Part Whole Model

Reasoning and Problem Solving

There are 6 children.

How many different ways can you sort the children?

Complete a part whole model for each way.

Can you partition the children into more than 2 groups?

Possible answers:

Children sorted into boys and girls.

Children sorted into wearing white, wearing red.

Children sorted into children with white shoes and children with non-white shoes.

Work in groups of up to eight children.

Can you split yourselves into different groups?

Think of different ways to group yourselves: hair colour, eye colour, gender, shoe size etc.

Can you partition into more than 2 groups?

Children may split themselves into groups in many different ways.

E.g. hair colour, month of birth, shoe size, gender etc.

The Addition Symbol

Reasoning and Problem Solving

$...... + ... = 6$

Which of the images could help to complete the number sentence?

Explain why.

Can you think of a number sentence for each of the other two images?

Bead string as there are 6 beads in total, 5 white and 1 red.

So $5 + 1 = 6$

Counters
$4 + 1 = 5$

Cubes
$3 + 4 = 7$

Using the numbers 0 – 9 how many ways can you fill in the boxes to make the calculation correct?

You can only use each number once.

$$\boxed{} + \boxed{} = \boxed{}$$

How many different calculations are there?

Answers will be in the following style with repeated calculations ignored.

$1 + 8 = 9$
$2 + 7 = 9$
$3 + 6 = 9$
$4 + 5 = 9$
$\cancel{5 + 4 = 9}$
$\cancel{6 + 3 = 9}$
$\cancel{7 + 2 = 9}$
$\cancel{8 + 1 = 9}$

Etc.

There are 16 in total.

Children could explore the possibilities if a number could be repeated.

Fact Families - Addition

Reasoning and Problem Solving

Kim has 3 number cards.

| 3 | 5 | 2 |

She has written two number sentences.

$3 + 5 = 2$ $3 = 5 + 2$

Explain what Kim has done wrong.

Correct her number sentences and complete the fact families.

Kim has placed the numbers in the order she was given them, rather than moving them to make the number sentence correct.

$3 + 2 = 5$

$2 + 3 = 5$

$5 = 3 + 2$

$5 = 2 + 3$

● + ▲ = 4   ▲ + ● = 4

4 = ▲ + ●   4 = ● + ▲

What could the ● and the ▲ be worth?

Possible answers:

● = 2
▲ = 2

● = 3
▲ = 1

● = 1
▲ = 3

● = 0
▲ = 4

● = 4
▲ = 0

Number Bonds within 10

Reasoning and Problem Solving

All the dots have fallen off 2 toad stools.

How many different ways can you put them back on?

There are 9 altogether.

Children could put:
8 + 0 or 0 + 8,
7 + 1 or 1 + 7,
6 + 2 or 2 + 6,
5 + 3 or 3 + 5,
4 + 4

Always, sometimes, never?

The bigger the number, the more number bonds it has.

Which number bond is the odd one out?

3 + 4   5 + 2   6 + 1   3 + 5

Explain your answer.

Sometimes, children can prove this by comparing the number bonds for a few numbers.
5 has 5 + 0, 4 + 1, 3 + 2
6 has 6 + 0, 5 + 1, 4 + 2, 3 + 3
7 has 7 + 0, 6 + 1, 5 + 2, 4 + 3
6 has more bonds than 5, 7 has the same number of bonds as 6

3 + 5 is the odd one out because all the other number bonds are equal to 7

Systematic Number Bonds

Reasoning and Problem Solving

Continue the pattern.

$0 + 8 = 8$

$1 + 7 = 8$

$\square + 6 = 8$

$3 + \square = \square$

$\square + \square = \square$

Can you make a similar pattern for 10?

$0 + 8 = 8$

$1 + 7 = 8$

$2 + 6 = 8$

$3 + 5 = 8$

$4 + 4 = 8$

$0 + 10 = 10$

$1 + 9 = 10$

$2 + 8 = 10$

$3 + 7 = 10$

$4 + 6 = 10$

$5 + 5 = 10$

A butterfly's spots have fallen off. How many different ways can you put the spots back on?

