2023 Maths Games Junior - Years 5 & 6
Resource Kit 3
Teaching Problem Solving

MATHS GAMES

Problem Solving Strategies

This resource kit focuses on the following problem solving strategies:

1. Solve a Simpler Related Problem

Many hard problems are actually simpler problems that have been extended to larger numbers.

Patterns can sometimes be identified by trying the problem with smaller numbers.

2. Eliminate All But One Possibility

Deciding what a quantity is not, can narrow the field to a very small number of possibilities.

These can then be tested against the conditions of the original problem.

It follows on from strategies introduced in the Preparation Resource Kit and Resource Kits 1 and 2:

Guess, Check and Refine

Draw a Diagram

Find a Pattern

Build a Table

Work Backwards

Make an Organised List

Resource Kit 3 focuses on:

Solve a Simpler Related Problem

Eliminate All But One Possibility

Set Yellow

Example problems for which full worked solutions are included.

Set Green

Problems that are designed to be similar to Set Yellow, but with fewer difficult elements.

Set Orange

Problems that are similar in mathematical structure to the corresponding Yellow problems.

Further questions and solution methods can be found in the APSMO resource book "Building Confidence in Maths Problem Solving", available from www.apsmo.edu.au.

How to use these problems

At the start of the lesson, present the problem and ask the students to think about it. Encourage students to try to solve it in any way they like. When the students have had enough time to consider their solutions, ask them to describe or present their methods, taking particular note of different ways of arriving at the same solution.

Each question includes at least one solution method that the majority of students should be able to follow. By participating in lessons that demonstrate achievable problem solving techniques, students may gain increased confidence in their own ability to address unfamiliar problems.

Finally, the consideration of different solution methods is fundamental to the students' development as effective and sophisticated problem solvers. Even when students have solved a problem to their own satisfaction, it is important to expose them to other methods and encourage them to judge whether or not the other methods are more efficient.

Preparation Kit

Guess, Check and Refine

This involves making a reasonable guess of the answer, and checking it against the conditions of the problem. An incorrect guess may provide more information that may lead to the answer.

Draw a Diagram

A diagram may reveal information that may not be obvious just by reading the problem.

It is also useful for keeping track of where the student is up to in a multi-step problem.

Resource Kit 1

Find a Pattern

A frequently used problem solving strategy is that of recognising and extending a pattern.

Students can often simplify a difficult problem by identifying a pattern in the problem situation.

Build a Table

A table displays information so that it is easily located and understood.

A table is an excellent way to record data so the student doesn't have to repeat their efforts.

Resource Kit 2

Work Backwards

If a problem describes a procedure and then specifies the final result, this method usually makes the problem much easier to solve.

Make an Organised List

Listing every possibility in an organised way is an important tool.

How students organise the data often reveals additional information.

Resource Kit 3

Solve a Simpler Related Problem

Many hard problems are actually simpler problems that have been extended to larger numbers.

Patterns can sometimes be identified by trying the problem with smaller numbers.

Eliminate All But One Possibility

Deciding what a quantity is not, can narrow the field to a very small number of possibilities.

These can then be tested against the conditions of the original problem.

Resource Kit 4

Convert to a More Convenient Form

There are times when changing some of the conditions of a problem makes a solution clearer or more convenient.

Divide a Complex Shape

Sometimes it is possible to divide an unusual shape into two or more common shapes that are easier to work with.

Set Yellow

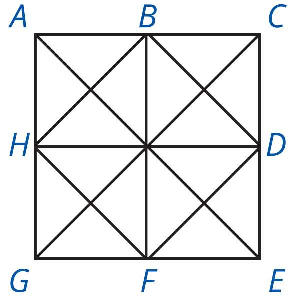
3.1) In the addition shown, different letters represent different digits.
What do the letters *A*, *T* and *E* represent?

$$\begin{array}{rccc} & & A & T \\ + & & & A \\ \hline & T & E & E \end{array}$$

3.2) Each of *AB* and *BA* represents a two-digit number having the same digits, but in reverse order.
If the difference of the two numbers is 54, and *A* + *B* = 10, find both numbers, *AB* and *BA*.

3.3) Pepper, Fuzzy, Socks and Bogart are competing in a guinea pig race.
Pepper didn't come first or last.
Fuzzy finished before Socks, and Bogart finished between Socks and Pepper.
Which guinea pig came third?

3.4) Square *ACEG* is drawn at the right.
Points *B*, *D*, *F*, and *H* are halfway along the sides of the square.
What is the total number of squares of all sizes which can be traced using only the lines drawn?



Set Yellow

3.5) The numbers from 1 to 9 can be placed in these boxes so that every row, column and diagonal add up to give the answer 15.

What number goes in the box that looks like this: □ ?

	7	
□		1
		8

3.6) There are ten students in the book club.

For an end of year celebration, each student brought one book each for everyone else in the club.

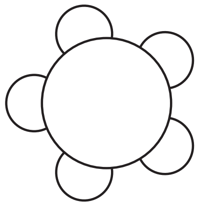
How many books were there all together?

3.7) Gemma, Harry, Ivy, Jared and Kelly are sitting around a round table, facing the centre.

Kelly is next to Gemma, on Gemma's right side.

Harry is not next to Kelly or Ivy.

Name the two students who are sitting next to Jared.



3.8) Archie had 5 shots for goal and scored 3 of them.

Charlotte had 6 shots for goal and scored 4 of them.

George had 7 shots for goal and scored 5 of them.

Louis had 8 shots for goal and scored 5 of them.

Who had the best scoring rate?

