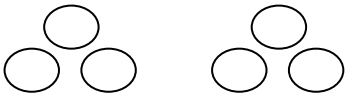
Calculation Policy

Addition

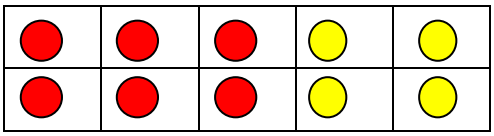
KS1

Combining objects



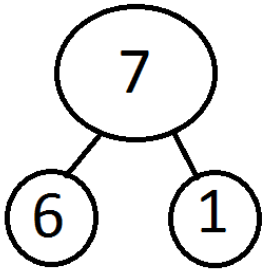
3 + 3 = 6

Tens frames to Add Within 10 (and above)

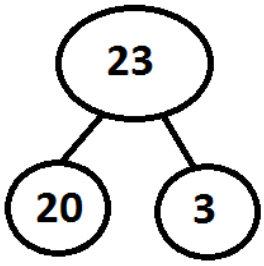


6 + 4 = 10

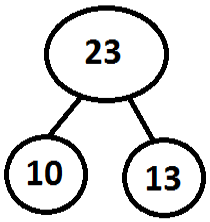
Part part whole diagrams



6 + 1 = 7
(Year 1)



20 + 3 = 23
(Year 2)



10 + 13 = 23
(Year 2)

