SOLVING PROBLEMS

Pupils should be taught to:	As outcomes, Year 1 pupils should, for example:
Choose and use appropriate number operations and ways of calculating to solve problems	Understand and use in practical contexts: *operation, sign, number sentence...* Choose and use appropriate number operations and mental strategies to solve problems in a wide variety of contexts, in mathematics and other subjects. Decide whether the calculation can be done mentally or needs the use of apparatus such as counters, cubes or rods, coins, squared paper, a number track... Explain and record how the problem was solved. **For examples of problems see sections on: reasoning about numbers, 'real life', money, measures and time (pages 62–71).** Make up 'number stories' to reflect statements like: 3 + 4 = 7 11 – 2 = 9 □ + 2 = 5 6 – □ = 3 For example: There were 11 apples in the bag. I ate 2 of them. There were 9 apples left.

As outcomes, Year 2 pupils should, for example:

Understand, use and begin to read:
operation, sign, symbol, number sentence...

Choose and use appropriate number operations and ways of calculating (e.g. mental, mental with jottings) to solve problems in a wide variety of contexts, in mathematics and other subjects.

Decide whether the calculation can be done mentally or needs the use of apparatus such as counters, cubes or rods, coins, squared paper, a number track or line or 100 square...

Explain and record how the problem was solved.

For examples of problems see sections on: reasoning about numbers, 'real life', money, measures and time (pages 62–71).

Make up 'number stories' to reflect statements like:

$13 + 14 = 27$ $4 \times 3 = 12$
$\square - 2 = 19$ $20 \div \square = 5$

For example:

A tricycle has three wheels.
Four tricycles have 12 wheels.

What sign does each ✻ stand for?

$24 ✻ 8 = 32$ $94 ✻ 5 = 89$

As outcomes, Year 3 pupils should, for example:

Use, read and begin to write:
operation, sign, symbol, number sentence, equation...

Choose and use appropriate number operations and ways of calculating (e.g. mental, mental with jottings, pencil and paper) to solve problems in a wide variety of contexts, in mathematics and other subjects.

Decide whether the calculation can be done mentally or needs the use of apparatus such as cubes, rods or blocks, coins, squared paper, a number line or 100 square, pencil and paper...

Explain and record how the problem was solved.

For examples of problems see sections on: reasoning about numbers, 'real life', money, measures and time (pages 62–71).

Make up 'number stories' to reflect statements like:

$135 + 145 = 280$ $14 \times 2 = 28$
$\square - 25 = 45$ $32 \div \square = 16$

For example:

A burger cost £1.35 and a large fries cost £1.45.
They cost £2.80 altogether.

What operation sign does each ✻ represent?

$63 ✻ 98 = 161$ $150 ✻ 21 = 129$ $18 ✻ 5 = 90$

Look at different calculations using, say, subtraction. Say which is hardest to do and justify why.

SOLVING PROBLEMS

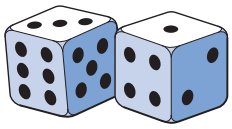
Pupils should be taught to:

Solve mathematical problems or puzzles, recognise simple patterns or relationships, generalise and predict. Suggest extensions by asking 'What if...?' or 'What could I try next?'

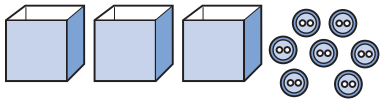
As outcomes, Year 1 pupils should, for example:

Solve puzzles and problems such as:

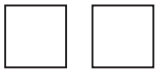
- Which dominoes have a total of 5 spots? 7 spots? 10 spots?
- How many different ways can you score 4 by rolling two dice? What about 6?



- Investigate different ways of putting 7 buttons in 3 boxes. Now try 10 buttons.

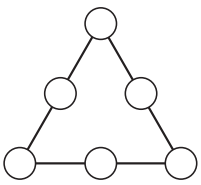


- Ann is 2 years older than Tom.
  How old could each of them be?
- How many different ways can you colour two squares using a red pen and a blue pen?



- Put the numbers 1 to 4 in the circles so that the difference between each pair of joined numbers is more than 1.

- Put 1, 2 or 3 in each circle so that each side adds up to 5. You can use each number as often as you like.
  Find different ways of doing it.

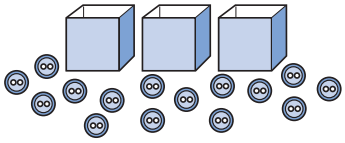


- Write as many different ways as you can of making the number 12.
- Cut up two different birthday cards into five or six pieces. Shuffle the pieces, then reassemble the two pictures.

