INEQUALITIES WITH NEGATIVE COEFFICIENTS

BUILDING BLOCKS

NAME _____ CLASS _____ DATE _____

KEY IDEA

Numbers get bigger as you move right.

–4 is to the left of 2, so –4 < 2

–5 is to the left of –2, so –5 < –2



1 Write < or > in each box. Use the number line to help.



a) –3 ☐ 2 b) –7 ☐ –4 c) 5 ☐ –6 d) –1 ☐ –10

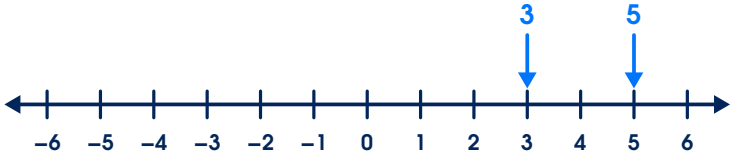
2 Multiply or divide.

same signs → + different signs → –

a) –3 × 4 = ☐ b) –2 × –5 = ☐

c) 12 ÷ –3 = ☐ d) –20 ÷ –4 = ☐

3 What happens when you multiply both sides by –1?



Mark –3 and –5 on the number line.

3 < 5 is true.

Multiply both sides by –1:

–3 ☐ –5

When you multiply by –1, the inequality sign TURNS ROUND STAYS THE SAME

4 Test some values of x to see when –x > 4.

x	–6	–5	–4	–3	0
–x					
–x > 4?					

Write yes or no

So –x > 4 means x ☐ –4

INEQUALITIES WITH NEGATIVE COEFFICIENTS

SUPPORT

NAME _____ CLASS _____ DATE _____

KEY IDEA

When you multiply or divide both sides by a NEGATIVE number, turn the inequality sign round.

$\div(-2)$ ($-2x > 10$; $x < -5$) $\div(-2)$

Check: $x = -6$ gives $-2 \times -6 = 12$, and $12 > 10$ ✓

1 Rewrite each one with x instead of –x. Remember to turn the sign round.

a) $-x < 7$ so x ☐ ☐

b) $-x \geq -2$ so x ☐ ☐

c) $-x > -9$ so x ☐ ☐

2 Solve. Fill in the boxes, including the inequality signs.

a) $\div(-3)$ ($-3x$ ☐ 12 ; x ☐ ☐) ☐

b) ☐ ($-5y$ ☐ 30 ; y ☐ ☐) ☐

TIP Did you turn the sign round?

3 Use your answer to 2 a).

a) Show your answer on the number line.



b) Circle the values that fit.

–5 –4 –3 0 10

4 Solve $7 - 2x > 1$

– 7 ($7 - 2x > 1$; $-2x$ ☐ ☐ ; x ☐ ☐) ☐ ☐

÷ (–2)

Check with x = 2:

$7 - 2 \times 2 =$ ☐

Is this greater than 1? YES NO

INEQUALITIES WITH NEGATIVE COEFFICIENTS

CORE

NAME _____ CLASS _____ DATE _____

KEY IDEA

Multiplying or dividing both sides by a negative number reverses the inequality. You can avoid this by adding the x term to both sides first, so that its coefficient is positive.

FLUENCY

1 Solve each inequality.

a) $-4x > 20$

b) $-\frac{x}{3} \leq 2$

c) $10 - x < 4$

d) $5 - 3x \geq 17$

e) $2 - 5x > -13$

f) $-2(x + 1) < 8$

2 Here is an inequality: $4 - 3x \leq 19$

a) Solve the inequality.

b) Show the solution on the number line.



c) What is the smallest integer that satisfies it?

REASONING

3 Two students solve $9 - 2x < 3$.

Method A

$-2x < -6$

$x > 3$

Method B

$9 < 3 + 2x$

$6 < 2x$

$3 < x$

a) Why does the sign turn round in A but not in B?

b) Same answer both ways?

4 Mo says, "$-x < 3$ means that x is less than -3." Explain why Mo is wrong and write the correct inequality for x.

INEQUALITIES WITH NEGATIVE COEFFICIENTS

GREATER DEPTH

NAME _____ CLASS _____ DATE _____

REASONING

1 Is each statement always, sometimes or never true? Circle your answer.

If it is sometimes true, give an example of when it is true and when it is not.

a) If $a < b$, then $-a > -b$. ALWAYS SOMETIMES NEVER

b) Multiplying both sides of an inequality by the same number keeps the sign the same way round. ALWAYS SOMETIMES NEVER

c) If $-x > 2$, then x is negative. ALWAYS SOMETIMES NEVER

PROBLEM SOLVING

2 Find all the integers that satisfy both $-3x < 15$ and $4 - x \geq 1$



Integers: _____ How many? _____

3 Write an inequality with a negative x term (for example $-2x$ or $5 - x$) that is:

a) One that needs one step to solve and has the solution $x < 4$ _____

b) One that needs two steps to solve and has the solution $x < 4$ _____

c) One that has the solution $x \geq -2$ _____

★ CHALLENGE FOR ALL

4 Negative coefficients with fractions and compound inequalities.

a) Solve $\frac{3(5 - x)}{4} > 6$ _____

b) Solve $-6 < 4 - 2x \leq 10$ _____

c) How many integers satisfy b)? _____

INEQUALITIES WITH NEGATIVE COEFFICIENTS ? ANSWERS

ANSWERS

BUILDING BLOCKS

1 a) < · b) < · c) > · d) >

2 a) –12 · b) 10 · c) –4 · d) 5

3 –3 > –5 · –3 is to the right of –5 · the sign TURNS ROUND

4 –x row: 6, 5, 4, 3, 0 · yes, yes, no, no, no · so $x < -4$

SUPPORT

1 a) $x > -7$ · b) $x \leq 2$ · c) $x < 9$

2 a) $x > -4$ (÷ (–3) both sides, sign turns round) · b) ÷ (–5): $y \leq -6$

3 a) open circle at –4, arrow to the right · b) –3, 0 and 10

4 $-2x > -6$, $x < 3$ · check: 7 – 4 = 3, YES (3 > 1)

CORE

1 a) $x < -5$ · b) $x \geq -6$ · c) $x > 6$ · d) $x \leq -4$ · e) $x < 3$ · f) $x > -5$

2 a) $-3x \leq 15$, $x \geq -5$ · b) filled circle at –5, arrow to the right · c) –5

3 a) A divides by –2, a negative number; B adds 2x so the x term stays positive and only adds, subtracts and divides by positive 2 · b) Yes: $x > 3$ and $3 < x$ are the same

4 $-x < 3$ means $x > -3$ (multiply both sides by –1 and turn the sign). E.g. x = 0 works: $-0 < 3$; x = –5 does not: $5 < 3$ is false

GREATER DEPTH

1 a) always · b) sometimes (true for positive numbers; false for negative numbers, e.g. $2 < 3$ but $-2 > -3$) · c) always ($x < -2$)

2 $x > -5$ and $x \leq 3$: –4, –3, –2, –1, 0, 1, 2, 3 · 8 integers

3 e.g. a) $-x > -4$ or $-3x > -12$ · b) $8 - 2x > 0$ or $10 - x > 6$ · c) $-3x \leq 6$ or $1 - x \leq 3$

4 a) $3(5 - x) > 24$, $5 - x > 8$, $x < -3$ · b) $-10 < -2x \leq 6$, so $-3 \leq x < 5$ · c) 8 (–3 to 4)