Set Green

3.1) In the addition shown, different letters represent different digits.
What do the letters *A*, *B* and *C* represent?

$$\begin{array}{r} A \\ +\ \ B \\ \hline A\ \ C \end{array}$$

3.2) Each of *AB* and *BA* represents a two-digit number having the same digits, but in reverse order.
If the difference of the two numbers is 18, and $A + B = 4$, find both numbers, *AB* and *BA*.

3.3) Pepper, Fuzzy and Socks are competing in a guinea pig race.
Pepper finished after Socks.
Socks finished before Fuzzy.
Which guinea pig came first?

3.4) Square *ACEG* is drawn at the right.
Points *B*, *D*, *F*, and *H* are halfway along the sides of the square.
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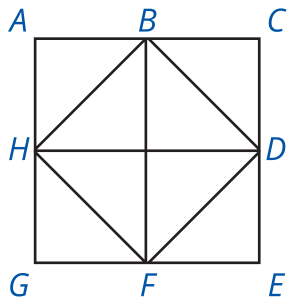


Set Green

3.5) The numbers from 1 to 9 can be placed in these boxes so that every row, column and diagonal add up to give the answer 15.

What number goes in the box that looks like this: □ ?

8		4
1		
6	□	

3.6) There are five students in the book club.

For an end of year celebration, each student brought one book each for everyone else in the club.

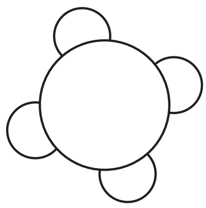
How many books were there all together?

3.7) Gemma, Harry, Ivy, and Jared are sitting around a round table, facing the centre.

Jared is next to Harry, on Harry's left side.

Ivy is not next to Jared.

Name the two students who are sitting next to Gemma.



3.8) Archie had 4 shots for goal and scored 0 of them.

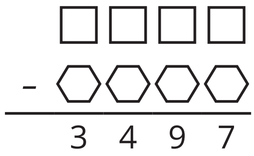
Charlotte had 6 shots for goal and scored 3 of them.

George had 7 shots for goal and scored 3 of them.

Who had the best scoring rate?

Set Orange

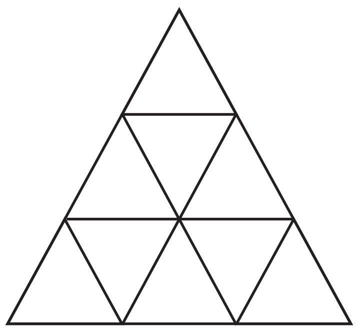
3.1) In this subtraction, the squares (□) contain the digits 3, 4, 6, and 9 in some order and the hexagons (⬡) contain the digits 4, 5, 8, and 9 in some order. What four-digit number is represented by the squares?



3.2) In a four-digit number, the sum of the thousands and hundreds digits is 3.
The tens digit is 4 times the hundreds digit.
The ones digit is seven more than the thousands digit.
No two digits are equal.
What is the four-digit number?

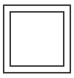
3.3) Amanda, Beth and Sarah run three races.
In each race, one of them earns 5 points, one of them earns 3 points, and one of them earns 1 point.
After the three races Beth has the highest point total.
What is the smallest total score that Beth can have?

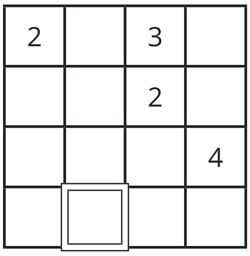
3.4) The diagram shows one large triangle.
There are some straight lines drawn between the sides.
How many triangles, of any size, can be traced on the lines in the diagram?



Set Orange

3.5) Each row and column of this square contain all of the numbers 1, 2, 3 and 4, in some order.

What number goes in the box that looks like this:  ?



3.6) When two people shake hands with one another, that counts as one "handshake".

Every person in a room shakes hands with each other person in the room exactly once.

There are a total of 15 "handshakes".

How many people are in the room?

3.7) Alexis, Emma, and Li play in the school band.

One plays the flute, one plays the saxophone, and one plays the drums.

Alexis is in Year 6.

Alexis and the saxophone player practise together after school.

Emma and the flute player are in Year 5.

Who plays the drums?

3.8) A group consisted of 2 girls for every boy.

24 more girls joined the group.

There are now 5 girls for every boy.

How many boys are in the group?

Maths Games – Example Problem 3.1

Example Problem 3.1 - Green

In the addition shown, different letters represent different digits.
What do the letters *A*, *B* and *C* represent?

$$\begin{array}{rr} & A \\ + & B \\ \hline A & C \end{array}$$

Example Problem 3.1 - Yellow

In the addition shown, different letters represent different digits.
What do the letters *A*, *T* and *E* represent?

$$\begin{array}{rrr} & A & T \\ + & & A \\ \hline T & E & E \end{array}$$

Example Problem 3.1 - Orange

In this subtraction, the squares (□) contain the digits 3, 4, 6, and 9 in some order and the hexagons (⬡) contain the digits 4, 5, 8, and 9 in some order.
What four-digit number is represented by the squares?

$$\begin{array}{rrrrr} & \square & \square & \square & \square \\ - & ⬡ & ⬡ & ⬡ & ⬡ \\ \hline & 3 & 4 & 9 & 7 \end{array}$$

Maths Games Example Solution 3.1 - Yellow

In the addition shown, different letters represent different digits.

What do the letters *A*, *T* and *E* represent?

$$\begin{array}{rrr} & A & T \\ + & & A \\ \hline T & E & E \end{array}$$

Strategy: Eliminate All But One Possibility

Let's consider what values are possible for each of these letters.

$$\begin{array}{rrr} & A & T \\ + & & A \\ \hline T & E & E \end{array}$$

The result, ***TEE***, is a three-digit number.

