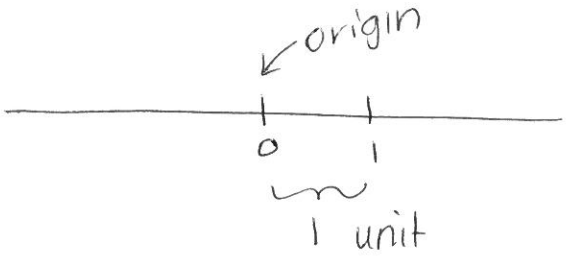
Number Line



- once 0 + 1 have been set, everything is determined in relation to this unit length.

  eg: 2 = 1 unit to right of 1

  $\frac{1}{3}$ = divide unit into 3 equal segments. ← Fractions.

  neg n°s placed in same way to left of 0.

- can think of every fraction as pt on n° line
- in fact there are "no gaps" on number - every pt is associated with a number.
- we call this the Real Line. + numbers called Real N°s.

Operations

addition → move forwards
subtraction → move backwards
mult, division } working with groups of n°s.

Remember: $3 \times 1 = 3$ (mult by 1 = itself)

$3 \times 0 = 0$ (mult by 0 = 0)

$3 \times 3 = 3^2$ ← power (repeated mult)

Also $\frac{3}{1} = 3$ (div by 1 = itself)

$\frac{3}{0}$ = undef ← can't divide by 0.

$\frac{3}{3} = 1$ but $\frac{0}{0}$ = undef.

Rearranging

$3+5-4 = (+3)(+5)(-4)$

$= +5-4+3$

$8-4 = 4$

$1+3 = 4$

Be careful $3-5 \neq 5-3$

Instead $3-5 = -5+3$

So $3-5 \neq 5-3$ ← subtraction is NOT commutative

$3+5 = 5+3$ ⇐ addition + mult are commutative

$3 \times 5 = 5 \times 3$

$3 \div 5 \neq 5 \div 3$ ← div is NOT

Commutativity: $a+b = b+a$ and $a \times b = b \times a$

↑ formal way of saying order doesn't matter

Also Associativity: $(a+b)+c = a+(b+c)$ and $(ab)c = a(bc)$

↑ formal way of saying grouping doesn't matter in addition + mult.

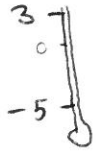
$3-5 = 3+(-5)$ ← can think of subtraction as a sum

Sometimes during calculations signs may double up.

$3+-5 = 3-5 = -2$
$3--5 = 3-5 = -2$
} when signs different → NEG

$3--5 = 3+5$
$3++5 = 3+5$
} when signs same → POS

note: $3--5$ → think of Temp



The difference is 8

$3--5 = 3+5 = 8$

Diff to $-3-5 = -8$

Also $-(-3) = +3$

Mult + Div Neg nos

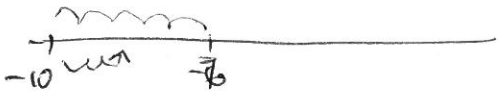
Rule: Mult/Div 2 numbers with same sign ⇒ POS answer
" " " " different " ⇒ NEG answer

eg: $-2 \times -4 = +8$
$-2 \times 4 = -8$
$-4 \div -2 = 2$
$-4 \div 2 = -2$

note: -2 can be thought of as -1×2

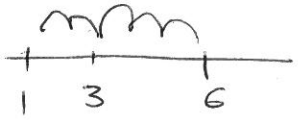
Eg1. Calculate:

(a) $-6-4+3$ $= -10+3 = -7$



(b) $6--4+2$ $= 10+2 = 12$

(c) $6+(-3)-2$ $= 6-3-2$
$= 1$



(d) $6\times-3\times2$ $= -18\times2$
$= -36$

(e) $-6\times-3\times-2$ $= 18\times-2$
$= -36$

← odd n° of − ⇒ neg

(f) $-22\div-2$ $= 11$

← even n° of − ⇒ pos

(g) $(-5)^2$ $= -5\times-5$
$= 25$

(h) -5^2 $= -25$ ← here 5 is squared + − out front

(i) $(-5)^3$ $= -5\times-5\times-5$
$= -125$

odd n° of − signs

Distributive Law

Eg 2: John takes three children ice-skating which costs $15 per child. They each get an ice cream which costs $2 each and when they return their skates they get a refund of $6 per person. Calculate the total cost for John?

Summarise ques: 3 children
ice skating - $15
ice cream - $2
refund - $6

Cost (Method ①) $= (3\times 15)+(3\times 2)-(3\times 6)$
$= 45 + 6 - 18 = 33$

Cost (Method ②) $= 3\times(15+2-6)$
$= 3\times 11 = 33$

So $3\times(15+2-6) = (3\times 15)+(3\times 2)-(3\times 6)$

↑ Distributive Law.

$3(a+b) = 3a+3b$ (→ expand, ← factorise)

Definition: a, b, c = real numbers

- $a(b+c) = ab+ac$
- $(a+b)c = ac+bc$