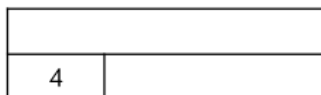# Fact Families

Reasoning and Problem Solving

Here is an incomplete bar model. The total is greater than 10 but less than 20
What could the numbers be?
How many different combination scan you find?

| 4 | |

7 and 11
8 and 12
9 and 13
10 and 14
11 and 15
12 and 16
13 and 17
14 and 18
15 and 19

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

Laura says, "I think that all of these facts are correct because the numbers are related."
Sam disagrees.
Who is correct? Can you prove it?

Sam is correct because 8 does not equal 5 – 3

Which of the representations are equivalent to the bar model?

| 12 | |
| 3 | 9 |

$- 3$
9   12

12
9   3
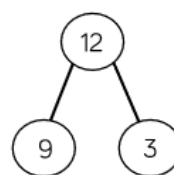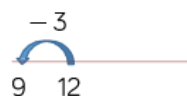
$12 = 9 + 3$

There were 9 cars in the car park.
3 cars have left.

$9 - 3 = 12$

The number line, the part whole model and $12 = 9 + 3$

Check Calculations

Reasoning and Problem Solving

Emily did the following calculation:

$12 - 8 = 4$

She checked it by using the inverse.

She did $12 + 8 = 20$ and said that her first calculation was wrong.

What advice would you give her?

It should have been $8 + 4 = 12$

Theo is checking Ellen's work but doesn't do an inverse calculation.

He says, "these calculations can't be right."

How might he know?

$24 + 6 = 84$
$25 - 23 = 12$
$18 - 3 = 21$

All of the calculations involve errors:

6 has been added to the tens instead of the ones.

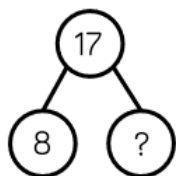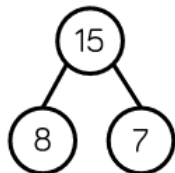25 and 23 are very close in value and therefore can't result in such a large difference.

18 and 3 have been added instead of subtracted.

Compare Number Sentences

Reasoning and Problem Solving

Deb thinks she knows the missing number without calculating the answer.

Can you explain how this could be possible?

15
8   7

17
8   ?

17 is two more than 15, so the missing number must be two more than 7

The missing number must be 9

Both missing numbers are less than 10

$$7 + \boxed{} < 7 + \boxed{}$$

How many different possible answers can you find?

Lots of different combinations, the left number has to be smaller than the right.

Possible answers:
1 and 2
1 and 3
1 and 4
1 and 5
1 and 6
1 and 7
1 and 8
1 and 9
Etc.

Related Facts

Reasoning and Problem Solving

Continue the pattern.

$$90 = 100 - 10$$
$$80 = 100 - 20$$
$$70 = 100 - 30$$

What are the similarities and difference between this pattern and the following one?

$$9 = 10 - 1$$
$$8 = 10 - 2$$
$$7 = 10 - 3$$

The digits are the same but the place value changes.

Kim says, "If I know $9 + 1 = 10$, I can work out $90 + \underline{} = 100$"

Find the missing number and explain how Kim knows.

10

All the numbers are ten times bigger.

Scott goes to the fruit shop.

**One apple costs 6p.
A bag of 10 apples costs 50p.**

If he needs 20 apples, what's the cheapest way to buy them?

What would the difference be between buying 20 single apples and 2 bags of 10 apples?

How much does each apple cost if he buys a bag of 10? Explain your answer.

Two bags of 10 costing £1 is cheaper.

The difference between buying 20 single apples and 2 bags of 10 is 20p.

In a bag, each apple costs 5p because $50p \div 10 = 5p$

Bonds to 100 (Tens)

Reasoning and Problem Solving

Sara thinks there are 10 different number bonds to 90 using multiples of 10
Beth thinks there are only 5

Who is correct?

Can you help the person who is wrong to understand their mistake?

Beth because 0 + 90 is the same as 90 + 0 Sara has repeated her answers the other way round.

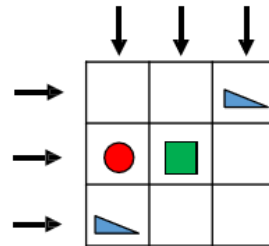Using multiples of 10, how many number bonds are there for the following numbers?

    20   30   40   50

What do you notice about the amount of bonds for each number?

If 80 has 5 bonds, predict how many 90 would have.

20 and 30 both have 2. 40 and 50 both have 3. When the tens digit is odd it has the same number of bonds as the previous tens number. 90 would also have 5
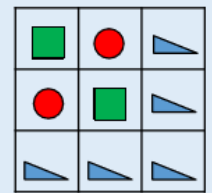
Squares are worth 10
Triangles are worth 20
Circles are worth 30

Can you complete the grid above so that all horizontal and vertical lines equal 60?

Can children create another pattern on an empty grid where each line equals 60?
How many possible ways are there to solve this?

Solution

Lots of possible solutions available.

Add and Subtract 1s

Reasoning and Problem Solving

True or False?

These four calculations have the same answer.