How would it be possible for ***TEE*** to be a three-digit number, given that it's the sum of:

- a two-digit number (***AT***) and
- a one-digit number (***A***)?

Method 1: Consider possible values for *AT*

For this to occur, ***AT*** must be greater than 90.

Therefore, ***A*** must be 9.

$$\begin{array}{rrr} & 9 & T \\ + & & 9 \\ \hline T & E & E \end{array}$$

The result of the addition must be between 99 (if ***T*** = **0**) and 108 (if ***T*** = **9**).

However, the result cannot be 99, because the question says that different letters represent different digits.

If the result were 99 then ***E*** would be 9, which doesn't work because we've already said that ***A*** is 9.

$$\begin{array}{rrr} & 9 & T \\ + & & 9 \\ \hline T & E & E \end{array}$$

Since the result of the addition cannot be 99, then it must be between 100 (if ***T*** = **1**) and 108 (if ***T*** = **9**).

Therefore, ***T*** must be 1, and ***E*** must be 0.

$$\begin{array}{rrr} & 9 & 1 \\ + & & 9 \\ \hline 1 & E & E \end{array} \qquad \begin{array}{rrr} & 9 & 1 \\ + & & 9 \\ \hline 1 & 0 & 0 \end{array}$$

So ***A*** **= 9**, ***T*** **= 1**, and ***E*** **= 0**.

Method 2: Consider possible values for *T*

For this to occur, ***T*** must be 1, because it's not possible for the result to be much larger than 100.

Note that, while it is possible for ***T*** to be 0, we can assume that it's not 0 because if it were then ***TEE*** would actually be presented as a two-digit number.

$$\begin{array}{rrr} & A & 1 \\ + & & A \\ \hline 1 & E & E \end{array}$$

The 1 in the hundreds place must be the result of regrouping from the tens place.

This means that the total from the tens column must be greater than or equal to 10.

For this to occur, there must have been a carry (regrouping) from the ones place, which means that the total from the ones column is also greater than or equal to 10.

$$\begin{array}{rrr} & A & 1 \\ + & & A \\ \hline 1 & E & E \end{array}$$

Because regrouping must occur from the ones place, the only possible value for ***A*** is 9.

$$\begin{array}{rrr} & 9 & 1 \\ + & & 9 \\ \hline 1 & E & E \end{array}$$

Finally, 91 + 9 = 100.

$$\begin{array}{rrr} & 9 & 1 \\ + & & 9 \\ \hline 1 & 0 & 0 \end{array}$$

Therefore ***A*** **= 9**, ***T*** **= 1**, and ***E*** **= 0**.

Answers

3.1 - Green: *A* = 1, *B* = 9, *C* = 0

3.1 - Orange: 9346

3.1 - Yellow: *A* = 9, *T* = 1, *E* = 0

Maths Games – Example Problem 3.2

Example Problem 3.2 - Green

Each of *AB* and *BA* represents a two-digit number having the same digits, but in reverse order.

If the difference of the two numbers is 18, and *A* + *B* = 4, find both numbers, *AB* and *BA*.

Example Problem 3.2 - Yellow

Each of *AB* and *BA* represents a two-digit number having the same digits, but in reverse order.
If *AB* - *BA* = 54 and *A* + *B* = 10, find both numbers, *AB* and *BA*.

Example Problem 3.2 - Orange

In a four-digit number, the sum of the thousands and hundreds digits is 3.
The tens digit is 4 times the hundreds digit.
The ones digit is seven more than the thousands digit.
No two digits are equal.
What is the four-digit number?

Maths Games Example Solution 3.2 - Yellow

Each of *AB* and *BA* represents a two-digit number having the same digits, but in reverse order.

If *AB* - *BA* = 54 and *A* + *B* = 10, find both numbers, *AB* and *BA*.

Strategy 1: Eliminate All But One Possibility

Let's think about the information we have about these numbers.

- If *AB* – *BA* = 54, then *AB* must be greater than 54.
  So *A* must be greater than or equal to 5.
- If *A* + *B* = 10, then *B* = 10 – *A*.

Let's build a table with the possible values of *AB* and *BA*:

A	*B* (= 10 – *A*)	*AB*	*BA*	*AB* – *BA*
5	5	55	55	0
6	4	64	46	18
7	3	73	37	36
8	2	82	28	54
9	1	91	19	72

We can see that there is only one combination of *A* and *B* where *AB* – *BA* = 54.

So *AB* is **82**, and *BA* is **28**.

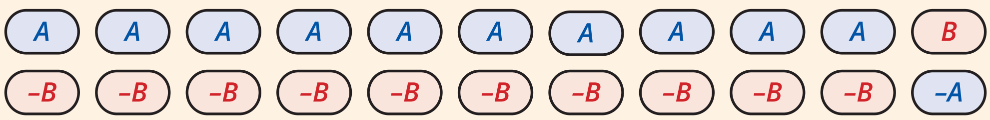
Strategy 2: Reason Logically

The value of the two-digit number *AB* is 10 × *A* + *B*, which is ten *A*s and one *B*.

The value of the two-digit number *BA* is 10 × *B* + *A*, which is ten *B*s and one *A*.