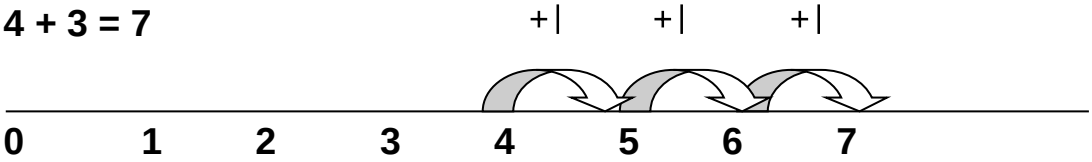
Number bonds

- bonds to 10
- bonds to 20
- bonds to 100

Number lines

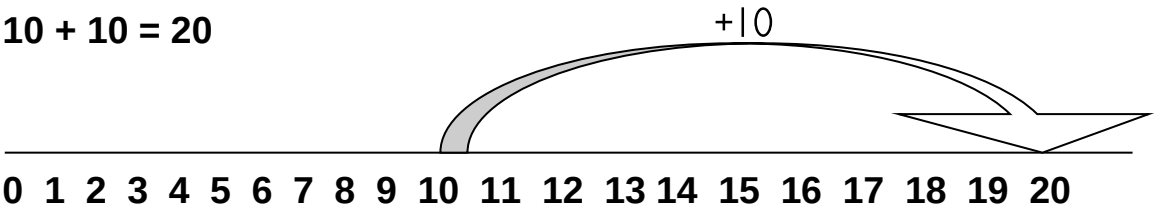
Adding units

4 + 3 = 7

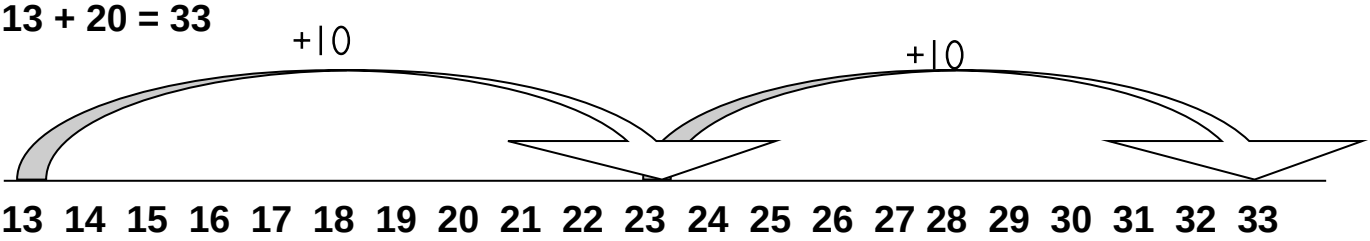


Adding tens

10 + 10 = 20

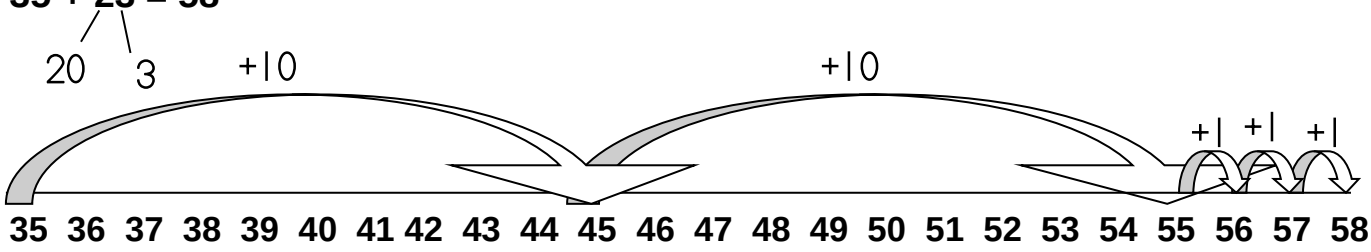


13 + 20 = 33



Adding tens and units

35 + 23 = 58



Hundred Squares

Adding tens **e.g.** **24 + 10 = 34** **47 + 20 = 67**

Adding tens and units **e.g.** **41 + 12 = 53** **72 + 24 = 96**

10 2 20 4

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Lower KS2

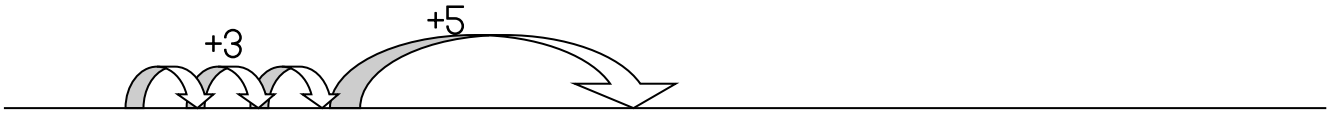
Bridging

37 + 8 =

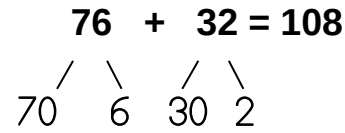
37 + (3+5) =

37 + 3 = 40

40 + 5 = 45



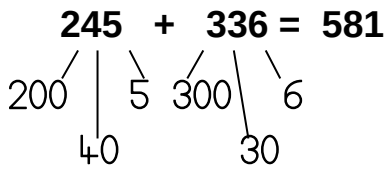
Partitioning



70 + 30 = 100

6 + 2 = 8

100 + 8 = 108



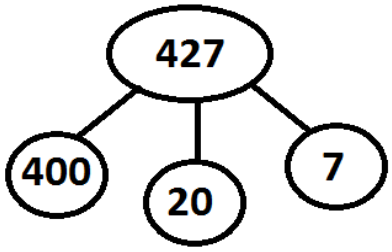
200 + 300 = 500

40 + 30 = 70

5 + 6 = 11

500 + 70 + 11 = 581

Part Part Whole Progressing to Bar Method



