Which pairs are always the same?

A. $3x + 7x$ and $10x$

B. $3x + 7$ and $10x$

C. $2(x + 5)$ and $2x + 10$

D. $2(x + 5)$ and $2x + 5$

E. $4x + 6$ and $2(2x + 3)$

Testing with values

$2(x + 5)$ and $2x + 10$

$x = 0$

$x = 1$

$x = 5$

$x = -2$

$x + 2$ and $2x$

$x = 2$

Equivalent?

Vocabulary we need

Example: $-6x^2 + 9x - 4$

term

coefficient

constant

variable part

Group the terms that can be combined.

$4x$

$3y$

$-7x$

8

$2x^2$

$-xy$

$-5x^2$

$9xy$

-12

x

$11y$

-4

6

$-3xy$

Like terms

$7x$ and $-2x$

$4y$ and $4x$

$3x^2$ and $8x^2$

$5x$ and $5x^2$

$9ab$ and $-ab$

6 and -11

Simplify

$3x + 4x - 2x$

$8a - 3 + 2a + 11$

$5m - 2n + 7m + n$

$-2x^2 + 6x - 5x^2 + x$

$9p + 4 - 3p - 10$

Create

Create an expression equivalent to $8x + 12$.

Create an expression not equivalent to $8x + 12$.

Create two expressions equal when $x = 2$ but not always equivalent.

Distribute

$4(x + 3)$

$3(2x - 7)$

$-2(x - 5)$

$-(x + 8)$

$5(3a + 2b - 4)$

Distribution backward

$6x + 12$

$9a - 3$

$10y + 15$

$14m - 21$

$5x + 7$

Distribute, then combine

$3(x + 4) + 2x$

$5a - 2(a + 3)$

$4(2y - 1) - 3y + 7$

$-2(3m - 5) + 4m$

$-3(2x - 5) + 4(x + 1)$

Create a distribution problem that simplifies to $5x - 7$.

Create an expression with two sets of parentheses that simplifies to $8x - 3$.

Do these individually:

Simplify: $4x + 9 - 2x + 6$

Simplify: $3(2x - 5) + 4x$

Are they equivalent? $5(x + 2)$ and $5x + 2$

Which values work?

$2x + 5 = 17$

$x = 4$

$x = 6$

$x = 8$

Solve

$x + 7 = 19$

$3a = 27$

$\frac{n}{4} = 6$

$y - 5 = -2$

Solve

$2x + 5 = 17$

$3m - 8 = 19$

$\frac{p}{5} + 2 = 9$

$-4r + 6 = 18$

Distribute and combine first

$4(x + 2) = 28$

$3(2a - 1) = 21$

$2(y + 5) + 3y = 20$

$5m - 2(2m - 3) = 18$

Variables on both sides

$7x - 4 = 4x + 17$

$2a + 9 = 5a - 6$

$3(p + 2) = p + 14$

Special cases

$4n - 7 = 4n - 7$

$6y + 5 = 6y - 8$

$5(x - 2) + 3 = 5x - 7$

$3(2a + 1) = 6a + 5$

Create an equation with variables on both sides whose solution is x = 4.

Create an equation with no solution.

Create an equation with infinitely many solutions.

Try these individually:

$3x + 5 = 26$

$2(x + 4) = 18$

$4p + 8 = 4p - 2$

What types of values make each statement true?

$x < 4$

$x > 9$

$x \geq 2$

$x \leq 4$

Solve

$x + 6 < 14$

$3a \geq 18$

$2y - 5 \leq 11$

$7m + 4 > 25$

Multiplying and dividing by a negative

$2 < 5$

Multiply by -1.

$-2 \ ? \ -5$

$-3x + 4 \geq 19$

Solve

$-2x + 5 > 13$

$-5m - 4 \leq 16$

$-3(2p - 1) < 9$

$8 - 2n \geq 20$

Variables on both sides

$4x - 7 < 2x + 5$

$6y + 2 \geq 3y + 17$

$-2(x - 4) > x - 7$

Compound inequalities

$-3 < x + 2 \leq 5$

$-6 \leq 2a < 10$

$-5 < 2x + 1 \leq 9$

$-8 \leq -2y + 4 < 10$

Create an inequality that requires reversing the inequality symbol and has solution $x < 4$.

Try these individually

$5x - 4 < 2x + 11$

$-2x + 4 \geq 14$

$-5 < 2x + 1 \leq 9$

Interval notation

$\leq$ or $\geq$ brackets [ ] and closed circles

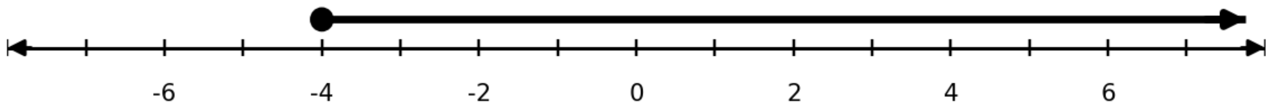
$<$ or $>$ parentheses ( ) and open circles

$-\infty$ or ∞ parentheses and arrows

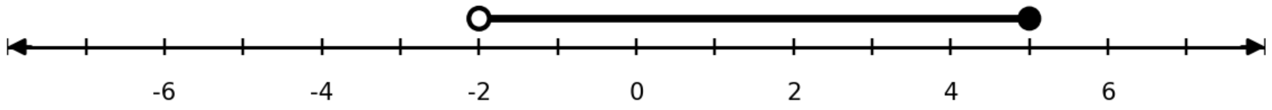
No brackets with infinity.