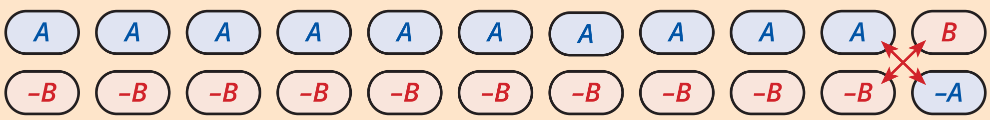
Let's figure out what happens when we subtract *BA* from *AB*.

Starting with ten *A*s and one *B*, we need to subtract ten *B*s and one *A*.

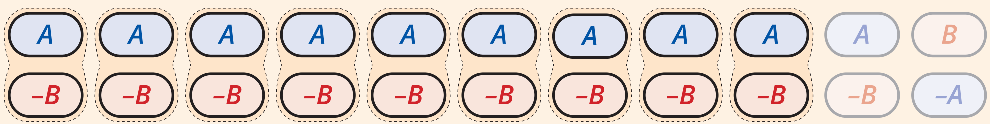


Let's subtract the *A*, and one of the ten *B*s.

We'll still need to subtract nine more *B*s.



The result is the same as nine (*A* – *B*)s.



The value of *AB* – *BA* is the same as 9 × (*A* – *B*).

We can now use this information to find *A* and *B*: →

Since *AB* – *BA* = 54,
9 × (*A* – *B*) = 54
A – *B* = 54 ÷ 9
and so *A* – *B* = 6.

So *A* = *B* + 6.

The question says that
A + *B* = 10.

Let's replace *A* with *B* + 6.

This gives us
B + 6 + *B* = 10.
So *B* + *B* = 4
and *B* = 2.

Since *A* = *B* + 6,
A = 8.

So *AB* is **82**, and *BA* is **28**.

Answers

3.2 - Green: *AB* = 31, *BA* = 13

3.2 - Orange: 2149

3.2 - Yellow: *AB* = 82, *BA* = 28

Maths Games – Example Problem 3.3

Example Problem 3.3 - Green

Pepper, Fuzzy and Socks are competing in a guinea pig race.

Pepper finished after Socks.

Socks finished before Fuzzy.

Which guinea pig came first?

Example Problem 3.3 - Yellow

Pepper, Fuzzy, Socks and Bogart are competing in a guinea pig race.

Pepper didn't come first or last.

Fuzzy finished before Socks, and Bogart finished between Socks and Pepper.

Which guinea pig came third?

Example Problem 3.3 - Orange

Amanda, Beth and Sarah run three races.

In each race, one of them earns 5 points, one of them earns 3 points, and one of them earns 1 point.

After the three races Beth has the highest point total.

What is the smallest total score that Beth can have?

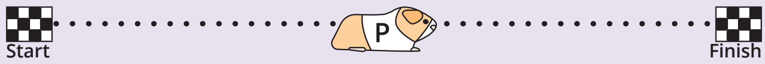
Maths Games Example Solution 3.3 - Yellow

Pepper, Fuzzy, Socks and Bogart are competing in a guinea pig race. Pepper didn't come first or last.

Fuzzy finished before Socks, and Bogart finished between Socks and Pepper. Which guinea pig came third?

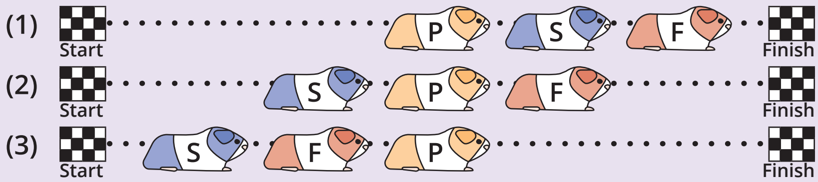
Strategy 1: Eliminate All But One Possibility (1)

Pepper didn't come first or last, so let's put her in the middle somewhere.



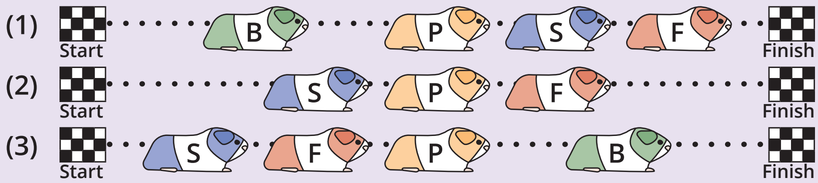
Fuzzy finished before Socks.

Let's draw all of the different possibilities for Pepper, Fuzzy and Socks.

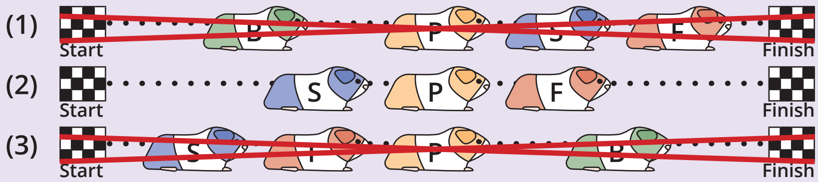


There are scenarios where Pepper is currently coming first or last.

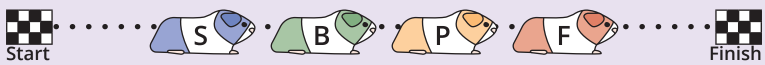
For these scenarios, let's place Bogart on the race track so that Pepper isn't first or last.



Since Bogart finished between Socks and Pepper, neither **(1)** nor **(3)** will work.



We can now put Bogart between Socks and Pepper.



The guinea pig that came third was **Bogart**.

Strategy: Eliminate All But One Possibility (2)

We can start by placing Socks and Fuzzy in the right order.

