# Exploring Inequalities

**whole number**
- the numbers 0, 1, 2, 3, ...

**inequality**
- a mathematical statement using symbols, such as > and <, to compare numbers or expressions

**solution set**
- a list of numbers that make a mathematical statement true

**12.** Long-stem roses cost $4.25 each. Delivery costs $10. Do not include tax. How many roses can be delivered for $50? Will there be any money left over?

| # roses | Cost $ |
|---|---|
| 1 | 14.25 |
| 2 | 18.50 |
| 3 | 22.75 |

+4.25, +4.25

$C$ = cost in $
$n$ = # of roses

$C = 4.25n + 10$

cost per rose; delivery charge

$\Rightarrow 50 = 4.25n + 10$

$50 - 10 = 4.25n + 10 - 10$

$\frac{40}{4.25} = \frac{4.25n}{4.25}$

$9.4117... = n$

$\Rightarrow$ 9 roses

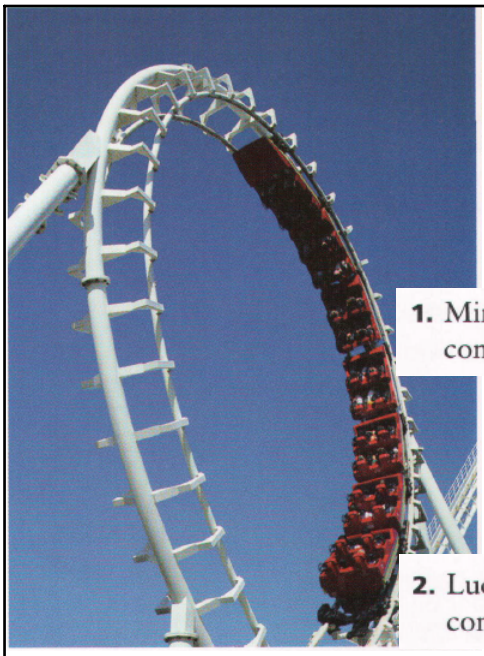
$C = 4.25(9) + 10$

$C = 38.25 + 10$

$C = \$48.25$

Change $= 50 - 48.25$

$= \$1.75$



Some rides have height restrictions for safety. A sign beside this ride states, "Riders must be at least 135 cm tall." How can you show this mathematically?

$h > 135cm$

**1.** Mira is 140 cm tall. Can she go on the ride? Write an **inequality** comparing Mira's height to the height restriction.

Yes she can.

$140cm > 135cm$

**2.** Lucas is 130 cm tall. Can he go on the ride? Write an inequality comparing Lucas's height to the height restriction.

No he can't $\therefore$.

$130cm < 135cm$

**3.** Write an inequality comparing Lucas's and Mira's heights.

$130 < 140$

$140 > 130$

**4.** The symbol ≥ means "is greater than or equal to." How might you use this symbol to model the statement, "Riders must be at least 135 cm tall"?

$h \geq 135\text{cm}$

**5. a)** What **whole number** solutions make your statement from step 4 true?

**b)** How would your answer change if you used the symbol >?

a) 135, 136, 137, 138, ....

b) 136, 137, 138, ... can't include 135cm

## Example 1: Model Inequalities

Model each sentence. Define your variables. Then, write a mathematical statement using the proper symbol.

**a)** The mass is less than 8 kg.

**b)** John gets at least 70 marks on the test.

**c)** Twelve dollars is more than the cost of the lunch box.

**d)** Diane takes no more than four cookies.

a) $m < 8\text{kg}$ where $m$ = mass in kg

b) $x \geq 70$ where $x$ = John's mark

c) $12 > b$ where $b$ = cost of lunch box

d) $n \leq 4$ where $n$ = # of cookies

## Example 2: Find the Solution Set for < and > Statements

Model each inequality. Then, write the whole number **solution set**.

**a)** $x < 3$

**b)** $72 < h$

Solution sets can have one number, two numbers, or more.

a) $x = 0, 1, \text{or } 2$

b) $h = 73, 74, 75, \ldots$

## Example 3: Find the Solution Set for ≥ and ≤ Statements

Model each mathematical statement. Then, write the whole number solution set.

**a)** $3 \geq x$

**b)** $h \geq 72$

a) 3, 2, 1, 0

b) 72, 73, 74, 75, ....

## Example 4: CD Sales

A local music band is having trouble selling its newest CD.

**a)** Model the situation with an inequality.

**b)** Find how many CDs have been sold.


Let $j$ = # of CDs

$2j < 100{,}000$

b) $\frac{2j}{2} < \frac{100{,}000}{2}$

$j < 50{,}000$

$\Rightarrow$ Sold fewer than 50,000 CDs.

## Translating Into Symbols

Look for words like these to help you identify what symbol to use. Make sure you show the greater term on the open side of the symbol.

| Possible Wording | Symbol |
|---|---|
| • less than<br>• fewer than | $<$ |
| • greater than<br>• more than<br>• over | $>$ |
| • less than or equal to<br>• no more than<br>• at most<br>• up to | $\leq$ |
| • at least<br>• greater than or equal to | $\geq$ |

## Key Ideas

- An inequality uses a symbol to compare numbers or expressions.

| Symbol | Meaning | Example |
|---|---|---|
| $<$ | less than | $5 < 8$ |
| $>$ | greater than | $8 > 5$ |
| $\leq$ | less than or equal to | $5 \leq 8$, $11 \leq 11$ |
| $\geq$ | greater than or equal to | $8 \geq 5$, $2 \geq 2$ |

- An inequality can involve a variable.

$9 > m + 5$

  - The variable represents all the numbers that make the inequality true.

| | | |
|---|---|---|
| $m = 0$ | $9 > 0 + 5$ | $9 > 5$ |
| $m = 1$ | $9 > 1 + 5$ | $9 > 6$ |
| $m = 2$ | $9 > 2 + 5$ | $9 > 7$ |
| $m = 3$ | $9 > 3 + 5$ | $9 > 8$ |
| ~~$m = 4$~~ | ~~$9 > 4 + 5$~~ | ~~$9 > 9$~~ |

$9 > 9$ is not true. So, $m = 4$ is not in the solution set.

  - The list of numbers is called the solution set.

$m = 0, 1, 2, 3$

**Page 410 #s 1-19 NOT 3,7,10,13,18**