As outcomes, Year 2 pupils should, for example:

Solve puzzles and problems such as:

- How many dominoes have an odd total of spots?
- Using three dice, find different ways of scoring 12.
- Explore different ways of adding three odd numbers to make 11.
- Put 15 buttons in three boxes so that each box has 3 more buttons than the one before.

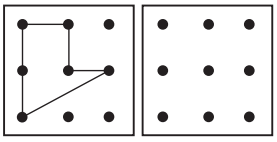


- Write as many different ways as you can of making the number 30.
- Solve a problem presented in a computer program: for example, find a strategy for buying stamps at a post office or using coins in a toy shop.
- Use 1, 4 and 5, and the signs +, – and =.
  What different answers can you make?
- Put the numbers 1 to 5 in the circles so that the difference between each pair of joined numbers is more than 1.

- Find ways of rearranging the digits so that the sum of each row, column and diagonal is the same.

1	1	1
2	2	2
3	3	3

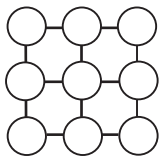
  Now try with different digits: for example, 4, 5, 6.
- Complete a pattern to make it symmetrical: for example, using pegboards or pinboards, or gummed shapes on squared paper...



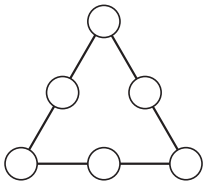
As outcomes, Year 3 pupils should, for example:

Solve puzzles and problems such as:

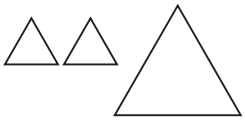
- How many different ways can you choose two dominoes with a total of 8 spots?
- Using three 1 to 6 dice, what even totals can you get? What if you used other dice?
- Explore different ways of adding four odd numbers to make 20.
- Find a pair of numbers with:
  a sum of 7 and a product of 10;
  a sum of 5 and a product of 6;
  a sum of 19 and a product of 90.
- Each ◆ marks a missing digit.
  Find the digits that are missing.
  a. 1◆ + ◆7 = 32
  b. 3◆ – ◆4 = 4
- Use a computer program to develop a strategy for rearranging the order of objects: for example, to change over two sets of 'frogs' in a line.
- Use 2, 4 and 5, and the signs +, × and =.
  How many different answers can you make between 40 and 200?
- Put the numbers 1 to 9 in the circles so that the difference between each pair of joined numbers is odd.



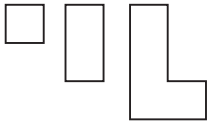
- Put the numbers 1 to 6 in the circles so that each side of the triangle totals 9.
  Now try 10, 11 or 12.



- Fit shapes together to make a symmetrical shape.
  For example, make symmetrical patterns from a set of three shapes such as:

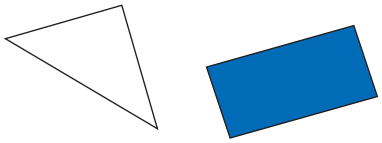


or



  Discuss the lines of symmetry in the patterns.

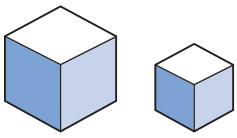
SOLVING PROBLEMS

Pupils should be taught to:	As outcomes, Year 1 pupils should, for example:
Investigate a general statement about familiar numbers or shapes: for example, by finding examples that satisfy it	Give examples to match statements such as: • *I can make 6 by adding two numbers.* For example: 0 + 6 = 6 1 + 5 = 6 2 + 4 = 6 3 + 3 = 6 • *I can pay for anything from 1p to 5p if I have two 2p and one 1p coins.* For example: 3p = 2p + 1p 5p = 2p + 2p + 1p • *When I add 10 to a number the units number stays the same.* For example: 3 + 10 = 13 16 + 10 = 26 • *I can add numbers in any order and the answer is the same.* For example: 3 + 10 = 10 + 3 = 13 • *I can make four different numbers with two different digits.* For example: with 2 and 3, I can make 22, 23, 32, 33 • *All triangles have 3 sides.* For example: the white shape is a triangle but the blue shape is not a triangle. 
Explain methods of calculation and reasoning about numbers orally and, where appropriate, in writing	For example, explain orally that: • 5 + 6 5 add 6 is 11 because 5 and 5 is 10 and one more is 11. • 14 – 5 14 take away 4 is 10. Take away one more is 9.