    $1 + 4 + 2$ $4 + 2 + 1$

    $2 + 4 + 1$ $4 + 1 + 2$

These four calculations have the same answer.

    $7 - 3 - 2$ $2 - 3 - 7$

    $3 - 2 - 7$ $7 - 2 - 3$

True because they all equal 7 and addition is commutative

False because subtraction isn't commutative

Sam's house

Lara's house

Sam lives 5km from school.
Laura lives 4km from school in the same direction.

What is the distance between Sam's and Laura's houses?

After travelling to and from school, Sam thinks that he will walk 1km more than Laura. Is he correct?
Explain your answer.

What will be the difference in distance walked after 2 school days?

1km

No, he will walk 2km further. 1 on the way to school and 1 on the way home.

4km

Reasoning and Problem Solving

SALE

Apple	Green Apple	Banana	Lemon
15p	22p	35p	68p

Each piece of fruit is reduced by 10p.

What are the new prices?

Red Apple 5p

Green Apple 12p

Banana 25p

Lemon 58p

Tomas says, "I know that 10 more than 72 is 82 because I only have to look at the tens digit."
Is he correct?
Explain your reasoning.

Molly is counting backwards in 10s.
She says forty nine, thirty nine, twenty nine and then stops.
What numbers comes next and why?

Yes because when you add ten you aren't adding ones.

19 because you take one ten away from 29

Class 3 gives one of their full packets of crayons away.

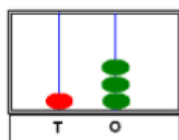How many crayons do they have left?

Explain your reasoning.

43

They will have four full packs left which is four tens, and thee crayon which represents three ones.

Reasoning and Problem Solving

Tom has three spare red beads.

What numbers could he make?
Explain your answer.

23

33

43

He doesn't have to use all of the beads.
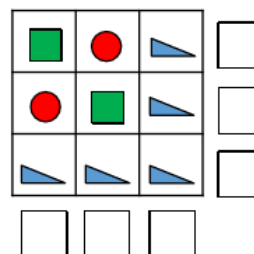

Here are class 2s crayons.

They are given a new box of 10 each day for a week.

How many crayons do they have at the end of the week?

Discussion could be had about whether it's a full week or a school week.

Answers would be 96 or 76 respectively.

Circles represent 20
Triangles represent 10
Squares represent 50

What Is the value of each row and column?

Rows
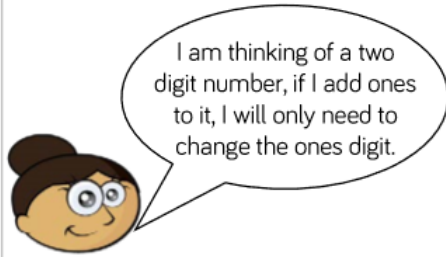
(top to bottom)

80

80

30

Columns

(left to right)

80

80

30

Add 2-digits and 1-digit

Reasoning and Problem Solving

Always, sometimes, never?

I am thinking of a two digit number, if I add ones to it, I will only need to change the ones digit.
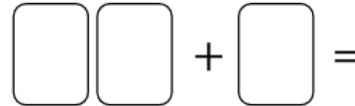
Explain your answer.

Sometimes because if your ones total 10 or more you will have to exchange them which will change the tens digit.

Here are three digit cards.

| 6 | 7 | 8 |

Place the digit cards in the number sentence.

How many different totals can you find?

$$\square\square + \square =$$

What is the smallest total?

What is the largest total?

$67 + 8 = 75$
$68 + 7 = 75$
$76 + 8 = 84$
$78 + 6 = 84$
$86 + 7 = 93$
$87 + 6 = 93$

75 is the smallest total.

93 is the largest total.

Subtract 1-digit from 2-digits

Reasoning and Problem Solving

Harry and Jenny are solving the subtraction 23 – 9

Here are their methods

Harry: I put 9 in my head and counted on to 23

Jenny: I put 23 in my head and counted back 9

Who's method is the most efficient?

Can you explain why?

Can you think of another method to solve the subtraction.

Jenny's method is most efficient because there are less steps to take. The numbers are quite far apart so Harry's method of finding the difference takes a long time.

Jack is counting back to solve 35 – 7

He counts

35, 34, 33, 32, 31, 30, 29
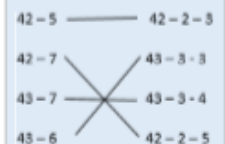
Is Jack correct?

Explain your answer.

Match the number sentences to the number bonds that make the method more efficient.

$42 - 5$ $42 - 2 - 3$

$42 - 7$ $43 - 3 - 3$

$43 - 8$ $43 - 3 - 5$

$43 - 6$ $42 - 2 - 5$

Jack is not correct as he has included 35 when counting back.

This is a common mistake and can be modelled on a number line.

$42 - 5 \longrightarrow 42 - 2 - 3$
$42 - 7$
$43 - 3 - 3$
$43 - 7$
$43 - 3 - 4$
$43 - 6$
$42 - 2 - 5$

Add 2-digit Numbers (1)

Reasoning and Problem Solving

Katie has 12 marbles.

Jim has 13 marbles more than Katie.