Interval notation examples

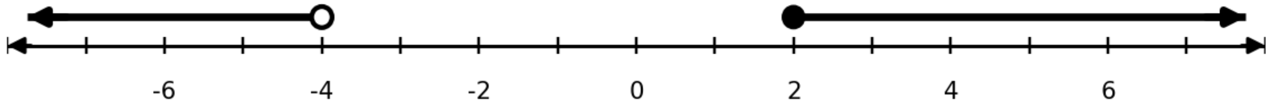
$x \geq -4$ $[-4, \infty)$



$-2 < x \leq 5$ $(-2, 5]$

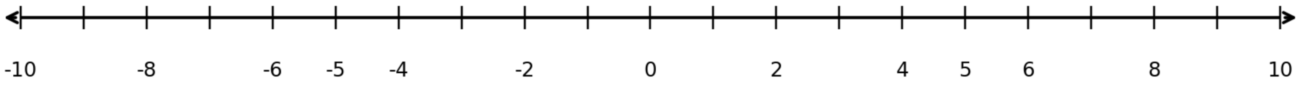


$x < -4$ or $x \geq 2$ $(-\infty, -4) \cup [2, \infty)$



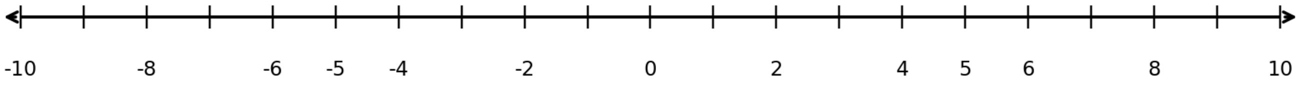
Inequality to graph and interval notation

$x \geq -4$



Interval notation:

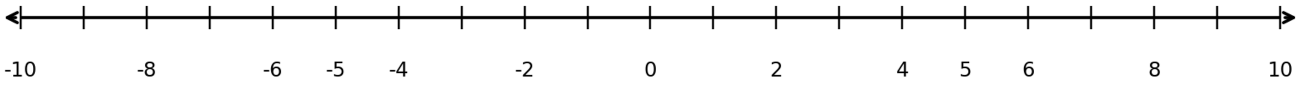
$-2 < x \leq 5$



Interval notation:

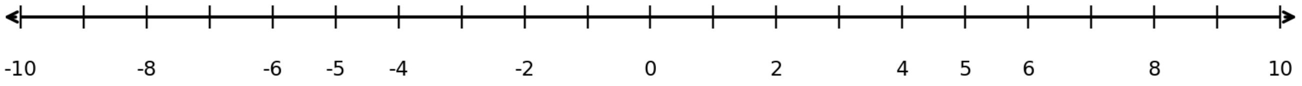
Interval notation → inequality and graph

$(-\infty, 3)$



Inequality:

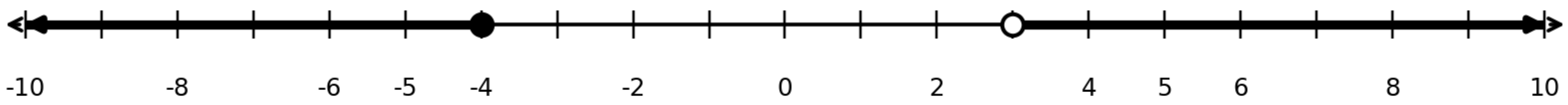
$[-5, 2)$



Inequality:

Graph → inequality and interval notation

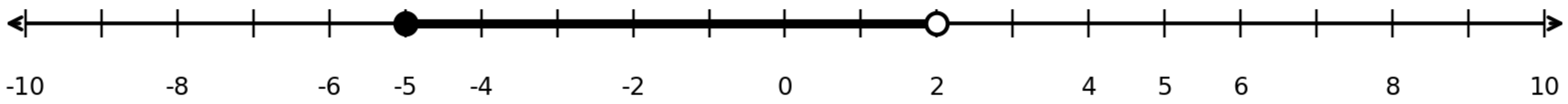
a.



Inequality:

Interval notation:

b.

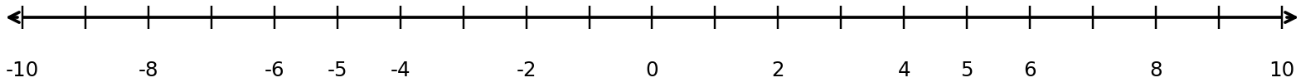


Inequality:

Interval notation:

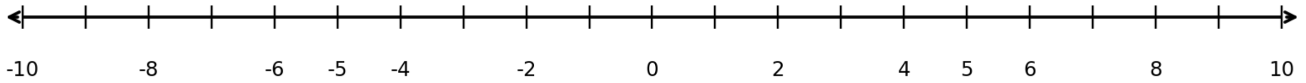
Solve → graph and interval notation

1. $-2x + 4 \geq 14$



Interval notation:

2. $5x - 4 < 2x + 11$



Interval notation:

Create solution sets and give the inequality, interval notation, and number-line graph.

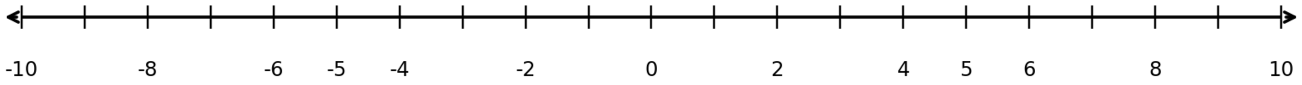
1. Create a bounded solution set (no infinity!) that contains 0 but does not contain 4.

2. Create a disconnected solution set that contains -6 and 6 but does not contain 0.

Do these on your own:

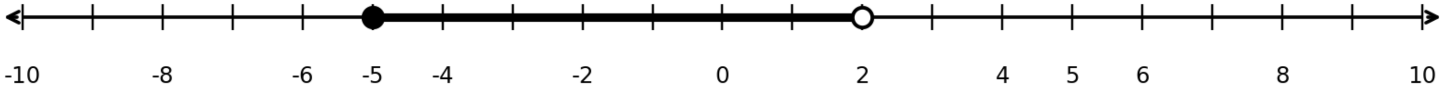
1. Solve, graph, and write interval notation.