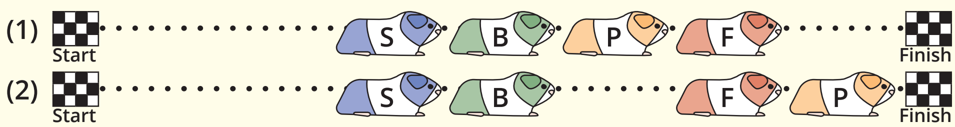
We know that Bogart finished between Socks and Pepper.

Let's try putting Bogart after Socks. Pepper then goes on the other side of Bogart.

However, we know that Pepper didn't come last, so that can't be the right order.

Let's try putting Bogart before Socks.

Again, Pepper goes on the other side of Bogart.



Since Pepper didn't come first, we can eliminate scenario **(2)**. The only remaining possibility is scenario **(1)**.

The guinea pig that came third was **Bogart**.

Answers

3.3 - Green: Socks

3.3 - Orange: 11

3.3 - Yellow: Bogart

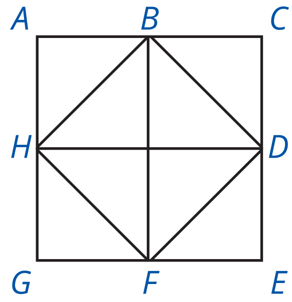
Maths Games – Example Problem 3.4

Example Problem 3.4 - Green

Square *ACEG* is drawn at the right.

Points *B*, *D*, *F*, and *H* are halfway along the sides of the square.

What is the total number of squares of all sizes which can be traced using only the lines drawn?

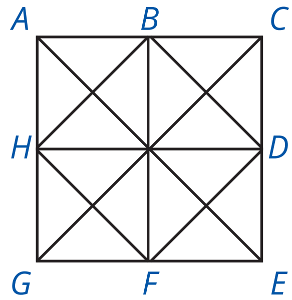


Example Problem 3.4 - Yellow

Square *ACEG* is drawn at the right.

Points *B*, *D*, *F*, and *H* are halfway along the sides of the square.

What is the total number of squares of all sizes which can be traced using only the lines drawn?

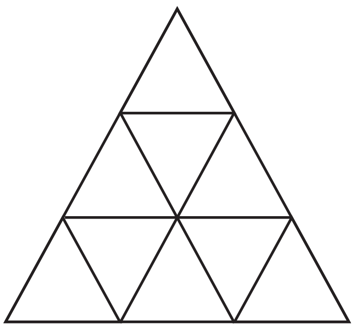


Example Problem 3.4 - Orange

The diagram shows one large triangle.

There are some straight lines drawn between the sides.

How many triangles, of any size, can be traced on the lines in the diagram?

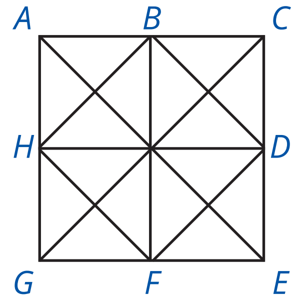


Maths Games Example Solution 3.4 - Yellow

Square *ACEG* is drawn at the right.

Points *B*, *D*, *F*, and *H* are halfway along the sides of the square.

What is the total number of squares of all sizes which can be traced using only the lines drawn?



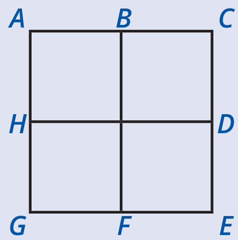
Strategy: Solve a Simpler Related Problem

This picture has a lot of lines. Let's simplify it by taking out some lines.

First let's think about squares where one of the sides is a horizontal (left-right) line.

- Can you use vertical lines in the same square? (Yes)
- Can you use other horizontal lines in the same square? (Yes)
- Can you use slanted lines in the same square? (No)

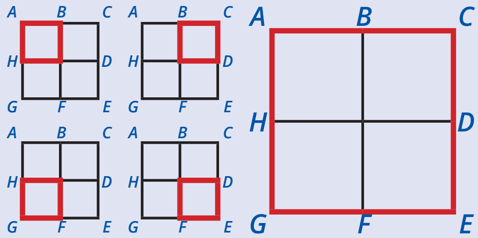
Let's take out the slanted lines for now.



We can now count the squares that are in our simplified diagram.

There's one big square around the outside, and four smaller squares inside.

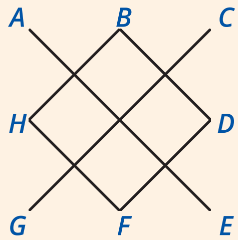
There are **5** horizontal-vertical squares.



Next let's think about squares where one of the sides is a slanted line.

- Can you use vertical lines in the same square? (No)
- Can you use horizontal lines in the same square? (No)

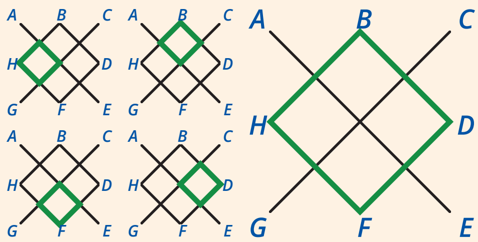
Let's take out the horizontal and vertical lines for now.



We can now count the squares that are in our simplified diagram.

There's one big square around the outside, and four smaller squares inside.

There are **5** slanted squares.



There are **5** horizontal-vertical squares, and **5** slanted squares.

There are **5** + **5** = **10** squares in the diagram.

Answers

3.4 - Green: 6

3.4 - Orange: 13

3.4 - Yellow: 10

Maths Games – Example Problem 3.5

Example Problem 3.5 - Green

The numbers from 1 to 9 can be placed in these boxes so that every row, column and diagonal add up to give the answer 15.

