to exactly one element in the range.



[9 pts]

14. Which one of the following is true? (Circle the correct letter.)

- (a) All relations are functions.
- (b) No two ordered pairs of a function can have the same second component and different first components.
- (c) The graph of every line is a function.
- (d) A horizontal line can intersect the graph of a function in more than one point.

Find the domain of each function.

[8 pts]

15. $f(x) = 3x + 5$

All Real Numbers

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

[10 pts]

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

$x - 3 = 0$

Excluded Value $\rightarrow x = 3$

Domain Set: $\{x \mid x \neq 3\}$

For $g(x) = 2x + 7$ and $f(x) = 3x^2 - 4x$, find the indicated functions.

[9 pts]

$$\begin{aligned} 17. (f+g)(x) &= f(x) + g(x) \\ &= (3x^2 - 4x) + (2x + 7) \\ &= 3x^2 - 4x + 2x + 7 \\ &= 3x^2 - 2x + 7 \end{aligned}$$

$$(f+g)(x) = \underline{3x^2 - 2x + 7}$$

[9 pts]

$$\begin{aligned} 18. (f-g)(x) &= f(x) - g(x) \\ &= (3x^2 - 4x) - (2x + 7) \\ &= 3x^2 - 4x - 2x - 7 \\ &= 3x^2 - 6x - 7 \end{aligned}$$

$$(f-g)(x) = \underline{3x^2 - 6x - 7}$$

[11 pts]

$$\begin{aligned} 19. (fg)(x) &= [f(x)] \cdot [g(x)] \\ &= (3x^2 - 4x) \cdot (2x + 7) \\ &= (3x^2)(2x) + (3x^2)(7) + (-4x)(2x) + (-4x)(7) \\ &= 6x^3 + 21x^2 - 8x^2 - 28x \\ &= 6x^3 + 13x^2 - 28x \end{aligned}$$

$$(fg)(x) = \underline{6x^3 + 13x^2 - 28x}$$

[9 pts]

$$\begin{aligned} 20. \left(\frac{f}{g}\right)(x) &= \frac{f(x)}{g(x)} \\ &= \frac{3x^2 - 4x}{2x + 7} \end{aligned}$$

$$\left(\frac{f}{g}\right)(x) = \underline{\frac{3x^2 - 4x}{2x + 7}}$$

Solve each inequality, and state the solution set in INTERVAL notation.

Graph this solution set on a number line.

[8, 3, 4 pts]

21. $17 - 3x \leq 29$

$-17 + 17 - 3x \leq -17 + 29$

$-3x \leq 12$

$-\frac{1}{3} \cdot (-3x) \geq -\frac{1}{3} \cdot 12$

$x \geq -4$

$\{x \mid x \geq -4\}$



Solution Set: $[-4, \infty)$

[11, 3, 4 pts]

22. $3 + 2(3 - 2x) < 5(2 - 3x)$

$3 + 6 - 4x < 10 - 15x$

$9 - 4x < 10 - 15x$

$15x + 9 - 4x < 15x + 10 - 15x$

$11x + 9 < 10$

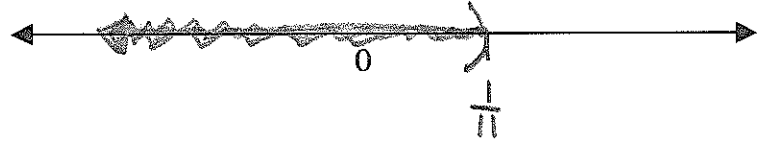
$-9 + 11x + 9 < -9 + 10$

$11x < 1$

$\frac{1}{11} \cdot 11x < \frac{1}{11} \cdot 1$

$x < \frac{1}{11}$

$\{x \mid x < \frac{1}{11}\}$



Solution Set: $(-\infty, \frac{1}{11})$

[16, 3, 4 pts]

23. $\frac{x-4}{6} \geq \frac{x-2}{9} + \frac{5}{18}$ LCD = 18

$\frac{18}{1} \left[\frac{x-4}{6} \right] \geq \frac{18}{1} \left[\frac{x-2}{9} + \frac{5}{18} \right]$

$3(x-4) \geq \frac{18}{1} \cdot \left(\frac{x-2}{9} \right) + \frac{18}{1} \cdot \frac{5}{18}$