   $-3x + 2 < 11$



   Interval notation:

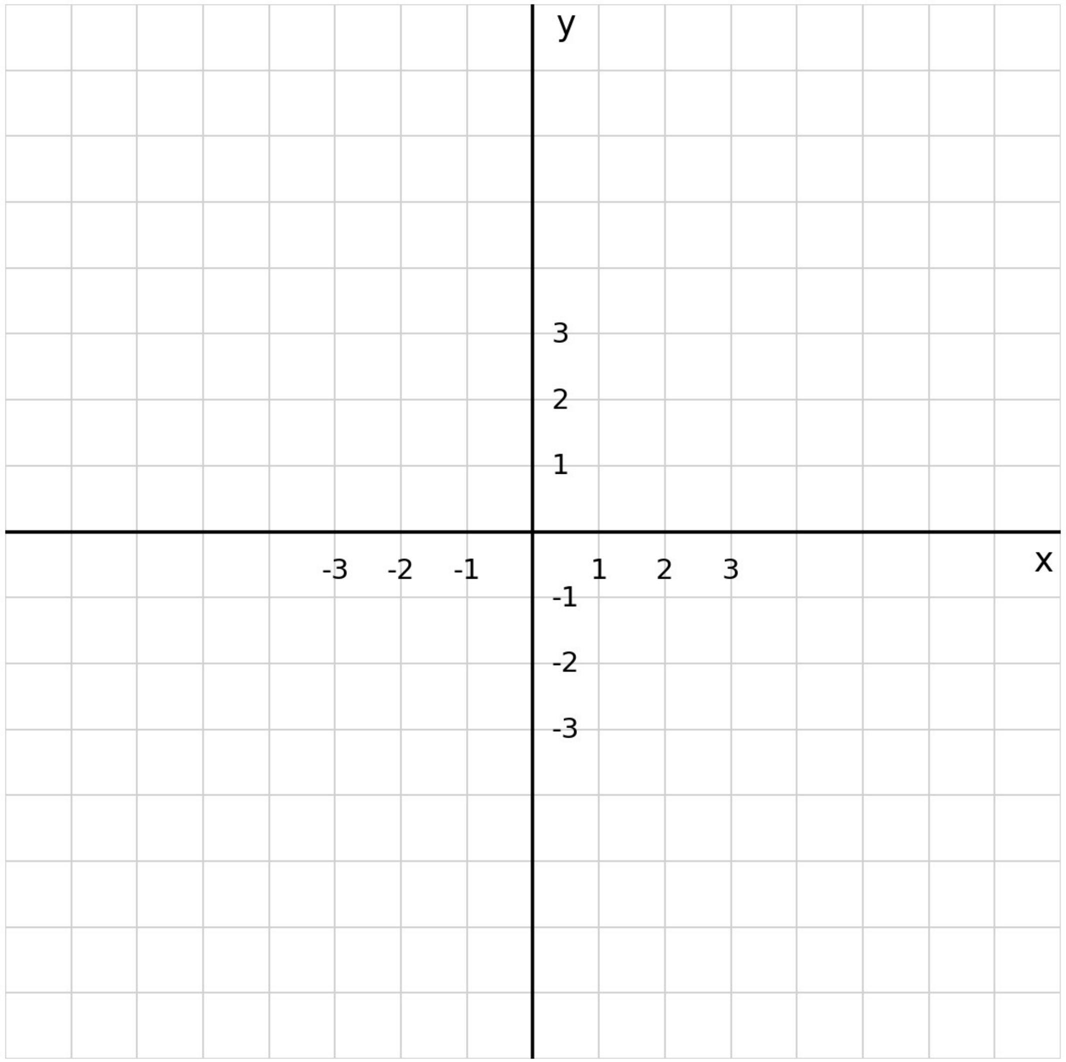
2. Write the inequality and interval notation for the graph.



   Inequality:

   Interval notation:

Plot these points



A(-4, 3)

B(2, -5)

C(0, 4)

D(-6, 0)

E(3, 2)

F(-1, -3)

G(5, 0)

H(0, -2)

Nine key features

Domain

Range

Increasing intervals

Decreasing intervals

Constant intervals

x-intercepts

y-intercept

Absolute maximum value and where it occurs

Absolute minimum value and where it occurs

Use x-values:

Domain

Increasing

Decreasing

Constant

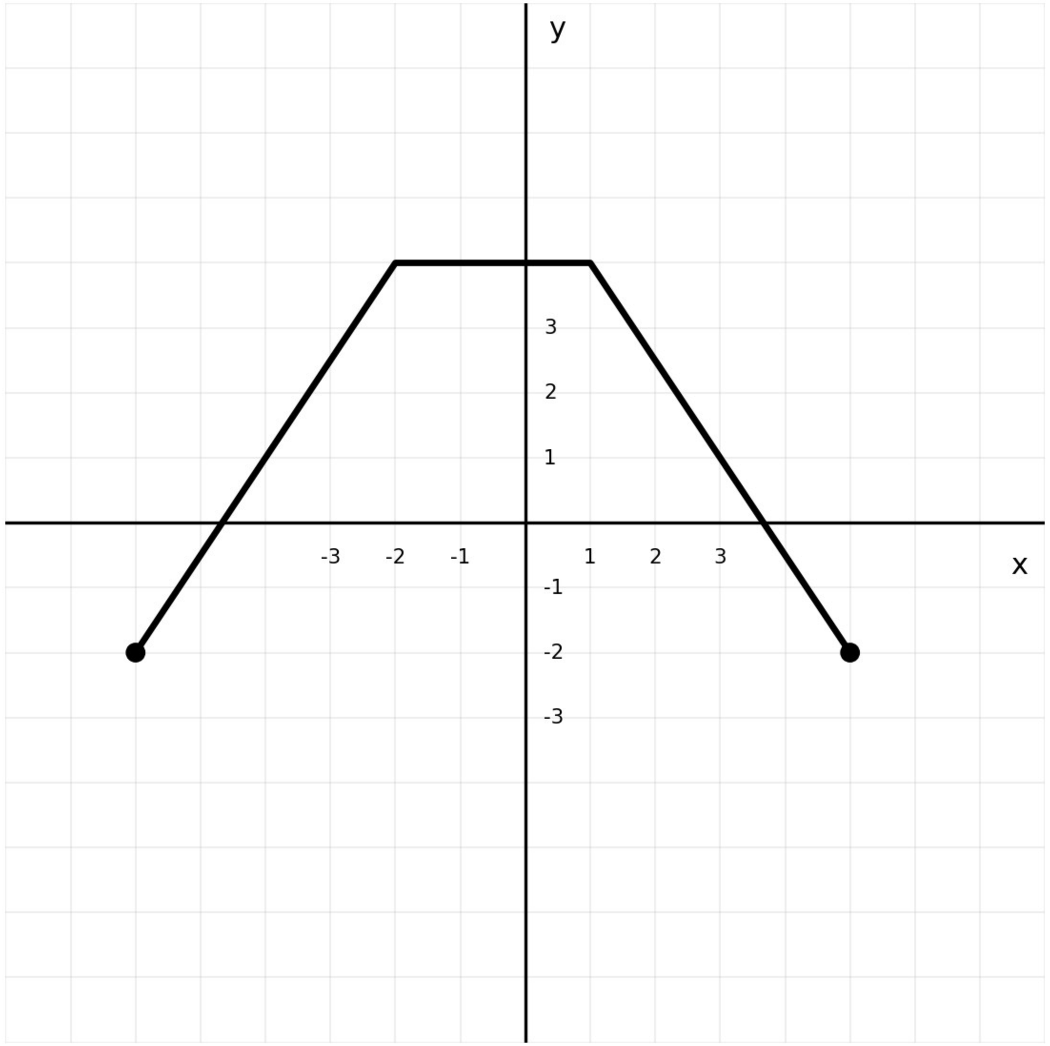
Use y-values:

Range

Maximum value

Minimum value

State all nine key features.



Domain:

Range:

Increasing:

Decreasing:

Constant:

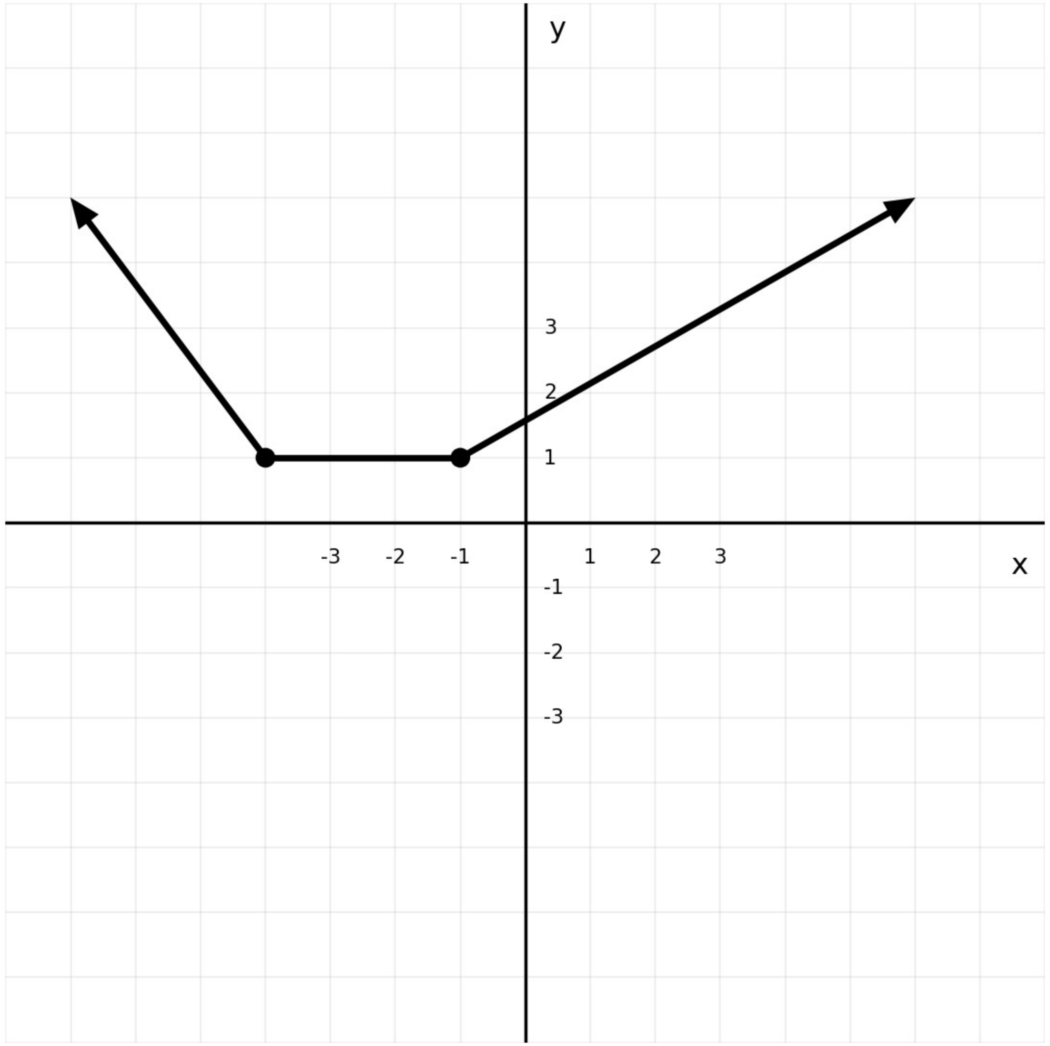
x-intercepts:

y-intercept:

Absolute maximum value and where it occurs:

Absolute minimum value and where it occurs:

State all nine key features.