Column Addition

Starting with the units and exchanging (not borrowing)

```
  H  T  U
  2  3  6
+ 1  4  7
  3  8  3
     1
```

Upper KS2

Using decimals and starting with the smallest unit

```
  H  T  U  .  t  h
  1  3  4  .  3  6
+ 7  4  2  .  4  5
  8  7  6  .  8  1
           1
```

Adding multiples of 10, 100, 1000 etc using place value

e.g.

1 4 6 7 + 3 0 = 1 4 9 7

2 6 5 4 + 3 0 0 = 2 9 5 4

5 4 3 2 1 + 4 0 0 0 = 58321

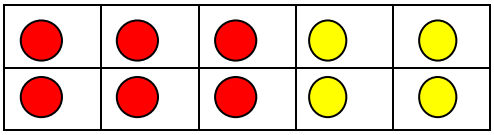
Subtraction

KS1

Taking away

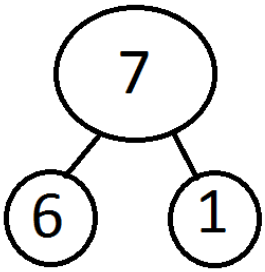
5 - 2 = 3

Tens Frame to Subtract Within 10

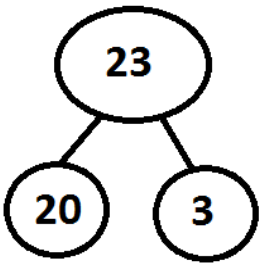


10 - 4 = 6

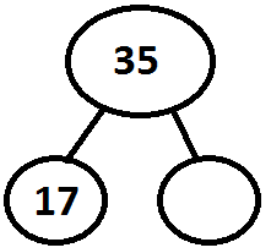
Part Part Whole



7 - 1 = 6
(Year 1)



23 + 20 = 3
(Year 2)



35 - 17 = ?
(Year 2)

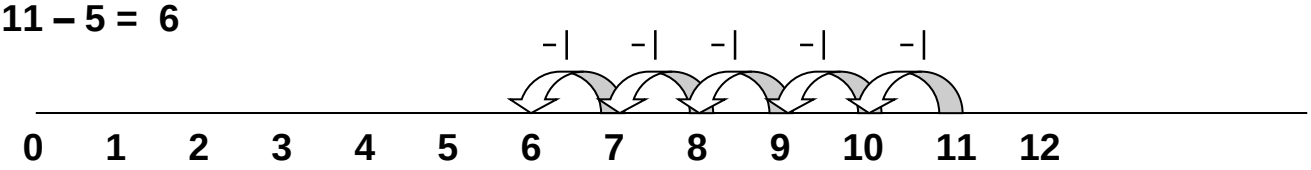
Number bonds – subtraction facts

- **bonds to 10 subtraction facts**
- **bonds to 20 subtraction facts**
- **bonds to 100 subtraction facts**