As outcomes, Year 2 pupils should, for example:

Give examples to match statements such as:

- *When I subtract 10 from a number the units number stays the same.*
  For example: 43 – 10 = 33 86 – 10 = 76
- *I can add 9 by adding 10 and taking away 1.*
  For example: 16 + 9 = 16 + 10 – 1 = 25
- *If a number ends in 2 then it is even.*
  For example: 12, 32, 82
- *If a number ends in 0 then it divides exactly by 10.*
  For example: 10, 40, 90, 100
- *There are three numbers less than 10 that divide exactly by 3.*
  For example: 3, 6, 9
- *Odd numbers have 1 left over when you divide them by 2, but even numbers do not.*
  For example: 9 ÷ 2 is 4 remainder 1
  15 ÷ 2 is 7 remainder 1
- *A cube has six square faces.*



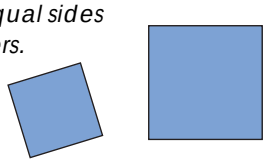
For example, explain orally or record that:

- 8 + 7 I did 7 + 7 + 1, which is double 7 plus 1; or I made the 8 into 10 then I added 5.
- 23 – 7 I did 23 – 3 = 20 then 20 – 4 = 16.
- 21 + 32 I did 20 + 30 = 50 then 1 + 2 = 3, so it's 53.

As outcomes, Year 3 pupils should, for example:

Give examples to match statements such as:

- *There are five odd numbers between 10 and 20.*
  For example: 11, 13, 15, 17, 19
- *If you multiply numbers either way round, the answer is the same.*
  For example: $5 \times 6 = 6 \times 5 = 30$
- *Any odd number is one more than an even number.*
  For example: 23 = 22 + 1 15 = 14 + 1
- *Any even number can be written as the sum of two odd numbers.*
  For example: 6 = 3 + 3 12 = 5 + 7 30 = 13 + 17
- *The multiplication table for 4 is always even.*
  For example: $7 \times 4 = 28$, which is even.
- *A multiple of 5 is always half a multiple of 10.*
  For example: 15 = 30 ÷ 2 40 = 80 ÷ 2
- *All squares are rectangles.*
- *A square always has four equal sides and four right-angled corners.*



For example, explain orally or write that:

- 23 + 17 I added 17 and 3 to get 20, then 20 more to get 40.
- 50 – 29 I did 50 take away 30, which makes 20, then added 1.
- 25 × 2 25 + 25 = 50, so $25 \times 2 = 50$.
- 46 ÷ 2 I know double 23 is 46, so half of 46 is 23.

SOLVING PROBLEMS

Pupils should be taught to:	As outcomes, Year 1 pupils should, for example:
Solve simple word problems set in 'real life' contexts and explain how the problem was solved	Use own mental strategies to solve 'story' problems about numbers in real life, choosing an appropriate operation (counting, addition, subtraction, halving or doubling). Explain methods and reasoning orally and record in own way how the problem was solved.

Examples of problems

One-step operations

- I think of a number, then add 2.
  The answer is 7.
  What was my number?

- Lisa has 5 pens and Tim has 2 pens.
  How many pens do they have altogether?
  How many more pens has Lisa than Tim?

- Tina rolled double 6 on her two dice.
  What was her score?

Two-step operations

- Scores in a game are:

Josh	2 + 3
Sam	3 + 5
Ny	4 + 2

  How many did Sam and Ny score altogether?
  How many more did Sam score than Josh?

- Some hens lay 2 eggs, 4 eggs and 3 eggs.
  How many eggs did they lay altogether?

- Half of the cakes in this box of 10 are gone.
  How many are left?

See also problems involving money (page 68), measures and time (page 70).

As outcomes, Year 2 pupils should, for example:

Use mental addition or subtraction, or simple multiplication, and own strategies to solve 'story' problems about numbers in real life, choosing the appropriate operation and way to calculate: mental, mental with jottings...

Explain methods and reasoning orally and, where appropriate, write a number sentence to show how the problem was solved.

Examples of problems

One-step operations

- I think of a number, then halve it.
  The answer is 9.
  What was my number?

- There are 16 plums.
  8 children share them equally.
  How many plums does each child have?

- Two people have 8 cakes each.
  How many cakes have they altogether?
  One person gives 2 cakes to the other.
  How many cakes does each one have now?

Two-step operations

- 7 people are on a bus.
  8 more get on and 3 get off.
  How many people are on the bus now?

- There are 25 bean bags.
  Kim takes 11 and Amit takes 9.
  How many bean bags are left?