Domain:

Range:

Increasing:

Decreasing:

Constant:

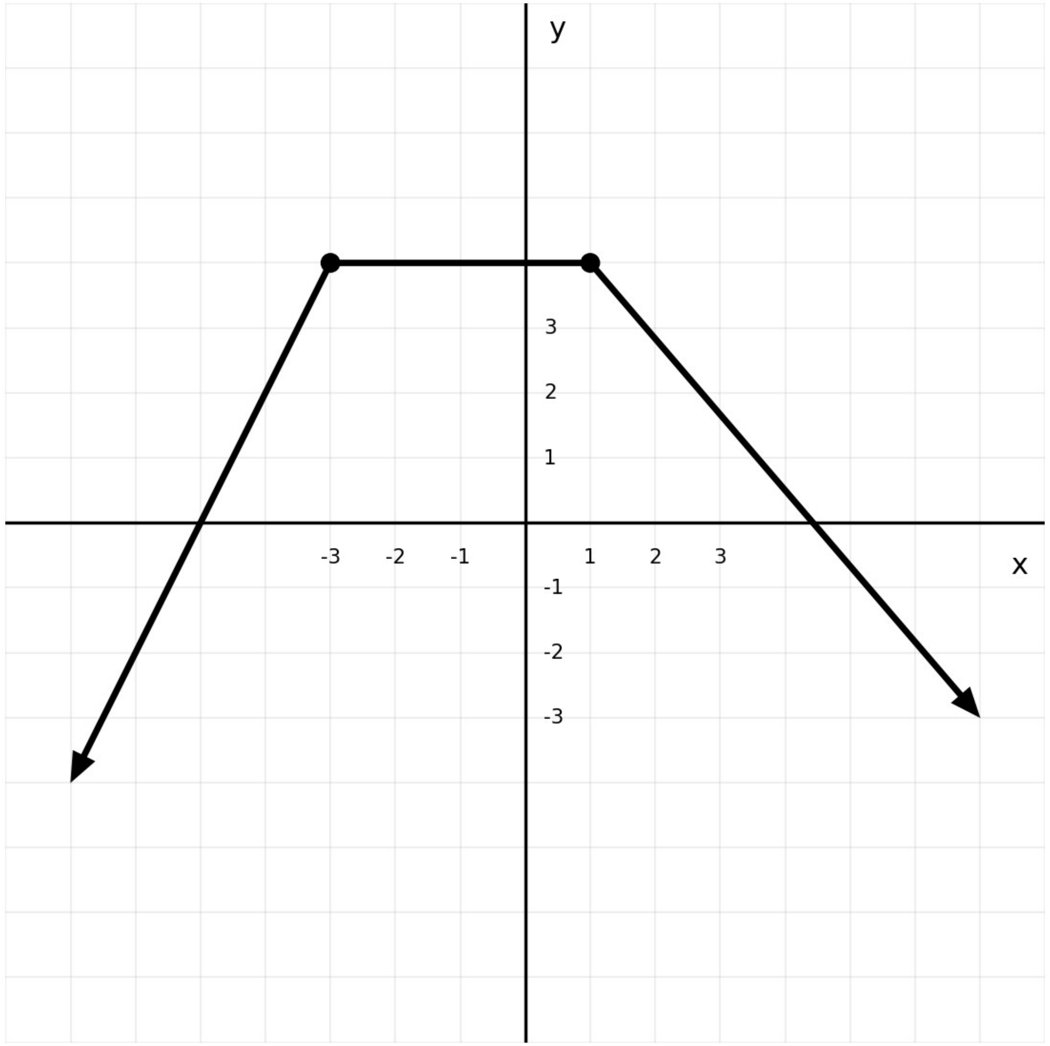
x-intercepts:

y-intercept:

Absolute maximum value and where it occurs:

Absolute minimum value and where it occurs:

State all nine key features.



Domain:

Range:

Increasing:

Decreasing:

Constant:

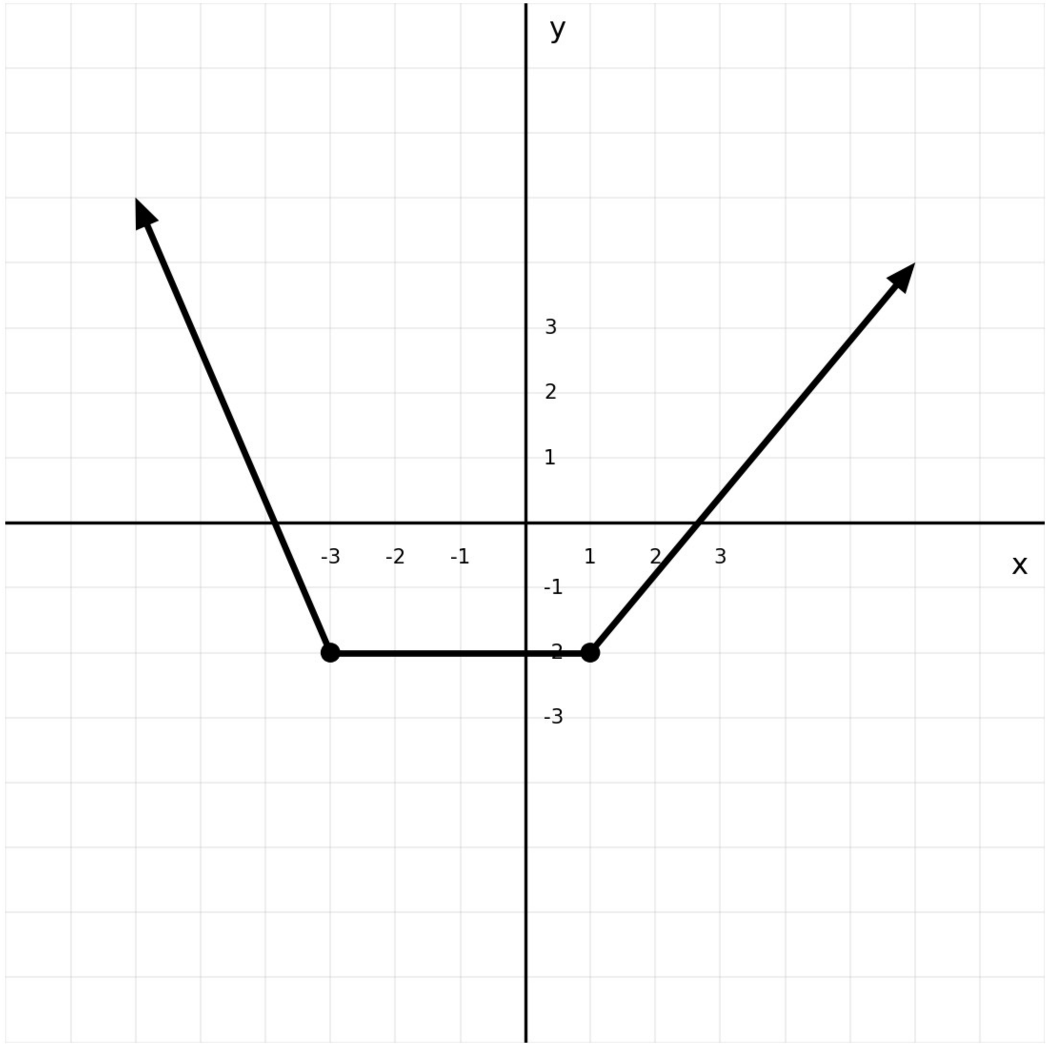
x-intercepts:

y-intercept:

Absolute maximum value and where it occurs:

Absolute minimum value and where it occurs:

State all nine key features.



Domain:

Range:

Increasing:

Decreasing:

Constant:

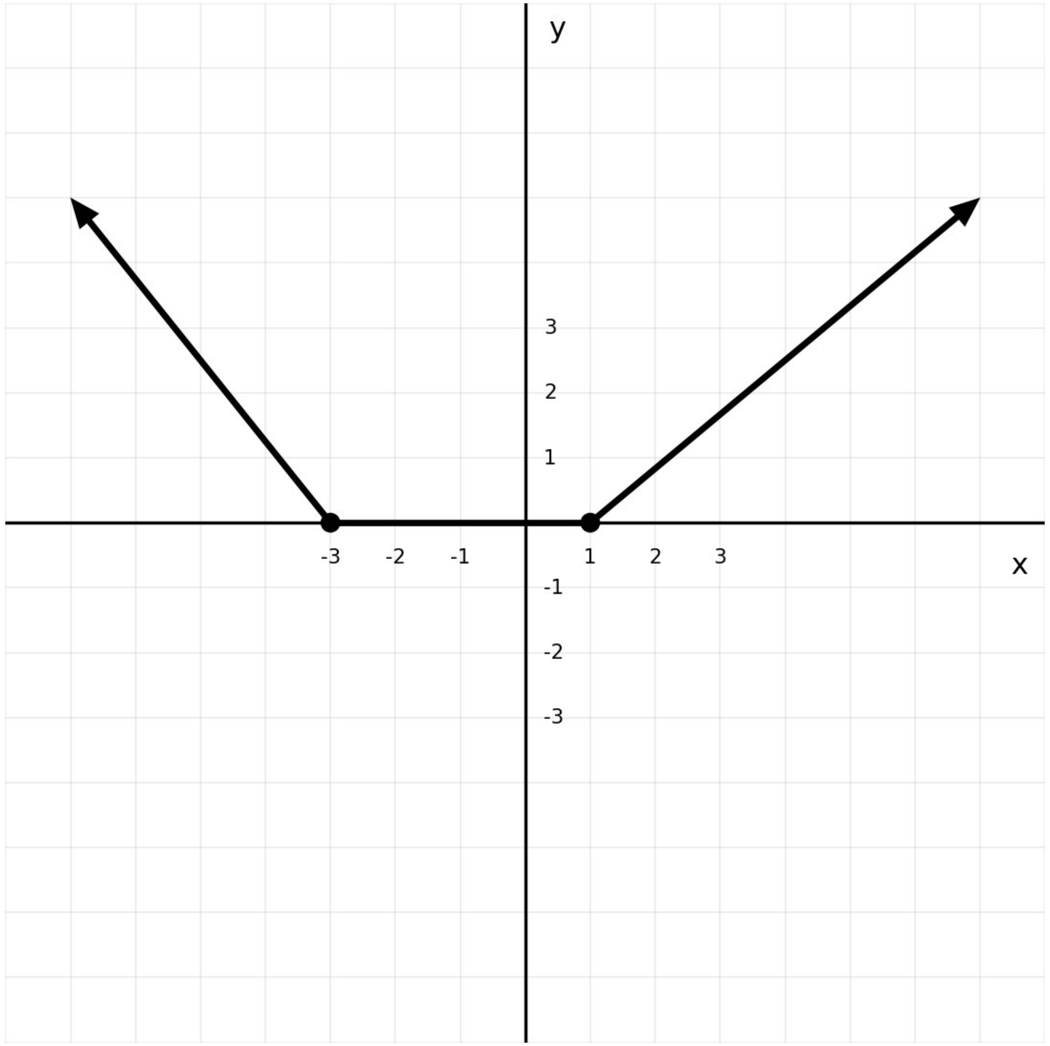
x-intercepts:

y-intercept:

Absolute maximum value and where it occurs:

Absolute minimum value and where it occurs:

State all nine key features.



Domain:

Range:

Increasing:

Decreasing:

Constant:

x-intercepts:

y-intercept:

Absolute maximum value and where it occurs:

Absolute minimum value and where it occurs:

Create one function satisfying all constraints.