Number lines

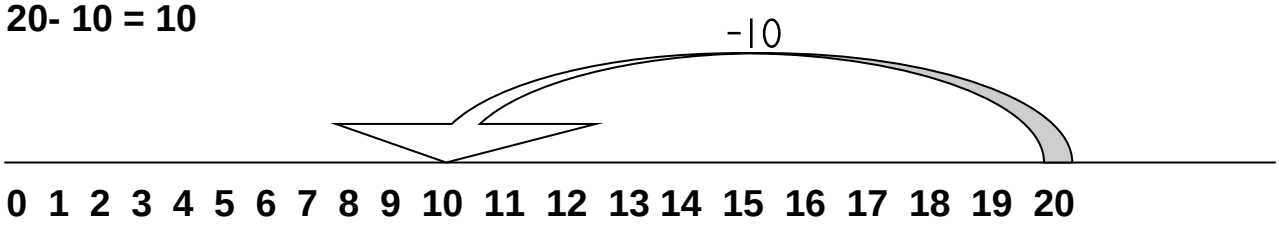
Subtracting units

11 – 5 = 6

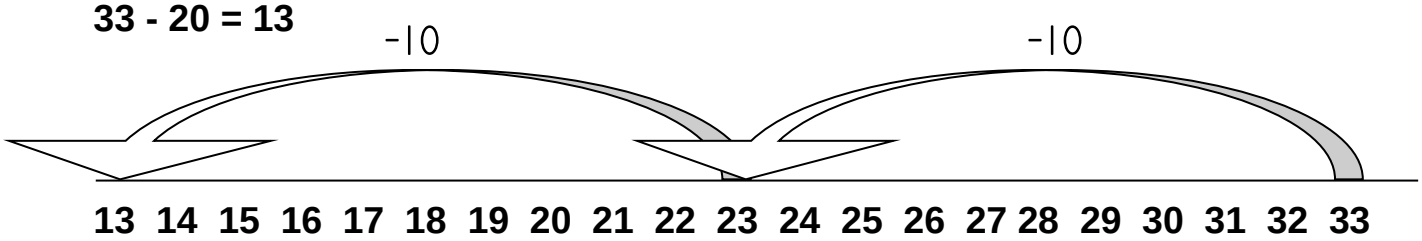


Subtracting tens

20- 10 = 10



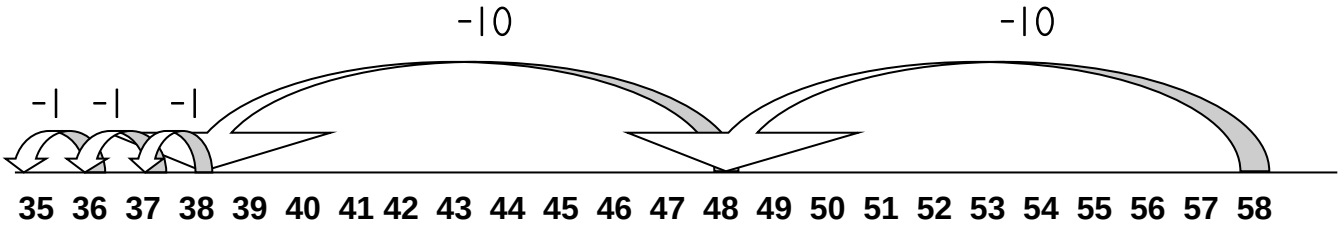
33 - 20 = 13



Subtracting tens and units

58 - 23 = 35

20 3



Hundred Squares

Subtracting tens **e.g** **34 - 10 = 24** **67 - 20 = 47**

Subtracting tens and units **e.g** **53 - 12 = 41** **96 - 24 = 72**

10 2 20 4

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Lower KS2

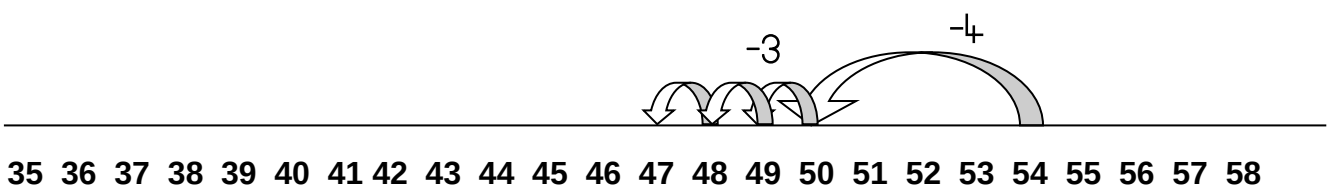
Bridging

54 – 7 =

54 – (4+3) =

54 – 4 = 50

50 – 3 = 47



Partitioning

98 - 32 = 66

30 2

98 - 30 = 68

68 - 2 = 62

98 – 32 = 66

588 - 336 = 252

300 6

30

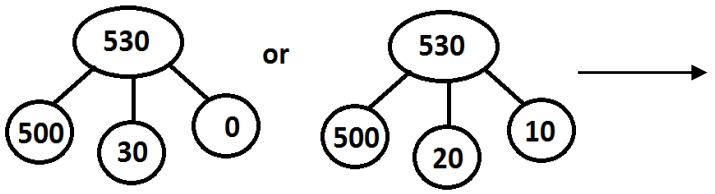
500 - 300 = 200

80 - 30 = 50

8 - 6 = 2

200 + 50 + 2 = 252

Part Part Whole and Exchanging



Understanding 530= 500 + 20 + 10 ready for column subtraction with exchanging.

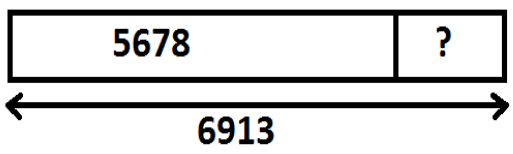
Column Subtraction

Starting with the units and exchanging (not borrowing)

H T U

$$\begin{array}{r} 5\,\overset{2}{\not{3}}\,\overset{1}{0} \\ -\ 2\,6 \\ \hline 5\,0\,4 \end{array}$$

Solving missing number problems using bar representation of problem



6913

- 5678

?

Upper KS2

Using decimals and starting with the smallest unit

H	T	U	.	t	h
$^{6}\cancel{7}$	$^{1}3$	$^{3}\cancel{4}$	.	$^{1}3$	6
- 1	4	2	.	4	5
5	9	1	.	9	1

Subtracting multiples of 10, 100, 1000 etc using place value

e.g.

1 4 6 7 - 3 0 = 1 4 3 7

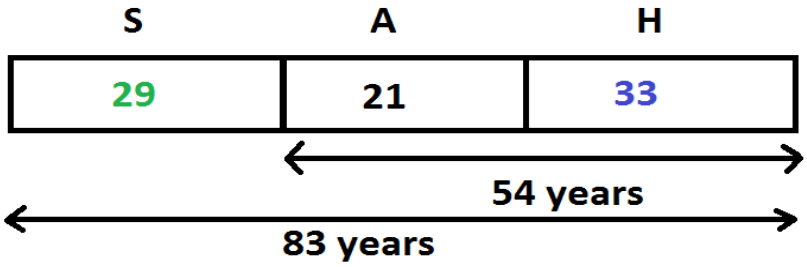
2 6 5 4 3 - 3 0 0 0 = 2 3 5 4 3

5 4 3 2 1 - 4 0 0 0 = 5 0 3 2 1

Bar Method to solve increasing complex questions

e.g.

Sasha, Amy and Hannah are three friends. The sum of Amy and Hannah's age is 54 years. The sum all three ages is 83 years. Amy is 21 years old. Who is the oldest?



54
- 21
33

$^{7}\cancel{8}^{1}3$
- 54
29

Hannah is the oldest at 33 years old.

Multiplication

KS1

Early tables, counting and chanting

1x, 2x, 10x and 5x

Sequences

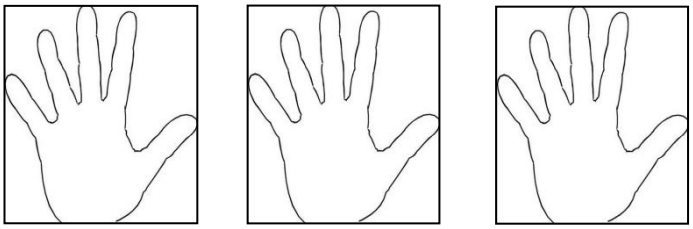
1, 2, 3, 4, 5 . . .

2, 4, 6, 8, 10 . . .

5, 10, 15, 20, 25 . . .

10, 20, 30, 40, 50 . . .