$3x - 12 \geq 2(x-2) + 5$

$3x - 12 \geq 2x - 4 + 5$

$3x - 12 \geq 2x + 1$

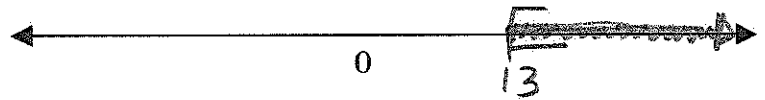
$-2x + 3x - 12 \geq -2x + 2x + 1$

$x - 12 \geq 1$

$12 + x - 12 \geq 12 + 1$

$x \geq 13$

$\{x \mid x \geq 13\}$



Solution Set: $[13, \infty)$

[8, 4 pts]

24. When solving an inequality, under what conditions will it be necessary to change the direction of the inequality symbol? Give one example.

If we multiply or divide both sides of an inequality by the same negative quantity and reverse the direction of the inequality symbol, the resulting inequality is equivalent to the original one.

Example:

$-5x \geq 15$

$x \leq -3$

$-\frac{1}{5} \cdot \frac{5x}{1} \leq -\frac{1}{5} \cdot \frac{15}{1}$

Multiplying by a Negative changes direction

Solve each compound inequality, and state the solution set in INTERVAL notation.

Graph this solution set on a number line.

[16, 5, 6 pts]

$$25. \quad 4(1-x) < -6 \text{ AND } \frac{x-7}{5} \leq -2$$

$$4 - 4x < -6$$

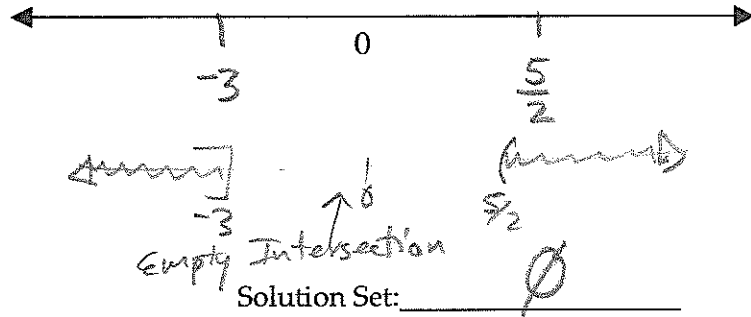
$$-4 + 4 - 4x < -6 + (-4) \quad \left| \begin{array}{l} 5 \cdot \left[\frac{x-7}{5} \right] \leq 5(-2) \\ x-7 \leq -10 \\ 7+x-7 \leq -10+7 \\ x \leq -3 \end{array} \right.$$

$$-4x < -10$$

$$\frac{-4x}{-4} > \frac{-10}{-4}$$

$$x > \frac{5}{2}$$

"Set intersection"



[16, 5, 6 pts]

$$26. \quad x-1 \leq 7x-1 \text{ AND } 4x-7 < 3-x$$

$$-x+x-1 \leq -x+7x-1 \quad \left| \begin{array}{l} x+4x-7 < 3-x+x \\ 5x-7 < 3 \\ 7+5x-7 < 3+7 \\ 5x < 10 \\ \frac{5x}{5} < \frac{10}{5} \\ x < 2 \end{array} \right.$$

$$-1 \leq 6x-1$$

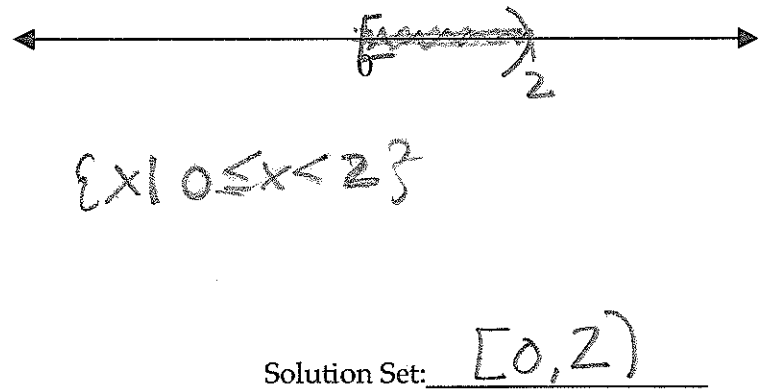
$$-1+1 \leq 6x-1+1$$

$$0 \leq 6x$$

$$\frac{0}{6} \leq \frac{6x}{6}$$

$$0 \leq x$$

"Set intersection"