What number goes in the box that looks like this: □ ?

8		4
1		
6	□	

Example Problem 3.5 - Yellow

The numbers from 1 to 9 can be placed in these boxes so that every row, column and diagonal add up to give the answer 15.

What number goes in the box that looks like this: □ ?

	7	
□		1
		8

Example Problem 3.5 - Orange

Each row and column of this square contain all of the numbers 1, 2, 3 and 4, in some order.

What number goes in the box that looks like this: □ ?

2		3	
		2	
			4
	□		

Maths Games Example Solution 3.5 - Yellow

The numbers from 1 to 9 can be placed in these boxes so that every row, column and diagonal add up to give the answer 15.

What number goes in the box that looks like this: ☐ ?

	7	
☐		1
		8

Strategy 1: Eliminate All But One Possibility (1)

We know that all together, the boxes contain each digit from 1 to 9.

We also know that each row, column and diagonal adds up to 15.

Let's fill in any squares we can figure out.

	7	
☐		1
		8

The rightmost column has

☐ + 1 + 8 = 15.

So ☐ + 9 = 15, and ☐ = 6.

	7	6
☐		1
		8

The top row has

☐ + 7 + 6 = 15.

So ☐ + 13 = 15

and ☐ = 2.

2	7	6
☐		1
		8

The diagonal from top left has

2 + ☐ + 8 = 15.

So ☐ + 10 = 15

and ☐ = 5.

2	7	6
☐	5	1
		8

The middle row has

☐ + 5 + 1 = 15.

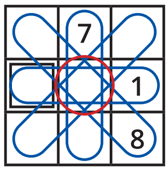
So ☐ + 6 = 15

and ☐ = 9.

2	7	6
9	5	1
		8

So the digit in the ☐ square is a **9**.

Strategy 2: Eliminate All But One Possibility (2)



The square in the centre is included in *one row*, *one column* and *both diagonals*.

So we need four different ways to make **15** using this centre digit, plus two more digits.

Let's find all of the different ways we can make **15** using three different digits:

We can't have, for example, 1 + 2 + 12 because 12 is not a one-digit number.

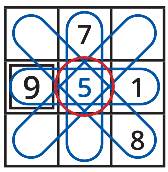
We also can't have 1 + 7 + 7 because the digits are not all different.

1 + 5 + 9	2 + 4 + 9	3 + 4 + 8	4 + 5 + 6
1 + 6 + 8	2 + 5 + 8	3 + 5 + 7	
	2 + 6 + 7		

Looking at these possibilities, we can see that 5 is the only digit that appears four times.

1 + (5) + 9	2 + 4 + 9	3 + 4 + 8	4 + (5) + 6
1 + 6 + 8	2 + (5) + 8	3 + (5) + 7	
	2 + 6 + 7		

So the centre square must be a 5.



Therefore, the middle row has ☐ + 5 + 1 = 15, so, ☐ = 15 – 6.

Since 15 – 6 = 9, the digit in the ☐ square must be **9**.

Answers

3.5 - Green: 7

3.5 - Orange: 3

3.5 - Yellow: 9

Maths Games – Example Problem 3.6

Example Problem 3.6 - Green

There are five students in the book club.

For an end of year celebration, each student brought one book each for everyone else in the club.

How many books were there all together?

Example Problem 3.6 - Yellow

There are ten students in the book club.

For an end of year celebration, each student brought one book each for everyone else in the club.

How many books were there all together?

Example Problem 3.6 - Orange

When two people shake hands with one another, that counts as one "handshake".

Every person in a room shakes hands with each other person in the room exactly once.

There are a total of 15 "handshakes".

How many people are in the room?

Maths Games Example Solution 3.6 - Yellow

There are ten students in the book club.

For an end of year celebration, each student brought one book each for everyone else in the club.

How many books were there all together?

Strategy 1: Solve a Simpler Related Problem

Let's pretend there are only **2** students: Adam and Bella.

Adam would give 1 book to Bella.

Bella would give 1 book to Adam.

In total, there are 1 + 1 = 2 books.

Let's pretend there are **3** students: Adam, Bella and Cam.

Adam would give 1 book to Bella, and 1 book to Cam.

Bella would give 1 book to Adam, and 1 book to Cam.

Cam would give 1 book to Adam, and 1 book to Bella.

In total, there are 2 + 2 + 2 = 6 books.

Is there a pattern?

Adam gives books to everyone but himself.

So, if there are 5 students, then Adam would bring 5 – 1 = 4 books.

Each student does the same thing, so with 5 students, there would be 5 × 4 = 20 books.

With 10 students, each student would bring 10 – 1 = 9 books.

There would be 10 × 9 = **90 books**.

Strategy 2: Build a Table

There are 10 students in the book club.

Let's call them Adam, Bella, Cam, Danny, Evie, Frances, George, Henry, Imogen and Jake.

Adam would give 1 book to each of the other students in the club.

Adam brings a book for	~~*A*~~	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*

Bella would also give 1 book to everyone except herself.

Adam brings a book for	~~*A*~~	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*
Bella brings a book for	*A*	~~*B*~~	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*

The same happens for Cam, Danny, and everyone else.

Our table shows that there would have been 10 × 10 = 100 books if all of the students brought a book for everyone, *including* themselves.

Since none of the students brought books for themselves, the number of books is reduced by 10.

In total, there were 100 – 10 = 90 books.