How many marbles do they have altogether?

Jim has 25 marbles.

Altogether they have 37 marbles

What digits could go in the boxes?

$$\Box 2 + \Box 5 = 87$$

Possible answers:
1 and 7
2 and 6
3 and 5
4 and 4
5 and 3
6 and 2
7 and 1

Interesting discussion could be had around is 1 and 7 different than 7 and 1? Etc.

Add 2-digit Numbers (2)

Reasoning and Problem Solving

Can you create a calculation where there will be an exchange in the ones, and your answer will have two ones and be less than 100?

There are lots of possible solutions.

E.g. $33 + 29 = 62$

How many different ways can you solve $19 + 11$?

Explain your method to a partner.

Use concrete or pictorial resources to help explain your method.

Children might add the ones and then the tens.

Children should notice that 1 and 9 are a number bond to 10 which makes the calculation easier to complete mentally.

Find all the possible pairs of numbers that can complete the addition.

$$\begin{array}{r} 1\ \Box \\ +\ 2\ \Box \\ \hline 4\ 2 \\ \scriptstyle 1 \end{array}$$

How do you know you have found all the pairs?

What is the same about all the pairs of numbers?

13 + 29

19 + 23

14 + 28

18 + 24

15 + 27

17 + 25

16 + 26

All the pairs of ones add up to 12

Subtract with 2-digits (1)

Reasoning and Problem Solving

Jasmine has 33 stickers.

Ollie has 54 stickers.

How many more stickers does Ollie have?

What method did you use to solve the problem?

Here the children are working out the difference.

Children might use subtraction to solve the problem or they might count on to find the difference.

Ollie has 21 more stickers than Jasmine.

Find the missing number.

57

$$
\begin{array}{r}
1\ \square \\
+\ 2\ \square \\
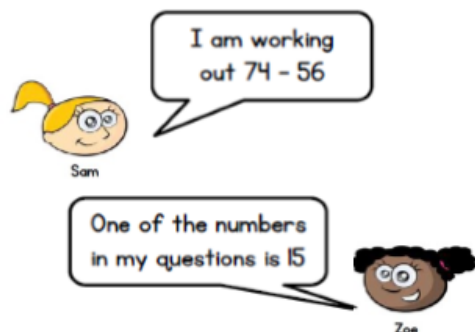\hline
4\ 2 \\
\end{array}
$$
1

Make the numbers using Base 10 to help you find your answer.

Subtract with 2-digits (2)

Reasoning and Problem Solving

Sam and Zoe are working out some subtractions.

I am working out 74 – 56

Sam

One of the numbers in my questions is 15

Zoe

Sam's answer is double Zoe's answer.

What could Zoe's subtraction be?

Sam's answer is 18

Zoe's answer is 9

Zoe's question could be 15 – 6 or 24 – 15

Find the greatest whole number that can complete each number sentence below.

$$45 - 17 > 14 + \boxed{}$$

13

$$26 + 15 < 60 - \boxed{}$$

18

Explain your answer.

Bonds to 100 (Tens and Ones)

Reasoning and Problem Solving

Chris has completed the missing number sentence.

$$46 + 64 = 100$$

Is Chris correct?
Explain your answer.

Chris is incorrect. He has seen number bonds to 10 but forgotten that he would need to exchange ten ones for one ten.

Complete the pattern

$$15 + 85 = 100$$
$$20 + 80 = 100$$
$$25 + 75 = 100$$
$$30 + \text{......} = 100$$
$$\text{......} + \text{......} = 100$$

Can you explain the pattern?

$$30 + 70 = 100$$
$$35 + 65 = 100$$
The first numbers are going up in fives and the second numbers are going down in fives. All of the number sentences are number bonds to 100

Each row and column adds up to 100

Complete the grid.

45	45	
	35	
15		65

45	45	10
40	35	25
15	20	65

Add Three 1-digit Numbers

Reasoning and Problem Solving

Always, sometimes, never?

$$odd + odd + odd = odd$$

Use one digit numbers to test if this is true. E.g.

$$3 + 5 + 7$$

Always – children should show this using different examples. They may recognise that two odds make an even so three odds make an odd.

Which numbers would you add together first in the following number sentences? Why would you add those first?

$$3 + 5 + 7 =$$

$$8 + 2 + 6 =$$

$$4 + 3 + 4 =$$

Is there always an easier order to add three one digit numbers?

3 and 7 first – number bond to 10
8 and 2 first – number bond to 10
4 and 4 first – double a number.

No, e.g. $5 + 6 + 7$

Take 3 consecutive one digit numbers, e.g. 4, 5 and 6

Add them together.

What do you notice?

Choose different groups of 3 consecutive one digit numbers and see if there is a pattern.

$$1 + 2 + 3 = 6$$
$$2 + 3 + 4 = 9$$
$$3 + 4 + 5 = 12$$
$$4 + 5 + 6 = 15$$
$$5 + 6 + 7 = 18$$
$$6 + 7 + 8 = 21$$
$$7 + 8 + 9 = 24$$

If we order the groups, we can see that the totals go up by 3 each time. This is because we are adding one to each number each time so we are adding 3 extra altogether.