[16, 5, 6 pts]

$$27. \quad 4x+3 < -1 \text{ OR } 2x-3 \geq -11$$

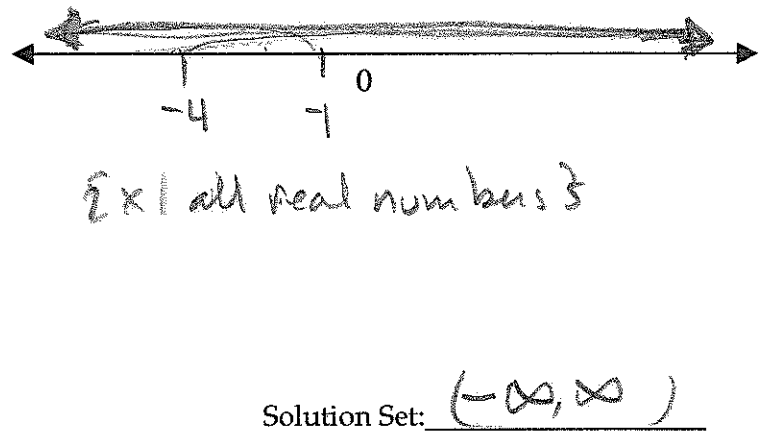
$$-3+4x+3 < -3+(-1) \quad \left| \begin{array}{l} 3+2x-3 \geq -11+3 \\ 2x \geq -8 \\ \frac{2x}{2} \geq \frac{-8}{2} \\ x \geq -4 \end{array} \right.$$

$$4x < -4$$

$$\frac{4x}{4} < \frac{-4}{4}$$

$$x < -1$$

"Set Union"



[16, 5, 6 pts]

$$28. \quad 2x-5 \leq -11 \text{ OR } 5x+1 \geq 6$$

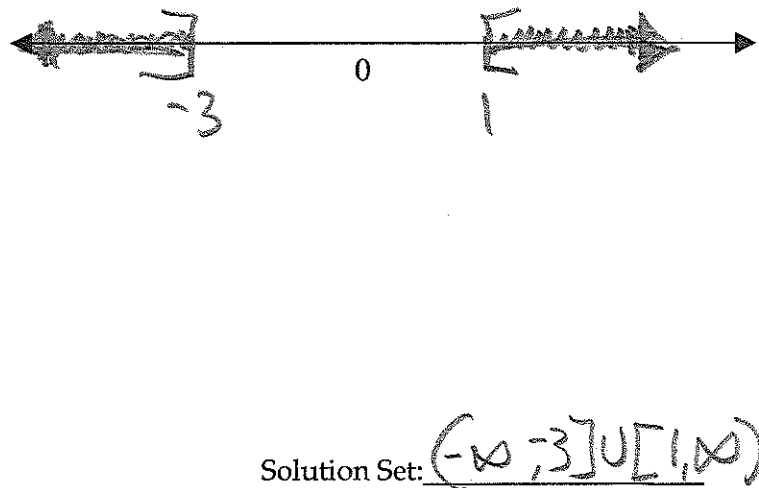
$$5+2x-5 \leq -11+5 \quad \left| \begin{array}{l} -1+5x+1 \geq -1+6 \\ 5x \geq 5 \\ \frac{5x}{5} \geq \frac{5}{5} \\ x \geq 1 \end{array} \right.$$

$$2x \leq -6$$

$$\frac{2x}{2} \leq \frac{-6}{2}$$

$$x \leq -3$$

"Set Union"



Solve each equation, and state the solution set.

[18, 5 pts]

29. $|2x - 1| = 7$

$$\begin{aligned} -(2x - 1) &= 7, \text{ or } +(2x - 1) = 7 \\ -2x + 1 &= 7 \\ -2x + 1 - 1 &= 7 - 1 \\ -2x &= 6 \\ \frac{-2x}{-2} &= \frac{6}{-2} \\ x &= -3 \end{aligned}$$

$$\begin{aligned} 2x - 1 + 1 &= 7 + 1 \\ 2x &= 8 \\ \frac{2x}{2} &= \frac{8}{2} \\ x &= 4 \end{aligned}$$

[18, 5 pts]

30. $|x + 1| + 5 = 3$

$$\begin{aligned} -5 + |x + 1| + 5 &= -5 + 3 \\ |x + 1| &= -2 \end{aligned}$$

Distance from zero can't be negative!