Adam brings a book for	~~*A*~~	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*
Bella brings a book for	*A*	~~*B*~~	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*
Cam brings a book for	*A*	*B*	~~*C*~~	*D*	*E*	*F*	*G*	*H*	*I*	*J*
Danny brings a book for	*A*	*B*	*C*	~~*D*~~	*E*	*F*	*G*	*H*	*I*	*J*
Evie brings a book for	*A*	*B*	*C*	*D*	~~*E*~~	*F*	*G*	*H*	*I*	*J*
Frances brings a book for	*A*	*B*	*C*	*D*	*E*	~~*F*~~	*G*	*H*	*I*	*J*
George brings a book for	*A*	*B*	*C*	*D*	*E*	*F*	~~*G*~~	*H*	*I*	*J*
Henry brings a book for	*A*	*B*	*C*	*D*	*E*	*F*	*G*	~~*H*~~	*I*	*J*
Imogen brings a book for	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	~~*I*~~	*J*
Jake brings a book for	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	~~*J*~~

Answers

3.6 - Green: 20

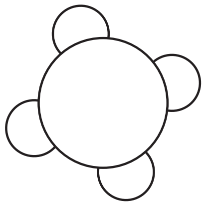
3.6 - Orange: 6

3.6 - Yellow: 90

Maths Games – Example Problem 3.7

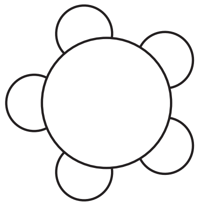
Example Problem 3.7 - Green

Gemma, Harry, Ivy, and Jared are sitting around a round table, facing the centre.
Jared is next to Harry, on Harry's left side.
Ivy is not next to Jared.
Name the two students who are sitting next to Gemma.



Example Problem 3.7 - Yellow

Gemma, Harry, Ivy, Jared and Kelly are sitting around a round table, facing the centre.
Kelly is next to Gemma, on Gemma's right side.
Harry is not next to Kelly or Ivy.
Name the two students who are sitting next to Jared.



Example Problem 3.7 - Orange

Alexis, Emma, and Li play in the school band.
One plays the flute, one plays the saxophone, and one plays the drums.
Alexis is in Year 6.
Alexis and the saxophone player practise together after school.
Emma and the flute player are in Year 5.
Who plays the drums?

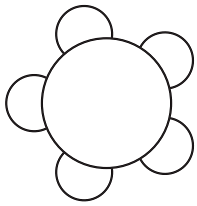
Maths Games Example Solution 3.7 - Yellow

Gemma, Harry, Ivy, Jared and Kelly are sitting around a round table, facing the centre.

Kelly is next to Gemma, on Gemma's right side.

Harry is not next to Kelly or Ivy.

Name the two students who are sitting next to Jared.

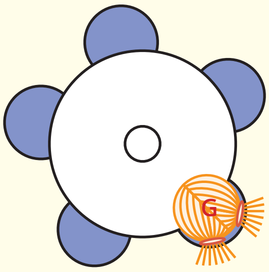


Strategy: Eliminate All But One Possibility

Let's fill in the diagram with the information we have.

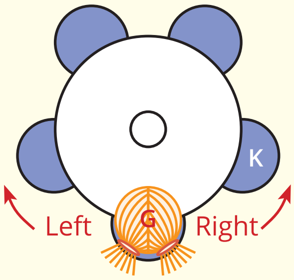
Kelly is on Gemma's right, so let's start by placing Gemma in one of the seats.

We'll draw Gemma with pigtails so that we can imagine her facing the centre.



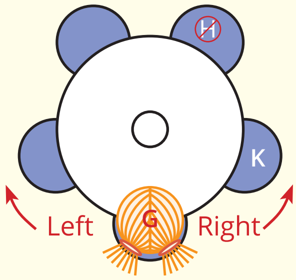
By turning the diagram, we can see which side is Gemma's right.

We'll place Kelly in the seat to the right of Gemma.



Harry is not next to Kelly or Ivy.

We know where Kelly is, so we can eliminate one possible position for Harry.

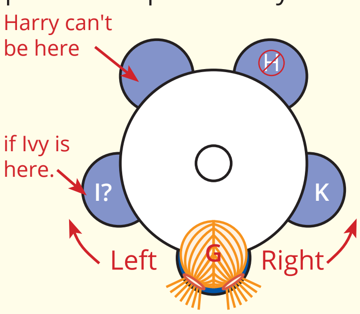


There are 3 possible positions for Ivy. Let's try them all.

Let's suppose that Ivy is on Gemma's left.

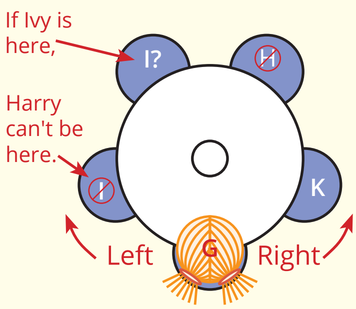
Harry is not next to Ivy.

With Ivy in this position, it's not possible to place Harry.



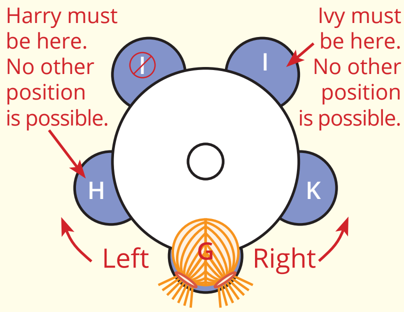
Suppose Ivy is in the next seat along.

Again, it's not possible to place Harry in a seat that is not next to Ivy.