Repeated addition



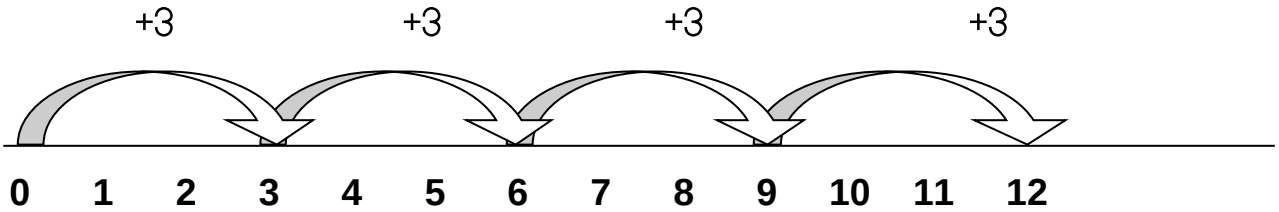
5 + 5 + 5 = 15

3 lots of 5 = 15

3 x 5 = 15

Using a number line (repeated addition)

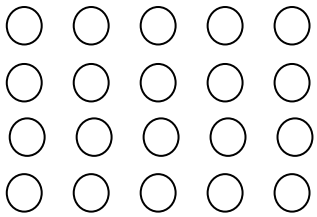
4 x 3 = 12



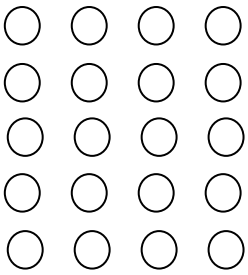
Arrays

Use to explore commutative law

4 x 5 = 20



5 x 4 = 20



Lower KS2

Grid method

TU x U

12 x 6 = 72

10 2

X	10	2
6	60	12

60 + 12 = 72

TU x TU

22 x 15 = 330

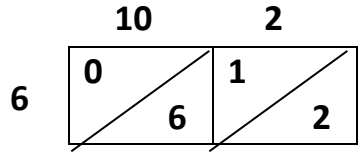
20 2 10 5

X	20	2
10	200	20
5	100	10

200 + 100 + 20 + 10 = 330

Alternative to Grid Method

12 x 6 = 72



Then add the diagonals

0

1+6 = 7

2

Therefore 12 x 6 = 72

Connections

X2 – Doubling

X4 – Double and double again

X8 – Double, double and double again

X20 – Multiply by 10 and double

X5 – Multiply by 10 and halve

X200 - Multiply by 100 and double

Short cut tricks for mental calculation

e.g. 13 x 8 =

Double 13 = 26

Double 26 = 52

Double 52 = 104

<u>Multiplying by 10, 100, 1000 etc</u>

Place value sliders are useful for illustrating this.

2 x 10 = 20

2 x 100 = 200

2 x 1,000 = 2,000

0.45 x 10 = 4.5

0.45 x 100 = 45

0.45 x 1,000 = 450

Linking multiplication tables

e.g.

7 x 3 = 21

700 x 3 = 2,100

7,000 x 3 = 21,000

<u>Written Method</u>

Alongside recalling tables to 12 x 12

TU x U

T U

3 6

X 4

2 4 (6 x 4)

1 2 0 (30 x 4)

1 4 4

Leading to...

H	T	U
	3	6
X		4
1	4	4
	2	

6 x 4 = 24

4 - units in the units column

20 – 2 in the tens column

30 x 4 = 120
Remember to add the 2 tens from 6x4

120 + 20 = 140

100 – 1 in hundreds column

40 - 4 in tens column

Short multiplication

Th	H	T	U
	6	3	7
X			9
5	7	3	3
	3	6	

Upper KS2

With decimals...

```
    4  0 . 2 8
X           6
  2  4  1 . 6 8
        1    4
```

Long Multiplication

Th H T U

```
    1 5 9
X     2 8
 1  2  7 2  (159 x 8)
   4  1
 3  1  8  0 (159 x 20)
1   1
-------------
 4  4  5  2
    1
```

```
    3  7 . 2 5
x         2  9
  3 3  5 . 2 5
     6  2   4
  7 4  5 . 0 0
  1      1
-------------------
1 0 8 0 . 2 5
-------------------
      1
```

Using the same method for up to 4 digit x 4 digit

Facts

Factors

e.g. 12 1, 2, 3, 4, 6 and 12

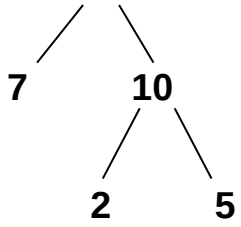
Common factors

e.g. 12 1, 2, 3, 4, 6 and 12

30 1, 2, 3, 5, 6, 10, 15 and 30

Factor Trees

e.g. 70



So 70 = 7 x 2 x 5

Prime numbers

The only factors are 1 and itself

e.g. 2, 3, 5, 7, 11, 13, 17 etc

Square numbers

2^2 = 2 x 2 = 4

3^2 = 3 x 3 = 9

4^2 = 4 x 4 = 16

etc.

Cubed numbers

2^3 = 2 x 2 x 2 = 8

3^3 = 3 x 3 x 3 = 27

4^3 = 4 x 4 x 4 = 64

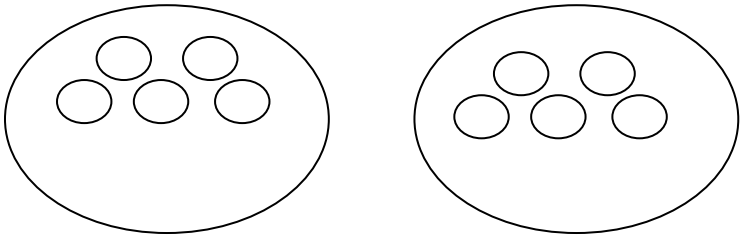
etc.