Possible Answers:
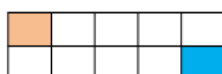
 $0 + 7 = 7$

 $1 + 6 = 7$

 $2 + 5 = 7$

 $3 + 4 = 7$

Children may choose to use:
$7 + 0 = 7$
$6 + 1 = 7$
$5 + 2 = 7$
$4 + 3 = 7$

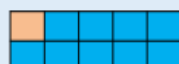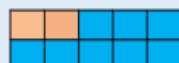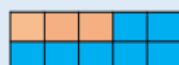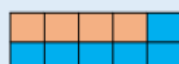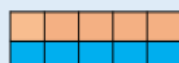# Number Bonds to 10

Reasoning and Problem Solving

Beth needs to colour in the boxes in two different colours.

One box of each colour has been coloured.

How many different ways can she colour the boxes?

Possible answers:

This can also be the other way where there are 9 oranges and 1 blue, 8 oranges and 2 blues, 7 oranges and 3 blues, 6 oranges and 4 blues.

I have 10p to spend.

CHEW 5p   6p   4p

5p   6p   4p

Which two items could I buy?

How many different ways can you do it?

Possible answers:

A chew bar and a muffin.

A banana and a chocolate bar.

A banana and a bottle of pop.

An apple and a bar of chocolate.

An apple and a bottle of pop.

Etc.

Compare Number Bonds
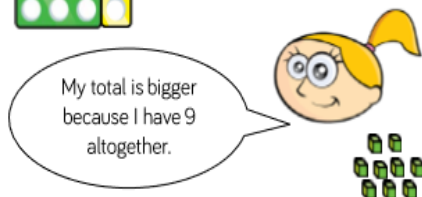
Reasoning and Problem Solving

How many different ways can you complete the number sentence?

$$3 + \_\_ < 3 + \_$$

Max and Stacey have both created their own number bonds.

My total is larger because I have a 5 and a 3

My total is bigger because I have 9 altogether.

Who do you agree with? Explain your answer.

$3 + 1 < 3 + 2$

$3 + 2 < 3 + 3$

$3 + 3 < 3 + 5$

Any combination where the number on the right is larger than the number on the left.

Stacey is right because 9 ones is greater than 3 ones and 5 ones (8 ones).

Tim has 5 counters in his hand and some in a cup.

Max has 3 counters in his hand and some in a cup.

They have the same amount altogether.

They each have less than 10 counters.

How many counters could be in Tim's cup?

How many counters could be in Max's cup?

Possible answers:

Tim has 1, Max has 3
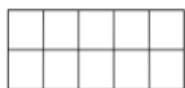Tim has 2, Max has 4
Tim has 3, Max has 5
Time has 4, Max has 6

Adding Together

Reasoning and Problem Solving

There are 8 cubes. Some are red and some are yellow.

How many different ways can you make a total of 8?

You could show your working on a part whole model or a ten frame.

Could be: 8 red and 0 yellow, 1 red and 7 yellow, 2 red and 6 yellow etc.

There are 9 sweets altogether.
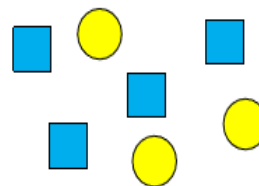3 have a red wrapper and 7 have a blue wrapper.

Is this correct?

Explain how you know.
What can you use to help you show your thinking?

Children could use cubes/ten frame to represent the problem a possible answer could be 'this is wrong because the total of 3 and 7 is 10

Which sentence is correct?

A: 5 is a part, 2 is a part and the whole is 7

B: 4 is a part, 3 is a part and the whole is 8

C: 4 Is a part, 3 is a part and the whole is 7

What mistakes have been made in the incorrect sentences?

A is wrong because the parts are not right.

B is wrong because the whole should be 7 not 8

C is correct.

Adding More

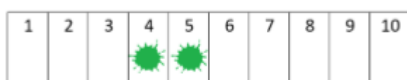## Reasoning and Problem Solving

True or false? Explain why.

'If I add 0 to a number, the number stays the same'

Can you use a number line or counters to help you explain your answer?

True because when you add 0 you are not adding any more.

Tom has used the number track to complete $4 + 2$
He thinks the total is 5

1	2	3	4	5	6	7	8	9	10

What mistake has he made?
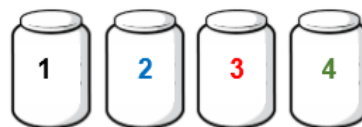How could Tom use the track to find the correct answer?