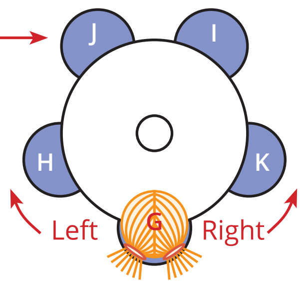
So the last remaining option for Ivy is to place her next to Kelly.

This also works for Harry, since there is one seat left that is not next to Kelly or Ivy.



Jared must be in the last remaining seat.

The students sitting next to Jared must be **Harry** and **Ivy**.



Answers

3.7 - Green: Ivy and Jared

3.7 - Orange: Alexis

3.7 - Yellow: Harry and Ivy

Maths Games – Example Problem 3.8

Example Problem 3.8 - Green

Archie had 4 shots for goal and scored 0 of them.

Charlotte had 6 shots for goal and scored 3 of them.

George had 7 shots for goal and scored 3 of them.

Who had the best scoring rate?

Example Problem 3.8 - Yellow

Archie had 5 shots for goal and scored 3 of them.

Charlotte had 6 shots for goal and scored 4 of them.

George had 7 shots for goal and scored 5 of them.

Louis had 8 shots for goal and scored 5 of them.

Who had the best scoring rate?

Example Problem 3.8 - Orange

A group consisted of 2 girls for every boy.

24 more girls joined the group.

There are now 5 girls for every boy.

How many boys are in the group?

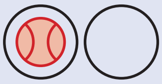
Maths Games Example Problem 3.8 - Solution

Archie had 5 shots for goal and scored 3 of them. Charlotte had 6 shots for goal and scored 4 of them. George had 7 shots for goal and scored 5 of them. Louis had 8 shots for goal and scored 5 of them. Who had the best scoring rate?

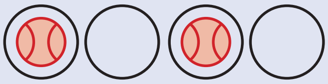
Strategy: Solve a Simpler Related Problem

Let's start by thinking about some simpler scoring rates.

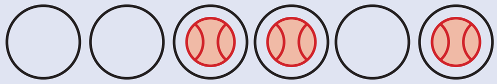
If I had **2** shots for goal and scored **1** of them,



that's the same scoring rate as if I had **4** shots for goal and scored **2** of them,

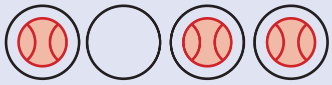


or if I had **6** shots for goal and scored **3** of them.



These three scenarios give scoring rates of $\frac{1}{2}$, $\frac{2}{4}$, and $\frac{3}{6}$, all of which are equivalent.

Next, let's consider a scenario where Sam had **4** shots for goal, and scored **3** of them.



The scoring rate here is higher. $\frac{3}{4}$ is greater than $\frac{2}{4}$. Sam has a better scoring rate than I do.

We can see that Sam's **3** goals out of **4** attempts is better than my **3** goals out of **6** attempts.

- Both *Sam and I scored the same number of goals*, but *Sam got them in fewer attempts*.

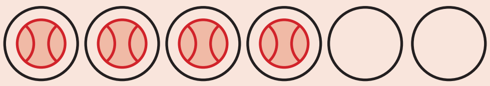
We can also see that Sam's **3** goals out of **4** attempts is better than my **1** goal out of **2** attempts.

- Both *Sam and I missed the same number of goals*, but *Sam had more attempts at goal* (and scored).

Now we can try comparing Archie and Charlotte.

Archie had **5** shots for goal and scored **3** of them.

Charlotte had **6** shots for goal and scored **4** of them.



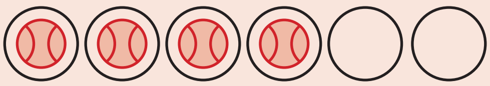
Both Archie and Charlotte *missed the same number of goals*.

- When Sam and I both *missed the same number of goals*, Sam had a better scoring rate, because he had *more attempts at goal* (and scored).

Charlotte had *more attempts at goal* than Archie.

So, Charlotte has a better scoring rate than Archie.

Charlotte had **6** shots for goal and scored **4** of them.



George had **7** shots for goal and scored **5** of them.

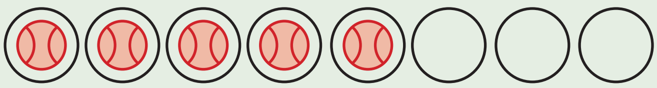
Both Charlotte and George *missed the same number of goals*.

George had *more attempts at goal* than Charlotte.

So, George has a better scoring rate than Charlotte.

George had **7** shots for goal and scored **5** of them.

Louis had **8** shots for goal and scored **5** of them.



Both George and Louis *scored the same number of goals*, but George *got them in fewer attempts* than Louis.

- Sam had a better scoring rate than me, because he *scored the same number of goals in fewer attempts*.

So, George has a better scoring rate than Louis.

Of the four students, **George** has the best scoring rate.

Answers

3.8 - Green: Charlotte

3.8 - Orange: 8

3.8 - Yellow: George

Answers

Set Green

3.1	$A = 1$, $B = 9$, $C = 0$
3.2	$AB = 31$, $BA = 13$
3.3	Socks
3.4	6
3.5	7
3.6	20
3.7	Ivy and Jared
3.8	Charlotte

Set Yellow

3.1	$A = 9$, $T = 1$, $E = 0$
3.2	$AB = 82$, $BA = 28$
3.3	Bogart
3.4	10
3.5	9
3.6	90
3.7	Harry and Ivy
3.8	George

Set Orange

3.1	9346
3.2	2149
3.3	11
3.4	13
3.5	3
3.6	6
3.7	Alexis
3.8	8