Division

KS1

Sharing practically

10 shared between 2



5 each

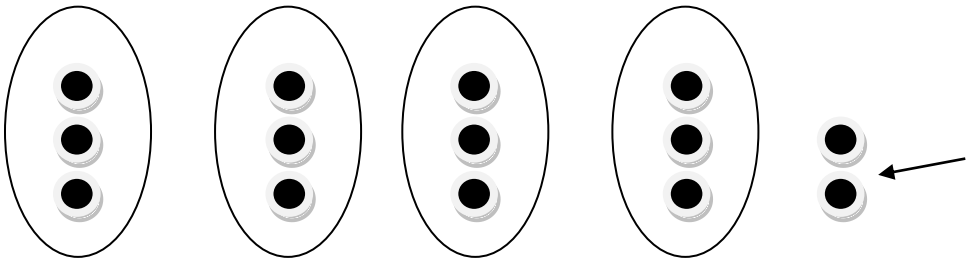
Groups of

10 shared into 2 *equal* groups

10 ÷ 2 = 5

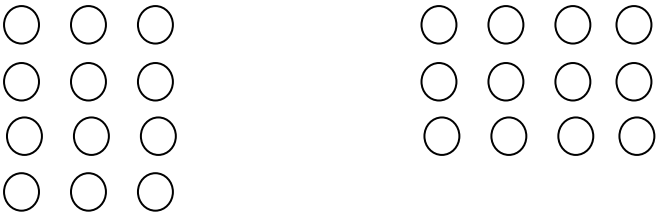
Remainders

14 ÷ 4 = 3 r 2

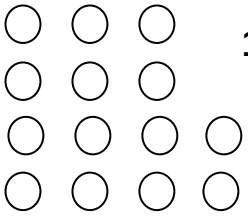


2 left over

Sharing and grouping with arrays



12 ÷ 3 = 4 **or** **12 ÷ 4 = 3**

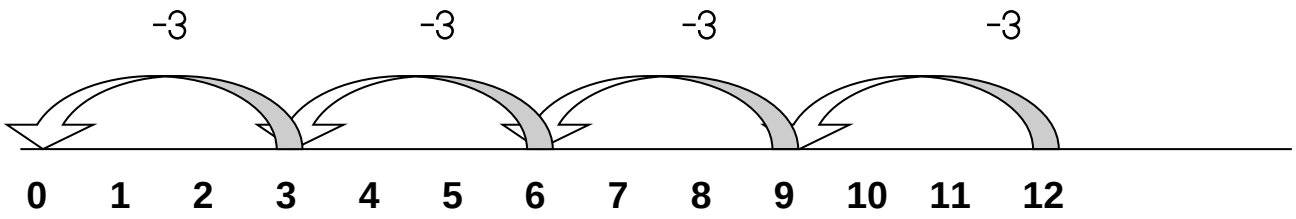


14 ÷ 3 = 4 r 2

Repeated Subtraction

e.g.

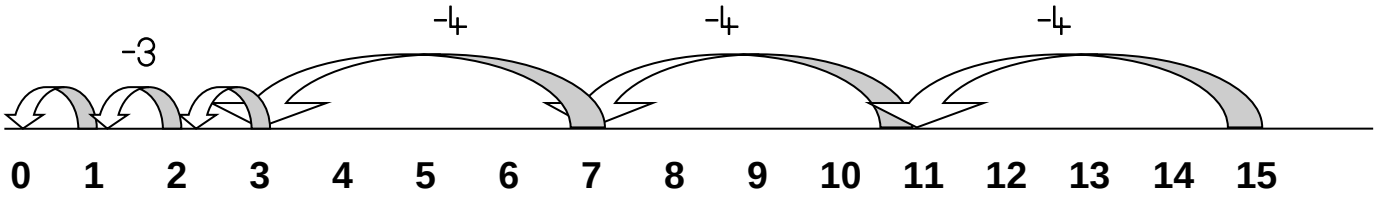
12 ÷ 3 = 4



Lower KS2

Repeated subtraction with remainders...

15 ÷ 4 = 3 r 3



Dividing multiples of 10, 100, 1000 etc

Place value sliders are useful for illustrating this.

e.g. 80 ÷ 4 = 10 x (8 ÷ 4)

= 10 x 2
= 20

e.g. 270 ÷ 3 = 10 x (27 ÷ 3)

= 10 x 9

= 90

e.g. 800 ÷ 4 = 10 x (8 ÷ 4)

= 10 x 2
= 20

Written method

TU ÷ U

Chunking

Repeated subtraction as chunking

72 ÷ 4 = 18

7 2
- 4 0 (10 x 4)
3 2
- 3 2 (8 x 4)
0

10 + 8 = 18

Leading to . . .