- There are 2 red buttons and 4 blue buttons on a card of buttons.
  How many buttons are there on 10 cards?

See also problems involving money (page 69), measures and time (page 71).

As outcomes, Year 3 pupils should, for example:

Use any of the four operations to solve 'story' problems about numbers in real life, choosing the appropriate operation and way to calculate: mental, mental with jottings, pencil and paper...

Explain methods and reasoning orally and, where appropriate, write a number sentence to show how the problem was solved.

Examples of problems

One-step operations

- I think of a number, then subtract 12.
  The answer is 26.
  What was my number?

- A spider has 8 legs.
  How many legs do 5 spiders have?
  Now work out how many legs 6 spiders have.

- A box holds 35 nuts.
  How many nuts are left if you eat 17 nuts?
  How many people can have 5 nuts each?
  How many nuts are there in 3 boxes?
  How many boxes are needed: to hold 70 nuts?
  ...to hold 80 nuts?

Two-step operations

- There are 19 books on the top shelf and 32 books on the bottom shelf.
  24 of the books are removed.
  How many books are left on the shelves?

- There are 18 apples, 21 pears and 19 bananas in some boxes of fruit.
  How many pieces of fruit are there altogether?

- I think of a number, double it and add 5.
  The answer is 35.
  What was my number?

See also problems involving money (page 69), measures and time (page 71).

SOLVING PROBLEMS

Pupils should be taught to:	As outcomes, Year 1 pupils should, for example:
Recognise coins and notes of different values	Recognise all coins. Exchange coins up to 10p for an equivalent value in smaller coins. Extend to 20p. Total coins: for example, how much is this? 
Solve simple word problems involving money and explain how the problem was solved	Understand and use in practical contexts: *coin, penny, pence, pound, price, cost, costs more/less, change, total, pay, how much?* Use own mental strategies to solve problems involving money in contexts such as the classroom shop. Explain methods and reasoning orally and record in own way how the problem was solved. For example: *Find totals and give change* • How much altogether is 5p + 2p + 1p? • Tim spent 4p. What was his change from 10p? • Anil spent 6p and 3p on toffees. What change from 10p did he get? • Rosie had 15p. She spent 6p. How much does she have left? • Chews cost 5p each. What do 3 chews cost? *Solve problems: what to buy and how to pay* • Gita paid 6p for chews with no change. What coins could she use? • Apples are 6p each. What do two apples cost? Which two coins would pay for them exactly? • Describe different ways of paying 7p exactly. And 13p? • Which three coins make: 14p, 15p, 16p, 17p? Can you make 18p using three coins?

See also problems involving 'real life' (page 66), measures and time (page 70).

As outcomes, Year 2 pupils should, for example:

Recognise and appreciate the value of all coins.

Exchange coins for their equivalent value using two or three smaller coins.

Total coins: for example, how much is this?

Understand, use and begin to read: *coin, pound, £, pence, price, cost, pay, costs more/less, change, total, how much?*

Begin to appreciate, for example, that £4.65 means £4 and 65p. Respond to questions such as:

- How many pence is £1.50?
- Write 125p in £ and pence (£1.25).
- Write in £ and pence the total of three £1 coins and six 1p coins (£3.06).

Use mental addition or subtraction, or simple multiplication, and own strategies to solve money problems. Explain methods and reasoning orally and, where appropriate, write a number sentence to show how the problem was solved. For example:

Find totals and give change

- I have £14. I am given another £9.
  How much do I have now?
- A pear costs 15p more than an apple.
  An apple costs 12p.
  What does a pear cost?
- Rhian spent 24p. She spent 8p more than Amy.
  How much did Amy spend?
- Patrick bought three choc bars at 15p each.
  How much change from 50p did he get?

Solve problems: what to buy and how to pay

- Investigate ways of using silver coins to pay 50p.
- You have three 10p and three 5p coins in a purse.
  You use two of the coins to buy a lolly.
  What might the lolly cost?
  What if you used three coins?
- Ruth has two coins of the same value.
  How much might she have altogether?
- Jo has three 20p and two 15p stamps. What values can he make using one or more of the stamps?

See also problems involving 'real life' (page 67), measures and time (page 71).

As outcomes, Year 3 pupils should, for example:

Recognise the value of £5, £10 and £20 notes.

Exchange a note for its equivalent value in smaller notes, or £2 or £1 coins or silver coins.