He has included his starting number.

The two ways he could have used the track are:
- Start at 2 and count 4 more.
- Start at 4 and count 2 more.

Sid has two bean bags.

He is throwing them into jars.

1   2   3   4

What is the highest score he can get?

What is the lowest score he can get?

Explain why he can't get a total of 9

The highest score is 8 if he gets two 4s

The lowest score is 0 if he misses all jars..

He can't get 9 because the highest is 4 and two 4s make 8 so that's the highest.

Finding a Part

Reasoning and Problem Solving

CHEW
1p   6p   4p

6p   4p

I spend 10p on a chocolate bar and something else. What else could I have bought? Explain how you know.

Tom spent 6p on a chocolate bar and something for his sister. What did he buy for his sister? Explain how you know.

Ellie spent 9p on a banana and a muffin.
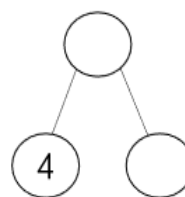How much is the muffin?
Explain how you know.

Banana or apple because $4 + 6 = 10$

Two chew bars because $1 + 1 = 2$ and $4 + 2 = 6$

It cost 3p because $6 + 3 = 9$

Using the digits 0 – 9, how many part whole models can you complete?

One of the parts always has to be 4

```
      ( )
     /    \
   (4)    ( )
```

You can only use each digit card once.

Explain why you can't use 0

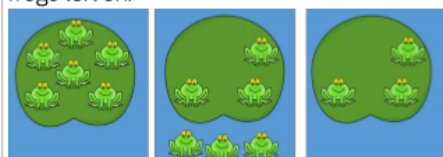What other digits can't you use and why?

It could be:
- 4, 1 and 5
- 4, 2 and 6
- 4, 3 and 7
- 4, 5 and 9

We would have to use 4 twice if we used 0
Can't be 4 because it would be repeated, or 8 because we would need another 4

How Many Left (1)

Reasoning and Problem Solving

Some frogs are on a lily pad.
Three frogs jumped off and there are three frogs left on.

First   Then   Now

Complete the sentences:

At first there were _.
Then _____.
Now there are ___.

In the 'then' picture, do the 3s show the same thing? Why not?

What if 4 jumped off, what would the start number be?

Explain how you know.

At first there were 6 frogs. Then 3 jumped off. Now there are 3 frogs left.

No, the 3 on the lily pad show how many are left. The 3 in the water show how many were taken away.

If 4 jumped off the start number would have been 7 because 4 and 3 make 7

Some cakes have been eaten.

There are 2 cakes left.

How many cakes could there have been, and how many could have been eaten to be left with 2?

Explain your reasons.

I could have had 10 and eaten 8, 9 and eaten 7. Children might use cubes/ten frame etc. to help them get two left.

How Many Left (2)

Reasoning and Problem Solving

Which calculations match?

Explain your reasons.

One has been done for you.

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

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

$3 - 3 = 0$ $0 = 3 - 3$

$10 - 1 = 9$ and $9 = 10 - 1$ because they are both equal to 9

$3 - 3 = 0$ and $0 = 3 - 3$ because they are both equal to 0

How many ways can you get an answer of 0?
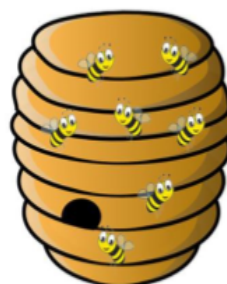
$\boxed{} + \boxed{} = 0$

What is the rule?

10 – 10
9 – 9
8 – 8 etc.
To get zero you have to take away the same number you started with.

How many calculations can you complete?

$\boxed{} = 7 - \boxed{}$

Why can't the digits 8 or 9 be used?

Children could write

$6 = 7 - 1$

$5 = 7 - 2$

Etc.

You can't use 8 or 9 because there are only seven bees.

Subtraction – Breaking Apart

Reasoning and Problem Solving

Think of two questions to ask your friend about the image.
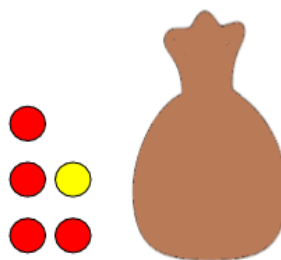

Represent them about the calculation.