Short Division (Bus Stop Method)

72 ÷ 4 = 18

$$4\overline{)\,7^{3}2}\;\Big|\;8$$

With remainders . . .

74 ÷ 4 = 18 r 2

Upper KS2

Chunking

7 4
- 4 0 (10 x 4)
3 4
- 3 2 (8 x 4)
2

10 + 8 = 18

2 left over or remaining

Short Division

```
  18 r 2
4) 7 3 4
```

HTU ÷ U, HTU ÷ TU and ThHTU ÷ U using Short Division

```
    16
11) 1 7 6 6
```

```
     147 r 2
9) 1 3 4 2 6 5
```

Interpreting remainders in context

e.g. A classroom was set up in tables of 6. There were 27 children in the class. How many tables of 6 would be needed?

27 ÷ 6 = 4 r 3

Therefore 5 tables needed, 4 tables of 6 and another table with only 3 children on.

Remainders as fractions and decimals

Fractions

57 ÷ 4 = 14 ¼

```
  14 r 1
4) 5 1 7
```

57 ÷ 4 = 14 with 1 out of 4 left over
57 ÷ 4 = 14 ¼

Decimals

- **57 ÷ 4 = 14.25**

```
  14.25
4) 5 1 7 . 1 0 2 0
```

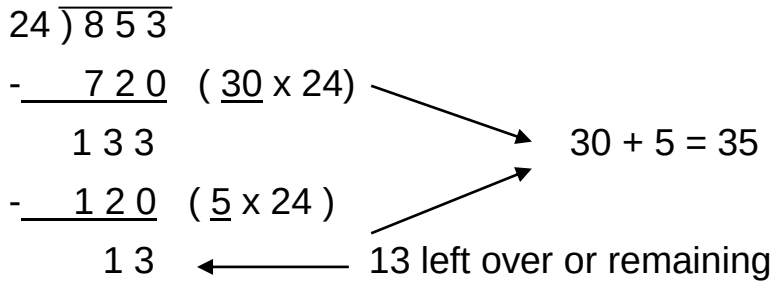
- **370.6** ÷ 4 = 92.65

```
   92.65
4) 3 7 1 0 . 2 6 2 0
```

Long Division

Beginning with recapping chunking

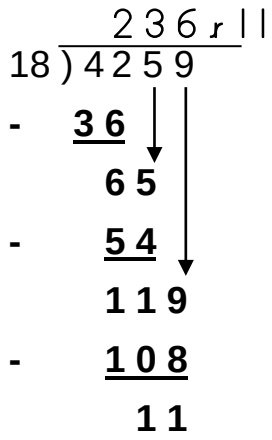
853 ÷ 24 = 35 r 13



Leading to . . .