Use, read and begin to write: *coin, pound, £, pence, note, price, cost, cheaper, more/less expensive, pay, change, total, value, how much?*

Use decimal notation for money. Respond to questions such as:

- How many pence is £9.05?
- Write 465p in £ and pence.
- Write in £ and pence the total of ten £1 coins and five 1p coins (£10.05).

Use any of the four operations and own strategies to solve money problems. Explain methods and reasoning orally and, where appropriate, write a number sentence to show how the problem was solved. For example:

Find totals and give change

- It costs 75p for a child to swim.
  How much does it cost for two children?
- Anna has a 50p coin and three 20p coins.
  She pays 90p for a Big Dipper ride.
  How much does she have left?
- A set of paints costs £3. Parveen saves 20p a week.
  How many weeks must she save to buy the paints?
- Dad bought three packets of cornflakes at 70p each. What was his change from £3?

Solve problems: what to buy and how to pay

- Which five coins make 74p? What other amounts can you make with five different coins?
- Winston offered two silver coins to pay for a 17p toy. Investigate how much change he got.
- Small pizzas cost: £4.20 £4.40 £4.50 £3.80 £4.25
  Big pizzas cost: £5.50 £5.75 £6.00 £4.95 £5.40
  Which two pizzas can you buy for exactly £10?
- You have £5. Some toys are priced at: £2.70, £1.80, £1.40, £1.60, £2.20, £1.20. Investigate which three you could buy.

See also problems involving 'real life' (page 67), measures and time (page 71).

Pupils should be taught to:

Solve simple word problems involving measures and explain how the problem was solved

As outcomes, Year 1 pupils should, for example:

Use own mental strategies to solve measurement problems in classroom contexts.

Explain methods and reasoning orally and record in own way how the problem was solved, using a number sentence and signs (+, –, =) where appropriate. For example:

Length, mass, capacity

- The classroom is 15 metres long.
  The library is 12 metres long.
  The classroom is longer than the library.
  How much longer?

- 8 bricks balance an apple.
  10 bricks balance a pear.
  The apple and the pear are together on the scales.
  How many bricks will balance them?

- A full jug hold 6 cups of water.
  How many cups of water do 2 full jugs hold?

Time

- How long is it from 2 o'clock to 6 o'clock?

- It is now half past seven. What time was it 2 hours ago?

- It is 5 o'clock.
  What time will it be 4 hours from now?
  What time was it 3 hours ago?
  If you had tea at 3 o'clock, how long ago was that?
  If you go to bed at 8 o'clock, how many hours until bed time?

See also problems involving 'real life' (page 66) and money (page 68).

As outcomes, Year 2 pupils should, for example:

Use mental calculation strategies to solve measurement problems set in a variety of contexts.

Explain methods and reasoning orally and, where appropriate, write a number sentence using numbers and signs (+, –, ×, ÷, =) to show how the problem was solved. For example:

Length, mass, capacity

- My cat is 30 cm tall.
  My dog is 25 cm taller.
  How tall is my dog?

- There are 5 kg of pears in 1 box.
  How many kilograms of pears are in 3 boxes?

- You have 50 litres of water.
  How many 10 litre buckets can you fill?

Time

- Sue got on the bus at 9 o'clock.
  The journey took half an hour.
  What time did she get off the bus?

- Mary went into a shop at 10:30.
  She came out at 10:45.
  How long was she in the shop?

- James walked from 9:45 until 10:15.
  For how many minutes did he walk?

See also problems involving 'real life' (page 67) and money (page 69).

As outcomes, Year 3 pupils should, for example:

Use mental calculation strategies to solve measurement problems set in a variety of contexts.

Explain methods and reasoning orally and, where appropriate, write a number sentence using numbers and signs (+, –, ×, ÷, =) to show how the problem was solved. For example:

Length, mass, capacity

- Two rolls of tape are 35 cm and 41 cm long.
  What is their total length?
  What is the difference in their lengths?

- An egg weighs about 50 grams.
  Roughly how much do 6 eggs weigh?

- A big potato weighs about ¼ kg on the scales.
  Roughly, what would be the weight on the scales of 10 big potatoes?

- A bottle of medicine holds 35 millilitres.
  A teaspoon holds 5 millilitres.
  How many teaspoons of medicine in the bottle?

Time

- Mark got into the pool at 3:30 pm.
  He swam for 40 minutes.
  What time did he get out?

- The cake went in the oven at 10:20.
  It came out at 10:45.
  How long was it in the oven?

- Lunch takes 50 minutes. It ends at 1:00 pm.
  What time does it start?

See also problems involving 'real life' (page 67) and money (page 69).