☐ - ☐ = ☐

There are 9 sheep in total. 5 of them are outside the barn. How many are inside?

There are 9 sheep in total. 4 of the are inside the barn. How many are outside?

$9 - 5 = 4$ and

$9 - 4 = 5$

There are no more than 10 counters in total.

How many counters could be in the bag?

Why can't it be six?

There could be 5, 4, 3, 2, 1 or 0

It can't be six because then there would be more than 10 in total

Fact Families – 8 Facts

Reasoning and Problem Solving

Explain the mistakes that have been made.

$5 + 2 = 7$	$7 = 5 + 2$
$2 + 5 = 7$	$7 = 2 + 5$
$7 - 2 = 5$	$7 = 5 - 2$
$7 - 5 = 2$	$7 = 2 - 5$

The last two should be

$2 = 7 - 5$

and

$5 = 7 - 2$

Explain the mistakes that have been made.

$8 + 0 = 8$	$8 - 0 = 8$
$0 + 8 = 8$	$0 = 8 - 0$
$8 = 0 + 8$	$8 - 8 = 0$
$8 = 8 + 0$	$0 = 8 - 8$

$0 = 8 - 0$ should be $0 = 8 - 8$

Counting Back

Reasoning and Problem Solving

Tami is calculating 7 – 2 and does this by counting backwards on a number line.

She gets an answer of 6

What mistake has she made?

Tami has included 7 when taking away, rather than counting 6, 5

The answer is 2

How many ways can you get to this by counting backwards on a number line to 10?

10 – 8

9 – 7

8 – 6 etc

GAME: Race to zero!

Start at 10 on a number line.

Roll a dice and subtract this amount.

What would you like to roll? Why?

Why would you not want to roll a 1?

Find the Difference

Reasoning and Problem Solving

Two numbers have a difference of 4

The larger number is less than 10

What could the two numbers be?
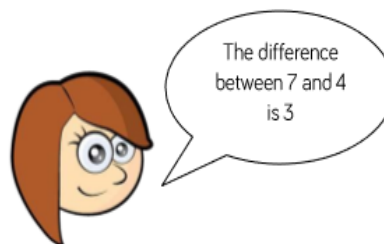
9 and 5

8 and 4

7 and 3

6 and 2

5 and 1

4 and 0

True or false?

Ann says;

The difference between 7 and 4 is 3

Can you show this in more than one way?

Children could show this by representing both numbers using cubes, bead strings, straws etc. or relating it back to counting backwards on a number line.

Compare Statements (1)

Reasoning and Problem Solving

Would you rather have 6 sweets and 2 more sweets, or 8 sweets?

Explain your answer.
Use cubes or draw an image to help you.

I don't mind because I know that 6 and 2 is equal to 8

Using the numbers 0-10, how many different ways can you complete the boxes?

$$\square + 7 = \square$$

$$\square + \square > 4$$

$$\square + \square < 9$$

Possible answers:

$3 + 7 = 10$

$1 + 4 > 4$

$1 + 1 < 9$

What signs are missing?

$$7 + 3 \;\square\; 10$$

$$9 \;\square\; 3 + 7$$

$$9 > 10 \;\square\; 3$$

Explain how you know.

$7 + 3 = 10$ because I know that 7 and 3 is equal to 10

$9 < 3 + 7$ because I know that 9 is less than 10

$9 > 10 - 3$ because I know that 9 is greater than 7

Compare Statements (2)

Reasoning and Problem Solving

Jeff says:

Is he correct?

Explain your answer.

No because

$5 + 2 = 7$

$4 + 4 = 8$

and

$7 < 8$

Use the digit cards to complete the sentences.

| 2 | 3 | 4 | 5 |

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

$$\square - \square = \square - \square$$

$$\square - \square > \square - \square$$

$$\square - \square > \square + \square$$

Can you write any more number sentences using these cards?

Possible answers:

$5 + 2 = 4 + 3$

$5 - 4 = 3 - 2$

$5 - 3 > 4 - 2$

$5 - 2 < 4 + 3$

Etc.