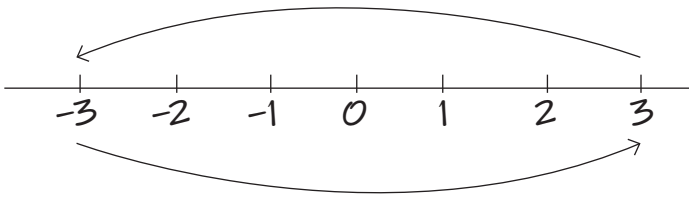


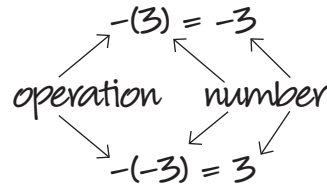
operations

"Take the opposite" (A new operation!)



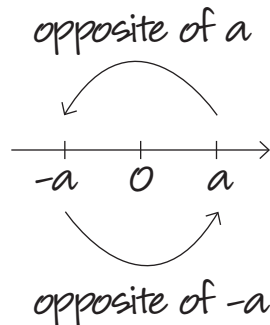
The opposite of 3 is -3

The opposite of -3 is 3



- Ex
- a) 8 steps back is ___ steps forward.
- b) A descent of 10 m means an ascent of ___.
- c) 6 steps forward is $\underbrace{\hspace{2cm}}_6 = \underbrace{\hspace{2cm}}_{-(-6)}$ -6 step forward.

In general



Principle: "The opposite of the opposite is the original."



Rule 1: $-(-a) = a$ for any integer.

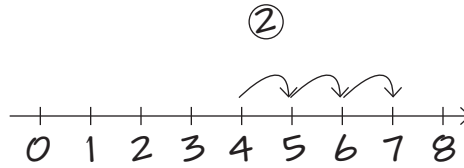
[SAY:

- Note:
- Works for both positive and negative #'s
 - Not the reason for $-1 \times -1 = 1$ More work!
 - 3 uses for "-": (1) opposite, label -3, subtraction]

Addition

Case 1 pos + pos

$$\begin{array}{c} \textcircled{3} \\ 4 + 3 = 7 \\ \textcircled{1} \quad \uparrow \quad \uparrow \\ \text{start} \quad \text{count up} \\ \quad \quad \quad 3 \end{array}$$

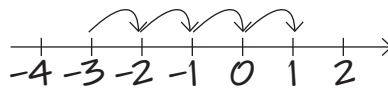


[SAY: We had \$4 and earned \$3 more.

• The elevator started on the 4th floor and went up 3.]

Case 2 neg + pos

$$\begin{array}{c} -3 + 4 = 1 \\ \text{start} \quad \uparrow \quad \uparrow \\ \quad \quad \quad \text{count up} \end{array}$$



• The temp was -3°F , then rose 4°F

• I was in debt \$3, then earned \$4 ← from students

Case 3 (Hardest) pos + neg

$$\begin{array}{c} 4 + -3 \\ \text{start} \quad \uparrow \quad \uparrow \\ \quad \quad \quad \text{count up} \\ \quad \quad \quad -3?? \end{array}$$

[SAY: what does this mean?

~> Need an interpretation!]

opposite

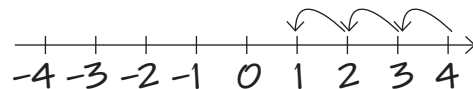
Interpretation: "count up -3 " means "take the opposite of counting up 3"

$$4 + -3 = \text{Start at 4, count up } -3$$

$$= \text{Start at 4, take the opposite of counting up 3}$$

$$= \text{ " " , count down 3}$$

$$= \underline{1}$$



Note: ① Same as $-3 + 4 = 1 \Rightarrow$ this interpretation makes addition commutative!

② Same as subtracting! $4 + -3 = 4 - 3$.

Principle: "Adding the opposite is the same as subtracting."

$$\text{Def: } a + -b = a - b$$

· If I have a \$4 in my right pocket and \$3 I.O.U. in my left,

How much money can I spend?

[SAY: · I was on the 5th floor and the elevator went up -2 floors.

Not realistic! We don't ever say that, so including problems like this makes negative #'s artificial, which they are not.

We are starting to find that integer word problems are difficult to create.]

Case 4 neg + neg HW problem. Modify Case 3.

HW Read § 8.1 [there is a lot of nice Teacher info]

Do HW set 34. Prob 11 won't get graded, but read it.