$$\begin{aligned} -(x + 1) &= -2, \text{ or } +(x + 1) = -2 \\ -x - 1 &= -2 \\ -x - 1 + 1 &= -2 + 1 \\ -x &= -1 \\ -1(-x) &= -1(-1) \\ x &= 1 \end{aligned}$$

$$\begin{aligned} x + 1 - 1 &= -2 - 1 \\ x &= -3 \end{aligned}$$

[20, 5 pts]

31. $|6y - 2| + 4 = 32$

$$\begin{aligned} -4 + |6y - 2| + 4 &= -4 + 32 \\ |6y - 2| &= 28 \end{aligned}$$

$$\begin{aligned} -(6y - 2) &= 28, \text{ or } +(6y - 2) = 28 \\ -6y + 2 &= 28 \\ -6y + 2 - 2 &= 28 - 2 \\ -6y &= 26 \\ \frac{-6y}{-6} &= \frac{26}{-6} \\ y &= -\frac{13}{3} \end{aligned}$$

$$\begin{aligned} 6y - 2 + 2 &= 28 + 2 \\ 6y &= 30 \\ \frac{6y}{6} &= \frac{30}{6} \\ y &= 5 \end{aligned}$$

[20, 5 pts]

32. $|2x - 4| = |x - 1|$

$$\begin{aligned} -(2x - 4) &= x - 1, \text{ or } +(2x - 4) = x - 1 \\ -2x + 4 &= x - 1 \\ -2x + 4 + 2x &= x - 1 + 2x \\ 4 &= 3x - 1 \\ 4 + 1 &= 3x - 1 + 1 \\ 5 &= 3x \\ \frac{5}{3} &= \frac{3x}{3} \\ \frac{5}{3} &= x \end{aligned}$$

$$\begin{aligned} 2x - 4 &= x - 1 \\ 2x - 4 - x &= x - 1 - x \\ x - 4 &= -1 \\ x - 4 + 4 &= -1 + 4 \\ x &= 3 \end{aligned}$$

check

$$\begin{aligned} |2(-3) - 1| &= 7 \\ |-6 - 1| &= 7 \\ |-7| &= 7 \\ 7 &= 7 \\ \text{TRUE!} \end{aligned}$$

check

$$\begin{aligned} |2(4) - 1| &= 7 \\ |8 - 1| &= 7 \\ |7| &= 7 \\ 7 &= 7 \\ \text{TRUE!} \end{aligned}$$

Solution Set: $\{-3, 4\}$

check

$$\begin{aligned} |0 + 1| + 5 &= 3 \\ |2| + 5 &= 3 \\ 2 + 5 &= 3 \\ 7 &= 3 \\ \text{False!} \end{aligned}$$

check

$$\begin{aligned} |(-3) + 1| + 5 &= 3 \\ |-2| + 5 &= 3 \\ 2 + 5 &= 3 \\ 7 &= 3 \\ \text{False!} \end{aligned}$$

No Solution

Solution Set: \emptyset or $\{ \}$

check

$$\begin{aligned} |6(-\frac{13}{3}) - 2| + 4 &= 32 \\ |2(-13) - 2| + 4 &= 32 \\ |-26 - 2| + 4 &= 32 \\ |-28| + 4 &= 32 \\ 28 + 4 &= 32 \\ 32 &= 32 \\ \text{TRUE!} \end{aligned}$$

check

$$\begin{aligned} |6(5) - 2| + 4 &= 32 \\ |30 - 2| + 4 &= 32 \\ |28| + 4 &= 32 \\ 28 + 4 &= 32 \\ 32 &= 32 \\ \text{TRUE!} \end{aligned}$$

Solution Set: $\{-\frac{13}{3}, 5\}$

check

$$\begin{aligned} |2(\frac{5}{3}) - 4| &= |(\frac{5}{2}) - 1| \\ |\frac{10}{3} - 4| &= |\frac{5}{3} - \frac{2}{3}| \\ |\frac{10}{3} - \frac{12}{3}| &= |\frac{2}{3}| \\ |-\frac{2}{3}| &= \frac{2}{3} \\ \frac{2}{3} &= \frac{2}{3} \\ \text{TRUE!} \end{aligned}$$

check

$$\begin{aligned} |2(3) - 4| &= |(3) - 1| \\ |6 - 4| &= |2| \\ |2| &= |2| \\ 2 &= 2 \\ \text{TRUE!} \end{aligned}$$

Solution Set: $\{\frac{5}{3}, 3\}$