Domain: [-6, 6]

Range: [-2, 5]

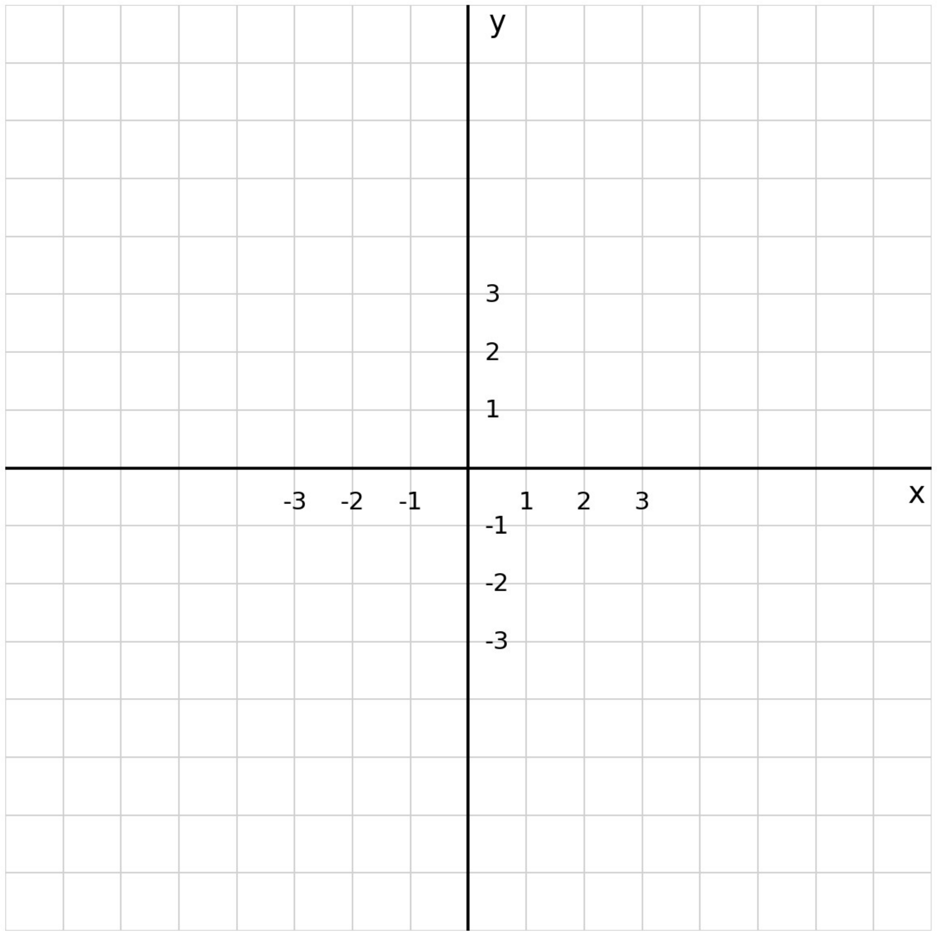
Increasing: (-6, -1)

Constant: [-1, 2]

Decreasing: (2, 6)

x-intercepts: two

y-intercept: one



Create one function satisfying all constraints.

Domain: (-∞, 4]

Range: [-3, ∞)

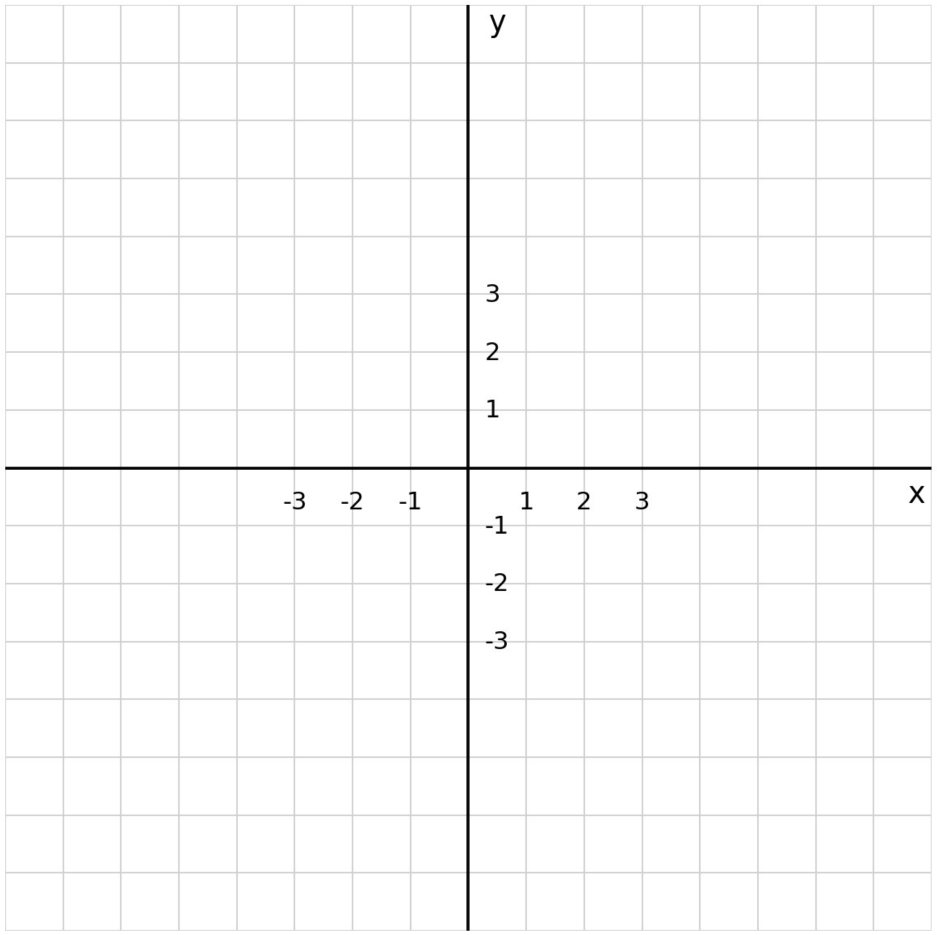
Decreasing: (-∞, 4)

x-intercepts: one

y-intercept: one

Absolute maximum: none

Absolute minimum: -3



Create one function satisfying all constraints.