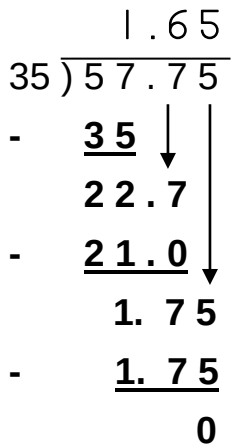
Formal Long Division

4259 ÷ 18 = 236 r 11



With decimals

57.75 ÷ 35 = 1.65

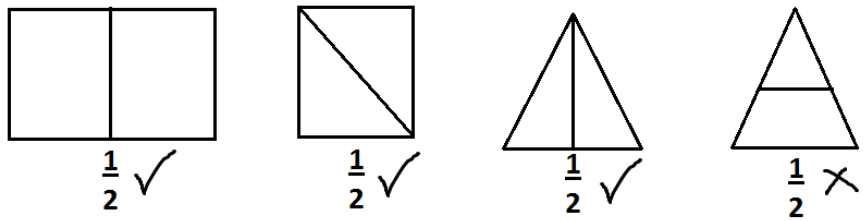


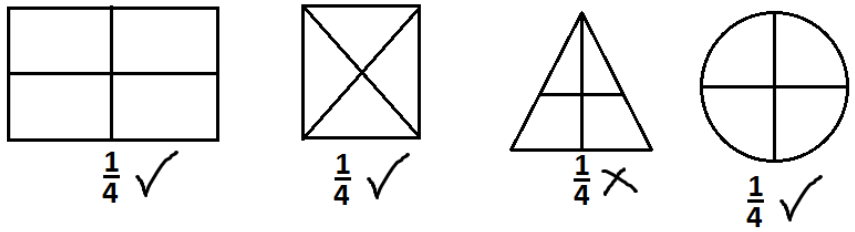
Fractions

KS1

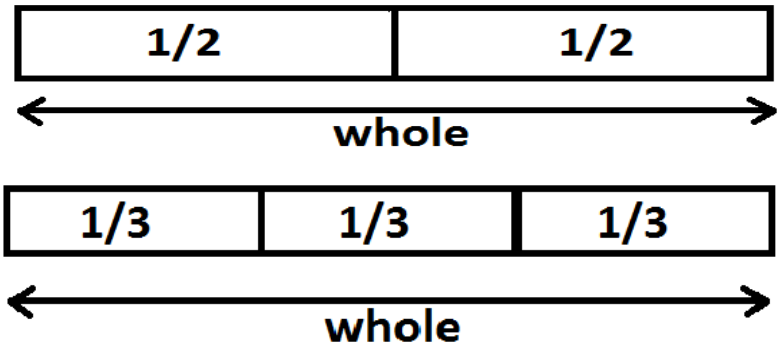
Identifying fractions of shapes

Identifying equal parts within fractions



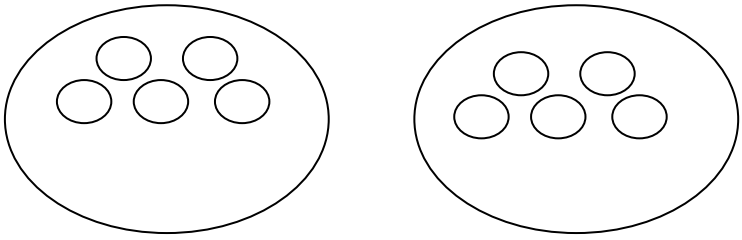


Fractions in the Bar Method



Finding fractions of numbers

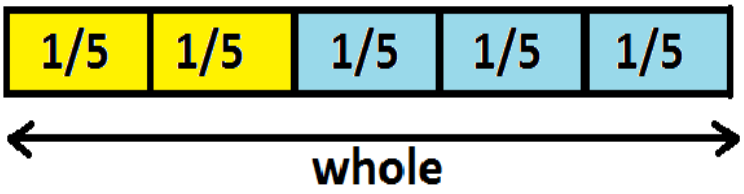
Using equipment to identify fractions of numbers



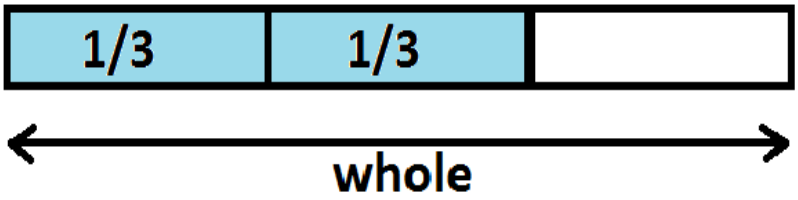
½ of 10 = 5

Lower KS2

Adding and subtracting fractions with the same denominator



2/5 + 3/5 = 5/5 **5/5 = 1** **so** **2/5 + 3/5 = 1**



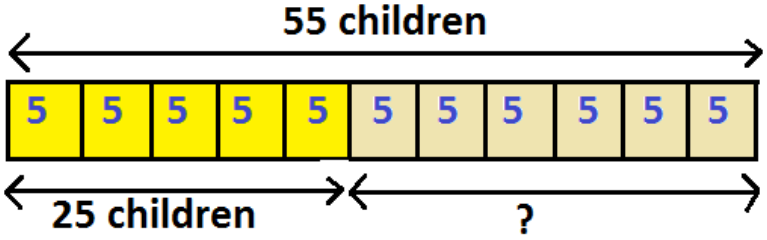
1 = 3/3 **so** **3/3 – 1/3 = 2/3**

Upper KS2

Bar method to represent increasing complex fraction, ratio and percentage problems.

e.g.

55 Year 4 students were invited to test two new computer games. 5/11 of the students preferred Galaxy Goo. The others preferred Planet Zak. How many students preferred Planet Zak?



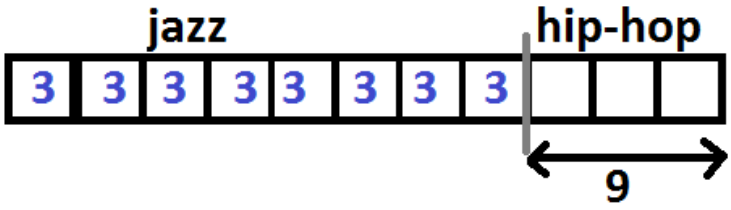
55 ÷ 11 = 5 **6 x 5 = 30**

so 6/11 of the children like Planet Zak.

6/11 of 55 = 30 **30 children liked Planet Zak**

e.g.

Grace has jazz and hip hop songs on her iPod in the ratio of 8:3. If Grace has 9 hip hop songs, how many Jazz songs does she have?



$9 \div 3 = 3$

Each portion of the ratio = 3

$8 \times 3 = 24$

Therefore Grace has 24 jazz songs on her iPod.