Domain: (-∞, ∞)

Range: (-∞, 4]

Increasing: (-∞, -2)

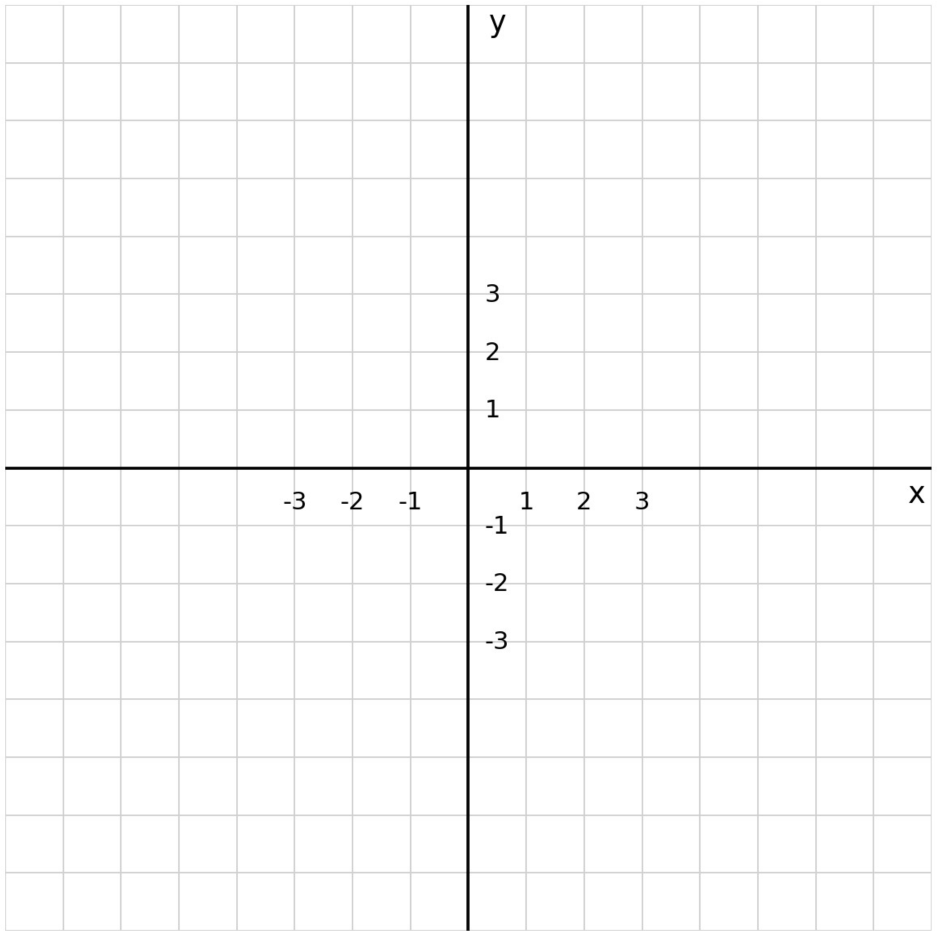
Constant: [-2, 1]

Decreasing: (1, ∞)

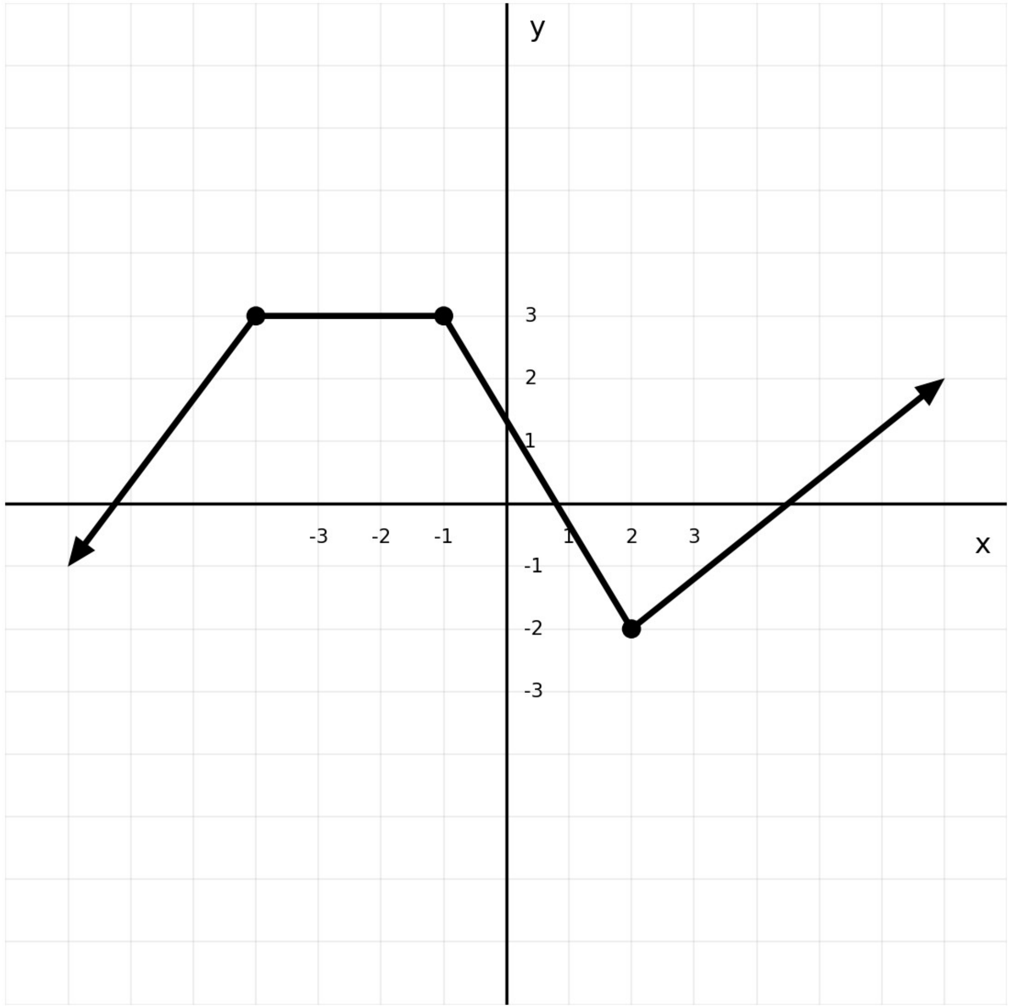
x-intercepts: two

Absolute maximum: 4

Absolute minimum: none



Do it on your own!



Domain:

Range:

Increasing:

Decreasing:

Constant:

x-intercepts:

y-intercept:

Absolute maximum value and where it occurs:

Absolute minimum value and where it occurs: