2025 Maths Games Senior - Years 7 & 8
Resource Kit 2
Teaching Problem Solving

MATHS GAMES

Problem Solving Strategies

This resource kit focuses on the following problem solving strategies:

1. Work Backwards

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

2. Make an Organised List

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

How students organise the data often reveals additional information.

It follows on from strategies introduced in the preparation resource kit and resource kit 1:

Guess, Check and Refine

Draw a Diagram

Find a Pattern

Build a Table

Resource Kit 2 focuses on:

Work Backwards

Make an Organised List

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.

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

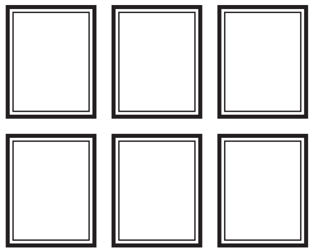
Sometimes it is possible to divide an unusual shape into two or more common shapes that are easier to work with.

Set Yellow

2.1) Emma paid $18 for the materials to make a set of six identical picture frames.

She sold each frame for the same price and made $24 in profit.

How much did she charge for each frame?



2.2) Nellie and her father share the same birthday.

On Nellie's 15th birthday, her father turned 51 years old, so they both used the two birthday candles shown at the right.

How old will Nellie be the next time she and her father will have the digits of their ages reversed?

2.3) A hall is normally set up with 10 rows of seats. Each row has the same number of seats.

For a special performance, the hall needs to be set up with 2 fewer rows, but the same number of seats.

To fit all of the seats in, they will need to add 2 seats to each remaining row.

How many seats are there in the hall?

2.4) A prime number is a number that is only divisible by 1 and itself.

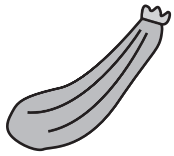
The length and width of a rectangle are both a prime number of centimetres.

The rectangle has a perimeter of 30 centimetres.

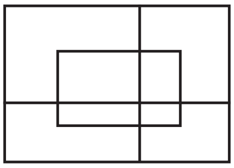
What is the area of the rectangle, in square centimetres?

Set Yellow

2.5) I bought a bag of zucchinis.
All together, the zucchinis weighed 500 grams.
The average weight of a zucchini was 100 grams.
None of the zucchinis weighed less than 80 grams.
What is the greatest possible weight of a single zucchini in this bag?



2.6) In the diagram at the right, all angles are right angles.
How many different rectangles can be traced along the lines in this diagram?
Remember that a square is a kind of rectangle.



2.7) I bought a large box of oranges at the farmers' market.
I gave half of the oranges to my brother, and then I gave him one more.
I gave half of the remaining oranges to my sister, and then I gave her two more.
I gave half of the remaining oranges to my neighbour, and then I gave him three more.
I had just two oranges left.
How many oranges were in the box in the beginning?

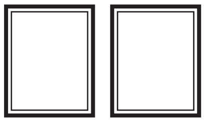
2.8) Six people, *A*, *B*, *C*, *D*, *E* and *F*, participated in a tennis tournament.
Each participant played exactly three games with each of the other participants.
How many games were played in all?

Set Green

2.1) Emma paid $10 for the materials to make two identical picture frames.

She sold each frame for the same price and made $4 in profit.

How much did she charge for each frame?



2.2) Nellie and her father share the same birthday.

Nellie's father is 36 years older than Nellie.

On Nellie’s 15th birthday, her father turned 51 years old, so they both used the two birthday candles shown at the right.

How old will Nellie be the next time she and her father will have the digits of their ages reversed?

2.3) A hall is normally set up with 10 rows of seats. Each row has the same number of seats.

For a special performance, the hall needs to be set up with 1 less row, but the same number of seats.

To fit all of the seats in, they will need to add 1 seat to each remaining row.

How many seats are there in the hall?

2.4) A prime number is a number that is only divisible by 1 and itself.

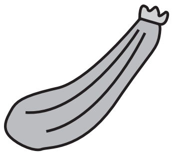
The length and width of a rectangle are both a prime number of centimetres.

The rectangle has a perimeter of 10 centimetres.

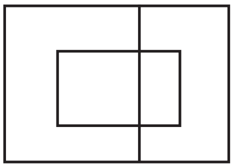
What is the area of the rectangle, in square centimetres?

Set Green

2.5) I bought 5 zucchinis.
All together, the zucchinis weighed 500 grams.
None of the zucchinis weighed less than 80 grams.
What is the greatest possible weight of one of the zucchinis?



2.6) In the diagram at the right, all angles are right angles.
How many different rectangles can be traced along the lines in this diagram?
Remember that a square is a kind of rectangle.



2.7) I bought a box of oranges at the farmers' market.
I gave half of the oranges to my brother, and then I gave him one more.
I gave half of the remaining oranges to my sister, and then I gave her two more.
I had just two oranges left.
How many oranges were in the box in the beginning?

2.8) Four people, *A*, *B*, *C*, and *D*, participated in a tennis tournament.
Each participant played exactly three games with each of the other participants.
How many games were played in all?

Set Orange

2.1) David buys a toy car.

He later sells it to Jessica and loses $3 on the deal.

Jessica makes a profit of $6 by selling it to Bryan for $25.

How much did David pay for the toy car?

2.2) There are four cards on which are written the digits 1, 2, 3, and 4.

$\boxed{1}$ $\boxed{2}$ $\boxed{3}$ $\boxed{4}$

The cards are held up to show scores in a game. For example, the 1 and 2 can be held up to show "12" or "21".

However "11" is not possible as there is only one card with a 1 on it.

How many of these scores are both less than 100 and prime?

2.3) Oliver has a rectangular garden with an area of 28 square metres.

Its length and width are a whole number of metres.

The length of the garden is 3 metres longer than its width.

Oliver places 50 cm × 50 cm tiles together to make a continuous path surrounding the garden, along its edges.

How many tiles does Oliver need?

2.4) There are two rectangles, one blue and one red.

Each rectangle has an area of 91 cm^2.

Both rectangles have lengths and widths that are whole numbers.

The blue rectangle has a greater perimeter than the red rectangle.

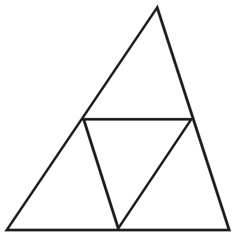
How many more centimetres is the perimeter of the blue rectangle compared to the perimeter of the red rectangle?

Set Orange

2.5) In a bowling competition, Jason's average score was 223 per game for his first 12 games.

How much must Jason average for his next 2 games in order to achieve an average score of 225 for the entire 14 game competition?

2.6) How many four-sided figures can be traced, using only the lines in this picture?



2.7) A piece of string is cut to be 75% of its original length.

Then, the string is again cut to be 75% of the new length, and so on, with each cut making the string 75% of its previous length.

After 22 cuts, the string is 3 cm long.

How long was the string, in centimetres, after 20 cuts?

Express your answer as a fraction in lowest terms.

2.8) A shopkeeper sells house numbers.

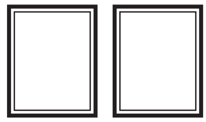
She has a large supply of the numerals 4, 7, and 8, but no other numerals.

How many different three-digit house numbers could be made using only the numerals in her supply?

Maths Games – Example Problem 2.1

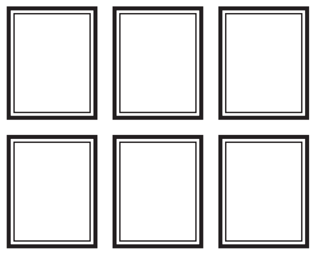
Example Problem 2.1 - Green

Emma paid $10 for the materials to make two identical picture frames.
She sold each frame for the same price and made $4 in profit.
How much did she charge for each frame?



Example Problem 2.1 - Yellow

Emma paid $18 for the materials to make a set of six identical picture frames.
She sold each frame for the same price and made $24 in profit.
How much did she charge for each frame?



Example Problem 2.1 - Orange

David buys a toy car.
He later sells it to Jessica and loses $3 on the deal.
Jessica makes a profit of $6 by selling it to Bryan for $25.
How much did David pay for the toy car?

Maths Games Example Solution 2.1 - Yellow

Emma paid $18 for the materials to make a set of six identical picture frames. She sold each frame for the same price and made $24 in profit. How much did she charge for each frame?

Strategy 1: Work Backwards

Emma set a price for each frame. | She sold 6 frames, so Emma made 6 times the price of one frame. | After subtracting the $18 she paid for materials, | she made $24 in profit.

? Price → Multiply by 6 → ? Price for 6 frames → Subtract $18 → $24 profit

Now, we can work backwards to find the price of one frame.

? Price ← Divide by 6 ← ? Price for 6 frames ← Add $18 ← $24 profit

So the price of one frame must be $42 ÷ 6 = $7. | She made the total of $42 by selling 6 frames. | She ended up with $24 profit after subtracting $18 for the cost of materials. So she must have made a total of $24 + $18 = $42. | Emma made $24 in profit.

Emma must have charged **$7** for each picture frame.

Strategy 2: Find the Cost and Profit for One Frame

Emma paid $18 for all the materials, which is $18 ÷ 6 = $3 for the materials for each frame.

She made $24 in profit, which is $24 ÷ 6 = $4 profit for each frame.

Having paid $3 for materials, in order to make $4 profit, Emma must have sold each frame for $3 + $4 = $7.

Strategy 3: Guess, Check and Refine

Let's guess that Emma charged $10 for each frame.

After selling all six frames for 6 × $10 = $60, she would have made a profit of $60 – $18 = $42.

That's more than the profit Emma actually made.

Price of 1 frame	$10			
Price of 6 frames	$60			
Profit	$42			

Let's guess that Emma charged $5 for each frame.

After selling all six frames for 6 × $5 = $30, she would have made a profit of $30 – $18 = $12.

That's less than the profit Emma actually made.

Price of 1 frame	$10	$5		
Price of 6 frames	$60	$30		
Profit	$42	$12		

Let's guess that Emma charged $7 for each frame.

After selling all six frames for 6 × $7 = $42, she would have made a profit of $42 – $18 = $24.

That matches the question.

Price of 1 frame	$10	$5	$7	
Price of 6 frames	$60	$30	$42	
Profit	$42	$12	$24	

Emma must have charged **$7** for each picture frame.

Answers

2.1 - Green: $7

2.1 - Orange: $22

2.1 - Yellow: $7

Maths Games – Example Problem 2.2

Example Problem 2.2 - Green

Nellie and her father share the same birthday.

Nellie's father is 36 years older than Nellie.

On Nellie's 15th birthday, her father turned 51 years old, so they both used the two birthday candles shown at the right.

How old will Nellie be the next time she and her father will have the digits of their ages reversed?

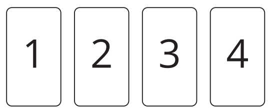
Example Problem 2.2 - Yellow

Nellie and her father share the same birthday.

On Nellie's 15th birthday, her father turned 51 years old, so they both used the two birthday candles shown at the right.

How old will Nellie be the next time she and her father will have the digits of their ages reversed?

Example Problem 2.2 - Orange



There are four cards on which are written the digits 1, 2, 3, and 4.

The cards are held up to show scores in a game. For example, the 1 and 2 can be held up to show "12" or "21".

However "11" is not possible as there is only one card with a 1 on it.

How many of these scores are both less than 100 and prime?

Maths Games Example Solution 2.2 - Yellow

Nellie and her father share the same birthday.

On Nellie’s 15th birthday, her father turned 51 years old, so they both used the two birthday candles shown at the right.

How old will Nellie be the next time she and her father will have the digits of their ages reversed?

Strategy 1: Make an Organised List

When Nellie is **15** years old, her father is **51** years old.

We can continue listing the ages of Nellie and her father for each subsequent year, until the next time they have digits that are reversed.

Nellie's Age	15	16	17	18	19	20	21	22	23	24	25	26	
Father's Age	51	52	53	54	55	56	57	58	59	60	61	62	

Nellie and her father will next have the digits of their ages reversed when Nellie is **26** years old.

Strategy 2: Reason Algebraically, and Make an Organised List

Let's use *A* and *B* to represent the two digits that comprise Nellie's age, so that her age looks like this:

A	*B*

Since the number "*A* *B*" has the value **10***A* + *B*, where *A* and *B* are both single digit numbers, we shall use **10***A* + *B* to represent Nellie's age.

We want to find circumstances when Nellie's father's age would look like this:

B	*A*

representing the value **10***B* + *A*.

We also know that, when Nellie is **15**, her father is **51**, so Nellie's father is **51 – 15 = 36** years older than Nellie.

Therefore:

$$\textit{Nellie's Age} + 36 = \textit{Father's Age}$$

$$10A + B + 36 = 10B + A$$

Subtracting *A* + *B* from both sides:

$$9A + 36 = 9B$$

Dividing both sides by **9**:

$$A + 4 = B$$

We now know that Nellie and her father will have the digits of their ages reversed whenever the tens digit and the ones digit differ by **4**.

Nellie's Age	15	26	37	48	59
Father's Age	51	62	73	84	95

Nellie and her father will next have the digits of their ages reversed, when Nellie is **26** years old.

Strategy 3: Reason Logically, and Check

When Nellie is **15** years old, her father is **51** years old, a difference of **51 – 15 = 36** years.

Suppose we reverse the digits of Nellie's age for the next few years.

Nellie's Age	16	17	18
Reversed Digits	61	71	81
Difference	45	54	63

Clearly, there are no other solutions with an age difference of **36** years, while Nellie is a teenager.

We might, however, have a solution when Nellie is in her 20s.

If Nellie is in her 20s, her father is likely to be in his 60s, so Nellie and her father might be 26 and 62 respectively.

When Nellie is 26, her father would be 26 + 36 = 62 years old.

The reversed digit birthday next occurs when Nellie is **26**.

Answers

2.2 - Green: 26

2.2 - Orange: 7

2.2 - Yellow: 26

Maths Games – Example Problem 2.3

Example Problem 2.3 - Green

A hall is normally set up with 10 rows of seats. Each row has the same number of seats.

For a special performance, the hall needs to be set up with 1 less row.

To fit all of the seats in, they will need to add 1 seat to each remaining row.

How many seats are there in the hall?

Example Problem 2.3 - Yellow

A hall is normally set up with 10 rows of seats. Each row has the same number of seats.

For a special performance, the hall needs to be set up with 2 fewer rows.

To fit all of the seats in, they will need to add 2 seats to each remaining row.

How many seats are there in the hall?

Example Problem 2.3 - Orange

Oliver has a rectangular garden with an area of 28 square metres.

Its length and width are a whole number of metres.

The length of the garden is 3 metres longer than its width.

Oliver places 50 cm × 50 cm tiles together to make a continuous path surrounding the garden, along its edges.

How many tiles does Oliver need?

Maths Games Example Solution 2.3 - Yellow

A hall is normally set up with 10 rows of seats. Each row has the same number of seats.

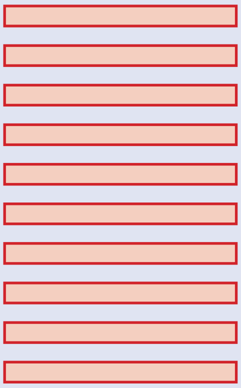
For a special performance, the hall needs to be set up with 2 fewer rows.

To fit all of the seats in, they will need to add 2 seats to each remaining row.

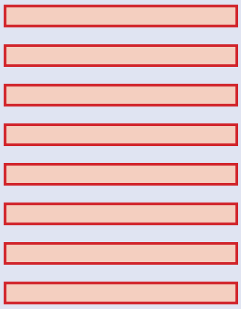
How many seats are there in the hall?

Strategy 1: Work Backwards

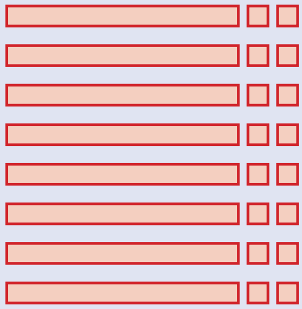
There are normally 10 rows of seats in the hall.



For this performance, we are removing two rows,



and adding two seats on to each of the remaining rows.

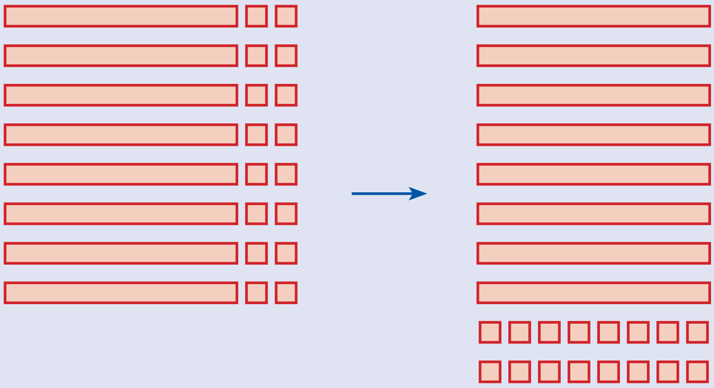


The number of seats in the hall remains the same.

To recreate the normal configuration, we would take those two extra seats on the ends of the rows, and put them back in their original two rows.

We can see that there would originally have been **8** seats in a row.

With **10** rows, the hall contains **10 × 8 = 80** seats.



Strategy 2: Guess, Check and Refine

We could begin by guessing that there are 10 seats in each of 10 rows, for a total of 10 × 10 = 100 seats.

After rearranging, there would be 10 + 2 = 12 seats in each of 10 – 2 = 8 rows, for a total of 12 × 8 = 96 seats.

This does not match, so we'll guess another number.

Normal configuration			Performance configuration		
Rows	Seats / row	Total seats	Rows	Seats / row	Total seats
10	10	10 × 10 = 100	8	10 + 2 = 12	8 × 12 = 96
10	9	10 × 9 = 90	8	9 + 2 = 11	8 × 11 = 88
10	8	10 × 8 = 80	8	8 + 2 = 10	8 × 10 = 80

We can see that the total number of seats is unchanged if the hall normally has 8 seats in each of the 10 rows.

Therefore the hall contains **10 × 8 = 80** seats.

Answers

2.3 - Green: 90

2.3 - Orange: 48

2.3 - Yellow: 80

Maths Games – Example Problem 2.4

Example Problem 2.4 - Green

A prime number is a number that is only divisible by 1 and itself.

The length and width of a rectangle are both a prime number of centimetres.

The rectangle has a perimeter of 10 centimetres.

What is the area of the rectangle, in square centimetres?

Example Problem 2.4 - Yellow

A prime number is a number that is only divisible by 1 and itself.

The length and width of a rectangle are both a prime number of centimetres.

The rectangle has a perimeter of 30 centimetres.

What is the area of the rectangle, in square centimetres?

Example Problem 2.4 - Orange

There are two rectangles, one blue and one red.

Each rectangle has an area of 91 cm^2.

Both rectangles have lengths and widths that are whole numbers.

The blue rectangle has a greater perimeter than the red rectangle.

How many more centimetres is the perimeter of the blue rectangle compared to the perimeter of the red rectangle?

Maths Games Example Solution 2.4 - Yellow

A prime number is a number that is only divisible by 1 and itself.

The length and width of a rectangle are both a prime number of centimetres.

The rectangle has a perimeter of 30 centimetres.

What is the area of the rectangle, in square centimetres?

Strategy 1: Make an Organised List

Since a prime number is only divisible by **1** and itself, it can only be written as a product of two whole numbers if those whole numbers are **1** and itself.

We can use this idea to list all of the prime numbers.

The first prime number is 2, because its only factors are **1** and **2**. Any further multiples of 2 are not prime.

~~ ~~	2	3	~~4~~	5	~~6~~	7	~~8~~	9	~~10~~	11	~~12~~	13	~~14~~	15	~~16~~	17	~~18~~	19	~~20~~	21	~~22~~	23	~~24~~	25	~~26~~	27	~~28~~	29	~~30~~

We can see that the next prime number must be 3. We can now eliminate further multiples of 3.

~~ ~~	2	3	~~4~~	5	~~6~~	7	~~8~~	~~9~~	~~10~~	11	~~12~~	13	~~14~~	~~15~~	~~16~~	17	~~18~~	19	~~20~~	~~21~~	~~22~~	23	~~24~~	25	~~26~~	~~27~~	~~28~~	29	~~30~~

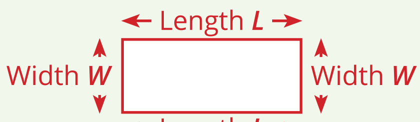
The next prime number must be 5.

~~ ~~	2	3	~~4~~	5	~~6~~	7	~~8~~	~~9~~	~~10~~	11	~~12~~	13	~~14~~	~~15~~	~~16~~	17	~~18~~	19	~~20~~	~~21~~	~~22~~	23	~~24~~	~~25~~	~~26~~	~~27~~	~~28~~	29	~~30~~

Continuing with this method (called Eratosthenes' Sieve), we would find that the prime numbers less than **30** are 2, 3, 5, 7, 11, 13, 17, 19, 23 and 29.

~~ ~~	2	3	~~4~~	5	~~6~~	7	~~8~~	~~9~~	~~10~~	11	~~12~~	13	~~14~~	~~15~~	~~16~~	17	~~18~~	19	~~20~~	~~21~~	~~22~~	23	~~24~~	~~25~~	~~26~~	~~27~~	~~28~~	29	~~30~~

The perimeter of a rectangle is equal to $L + W + L + W$, as shown.



The problem states that the perimeter of the rectangle is **30** cm.

$L + W + L + W = 30$ cm, so

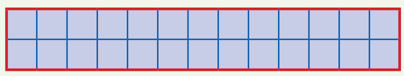
$L + W = 30$ cm $\div 2$

$= 15$ cm.

We can try different prime numbers for the Length L measurement, to see if the Width W is likewise prime.

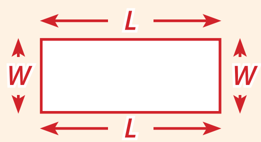
L	$W = 15 - L$	Both prime?
2	15 – 2 = 13	Yes
3	15 – 3 = 12	No
5	15 – 5 = 10	No
7	15 – 7 = 8	No
11	15 – 11 = 4	No
13	15 – 13 = 2	Yes

Since the rectangle is either **2** cm long and **13** cm wide, or **13** cm long and **2** cm wide, its area must be **13** cm × **2** cm = **26** cm^2.



Strategy 2: Use Number Sense

As noted in Method 1, the perimeter of a rectangle is equal to $L + W + L + W$.



Therefore,

$L + W + L + W = 30$ cm

and so $L + W = 15$ cm.

Since **15** is odd, L and W must have different parity (they cannot both be odd, or both even).

2 is the only prime number that is also even, so one of the side lengths must be **2** cm.

The other side length would then be $15 - 2 = 13$ cm.

Therefore, the area of the rectangle must be **2** cm × **13** cm = **26** cm^2.

Answers

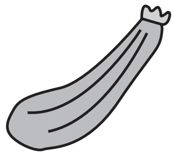
2.4 - Green: 6 (cm^2)

2.4 - Orange: 144 (cm)

2.4 - Yellow: 26 (cm^2)

Maths Games – Example Problem 2.5

Example Problem 2.5 - Green



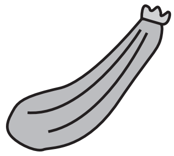
I bought 5 zucchinis.

All together, the zucchinis weighed 500 grams.

None of the zucchinis weighed less than 80 grams.

What is the greatest possible weight of one of the zucchinis?

Example Problem 2.5 - Yellow



I bought a bag of zucchinis.

All together, the zucchinis weighed 500 grams.

The average weight of a zucchini was 100 grams.

None of the zucchinis weighed less than 80 grams.

What is the greatest possible weight of a single zucchini in this bag?

Example Problem 2.5 - Orange

In a bowling competition, Jason's average score was 223 per game for his first 12 games.

How much must Jason average for his next 2 games in order to achieve an average score of 225 for the entire 14 game competition?

Maths Games Example Solution 2.5 - Yellow

I bought a bag of zucchinis. All together, the zucchinis weighed 500 grams.

The average weight of a zucchini was 100 grams. None of the zucchinis weighed less than 80 grams.

What is the greatest possible weight of a single zucchini in this bag?

Strategy 1: Work Backwards

To find the average weight of a zucchini in the bag, we would:

- Find the combined weight of the zucchinis in the bag, then
- Divide the weight by the number of zucchinis.

We know that the combined weight of the zucchinis is **500** grams.

We also know that the average weight of a zucchini is **100** grams.

Therefore, we can construct the following number sentence:

$500 \div \square = 100$

where $\square$ stands for the number of zucchinis.

The number sentence

$500 \div \square = 100$

is equivalent to

$100 \times \square = 500$.

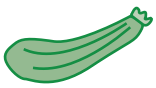
So, $\square$ must be 5.

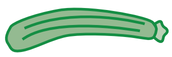
There are 5 zucchinis in the bag.

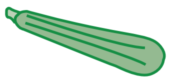
We know that none of the zucchinis weighed less than **80** grams.

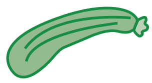
With 5 zucchinis in the bag, it's possible that up to 5 – 1 = 4 of them actually weigh **80** grams each.

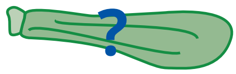
This would give us the greatest possible weight for the fifth zucchini.


80 grams


80 grams


80 grams


80 grams


fifth zucchini

All together, the zucchinis weigh **500** grams.

Therefore, $80 + 80 + 80 + 80 + \square = 500$

$320 + \square = 500$

$\square = 500 - 320$

$\square = 180$

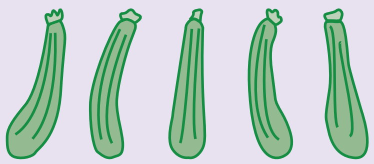
The greatest possible weight of a single zucchini in the bag is **180** grams.

Strategy 2: Work Backwards (Alternative Method)

Since the average weight of a zucchini is 100 grams, we can begin with each zucchini actually weighing 100 grams.

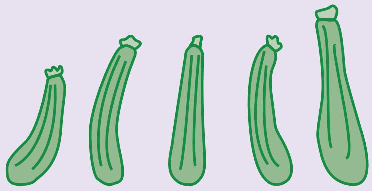
The combined weight of the zucchinis is **500** grams.

Therefore, there would be **500** ÷ 100 = 5 zucchinis.



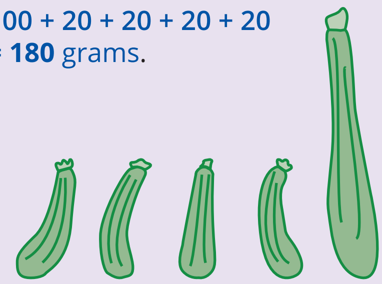
Let's make the first zucchini weigh 80 grams instead of 100 grams.

The remaining **100** – 80 = 20 grams is added to the fifth zucchini, which would then weigh **100** + 20 = 120 grams.



We can repeat this process for the next 3 zucchinis.

The maximum weight we can achieve for the fifth zucchini is then 100 + 20 + 20 + 20 + 20 = **180** grams.



Answers

2.5 - Green: 180 (grams)

2.5 - Orange: 237

2.5 - Yellow: 180 (grams)

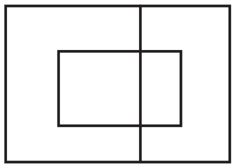
Maths Games – Example Problem 2.6

Example Problem 2.6 - Green

In the diagram at the right, all angles are right angles.

How many different rectangles can be traced along the lines in this diagram?

Remember that a square is a kind of rectangle.

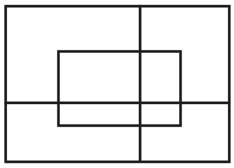


Example Problem 2.6 - Yellow

In the diagram at the right, all angles are right angles.

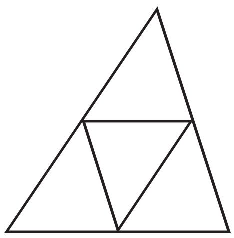
How many different rectangles can be traced along the lines in this diagram?

Remember that a square is a kind of rectangle.



Example Problem 2.6 - Orange

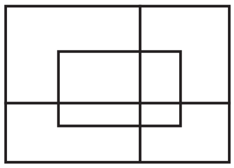
How many four-sided figures can be traced, using only the lines in this picture?



Maths Games Example Solution 2.6 - Yellow

In the diagram at the right, all angles are right angles.

How many different rectangles can be traced along the lines in this diagram?

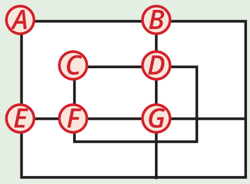


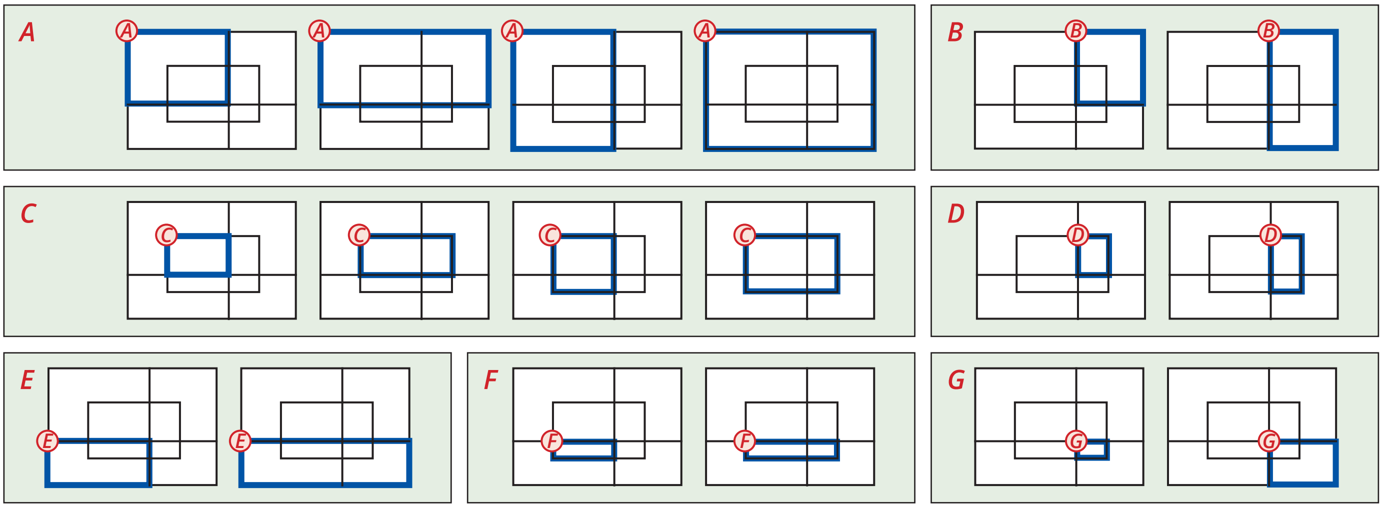
Strategy 1: Make an Organised List

We could begin by marking all of the positions where we might have the top left corner of a rectangle.

Then, we can list all of the possible rectangles with top left corner *A*, *B*, and so on.

Working our way around systematically through all of the different positions, we can be sure that we have found them all.



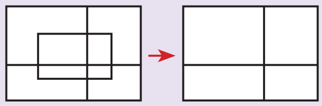


We can trace **18** different rectangles on the lines in this diagram.

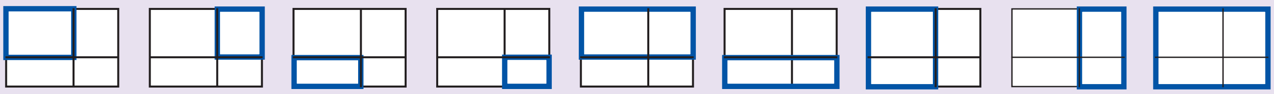
Strategy 2: Solve a Simpler Related Problem

We can make the problem easier to solve by first removing some of the lines in the diagram.

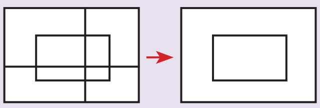
For example, we might begin by removing the inner rectangle.



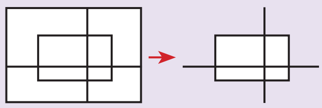
The following 9 rectangles can be traced on the resulting diagram.



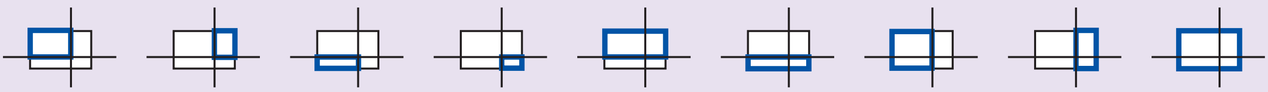
It is impossible for a rectangle to include sides from both the inner and outer rectangles.



However, we can remove the outer rectangle, and trace another 9 rectangles on the resulting diagram.



We can trace **9 + 9 = 18** different rectangles on the lines in this diagram.



Answers

2.6 - Green: 6

2.6 - Orange: 6

2.6 - Yellow: 18

Maths Games – Example Problem 2.7

Example Problem 2.7 - Green

I bought a box of oranges at the farmers' market.

I gave half of the oranges to my brother, and then I gave him one more.

I gave half of the remaining oranges to my sister, and then I gave her two more.

I had just two oranges left.

How many oranges were in the box in the beginning?

Example Problem 2.7 - Yellow

I bought a large box of oranges at the farmers' market.

I gave half of the oranges to my brother, and then I gave him one more.

I gave half of the remaining oranges to my sister, and then I gave her two more.

I gave half of the remaining oranges to my neighbour, and then I gave him three more.

I had just two oranges left.

How many oranges were in the box in the beginning?

Example Problem 2.7 - Orange

A piece of string is cut to be 75% of its original length.

Then, the string is again cut to be 75% of the new length, and so on, with each cut making the string 75% of its previous length.

After 22 cuts, the string is 3 cm long.

How long was the string, in centimetres, after 20 cuts?

Express your answer as a fraction in lowest terms.

Maths Games Example Solution 2.7 - Yellow

I bought a large box of oranges at the farmers' market.

I gave half of the oranges to my brother, and then I gave him one more.

I gave half of the remaining oranges to my sister, and then I gave her two more.

I gave half of the remaining oranges to my neighbour, and then I gave him three more.

I had just two oranges left.

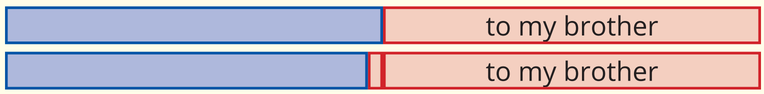
How many oranges were in the box in the beginning?

Strategy: Draw a Diagram, and Work Backwards

Let's use a bar to represent the number of oranges I bought.

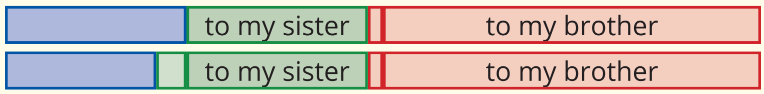
I gave half of them to my brother,

and then I gave him **1** more.



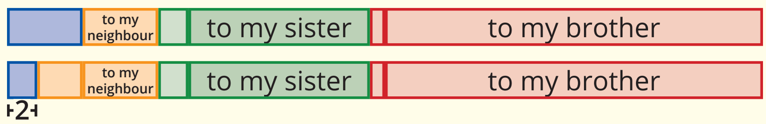
I gave half of what remained to my sister,

and then I gave her **2** more.



I gave half of the remaining oranges to my neighbour, and then I gave him **3** more.

I had just **2** oranges left.



Let's work backwards to see how many oranges I had at the beginning.

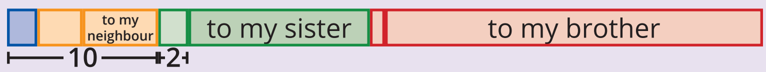
Before I had just **2** oranges left, I gave **3** oranges to my neighbour.

Before that, I gave him half of the oranges I had.

If I gave him half of what I had, then I must have been left with the other half.

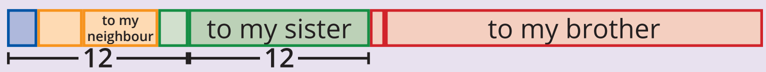
Since I was left with **3** + **2** = **5** oranges,
I must have given him **5** oranges.

I had **5** + **5** = **10** oranges before giving **2** oranges to my sister.

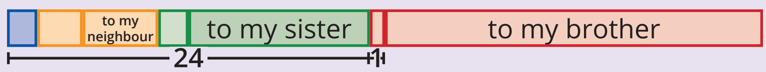


Before that, I gave my sister half of the oranges I had.

Since I was left with **10** + **2** = **12** oranges,
I must have given her **12** oranges.

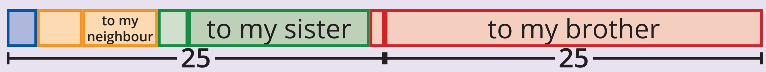


I had **12** + **12** = **24** oranges before giving **1** orange to my brother.

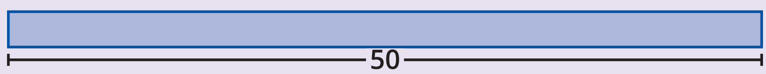


Before that, I gave my brother half of the oranges I had.

Since I was left with **24** + **1** = **25** oranges,
I must have given him **25** oranges.



I must have bought **25** + **25** = **50** oranges at the farmers' market.



Answers **2.7 - Green:** 18 **2.7 - Orange:** $5\frac{1}{3}$ or $\frac{16}{3}$

2.7 - Yellow: 50

Maths Games – Example Problem 2.8

Example Problem 2.8 - Green

Four people, *A*, *B*, *C*, and *D*, participated in a tennis tournament.

Each participant played exactly three games with each of the other participants.

How many games were played in all?

Example Problem 2.8 - Yellow

Six people, *A*, *B*, *C*, *D*, *E* and *F*, participated in a tennis tournament.

Each participant played exactly three games with each of the other participants.

How many games were played in all?

Example Problem 2.8 - Orange

A shopkeeper sells house numbers.

She has a large supply of the numerals 4, 7, and 8, but no other numerals.

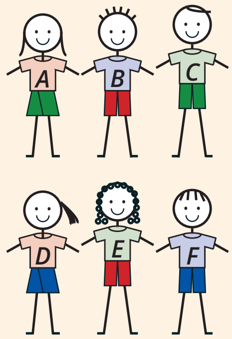
How many different three-digit house numbers could be made using only the numerals in her supply?

Maths Games Example Solution 2.8 - Yellow

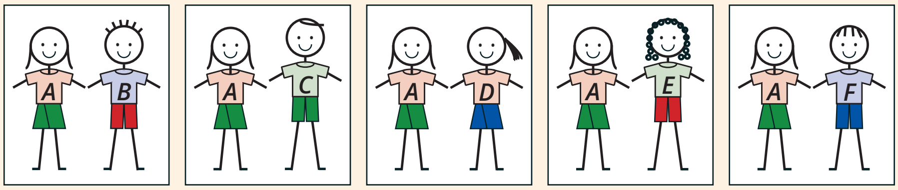
Six people, *A*, *B*, *C*, *D*, *E* and *F*, participated in a tennis tournament. Each participant played exactly three games with each of the other participants. How many games were played in all?

Strategy 1: Make an Organised List

There were six people in the tennis tournament.



Person ***A*** played with each of the other people.



Let's call these games ***AB***, ***AC***, ***AD***, ***AE*** and ***AF***, listing the players alphabetically each time.

By continuing our organised list, we can arrange all of the possible games in the same way.

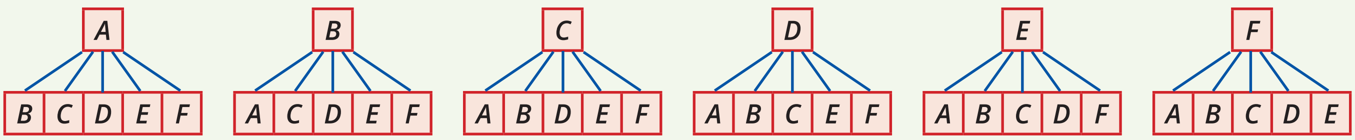
AB	*AC*	*AD*	*AE*	*AF*
	BC	*BD*	*BE*	*BF*
		CD	*CE*	*CF*
			DE	*DF*
				EF

We can see that there are **15** possible player combinations.

Since each pair of players played **3** games, there would have been **3 × 15 = 45** games played in the tournament.

Strategy 2: Draw a Diagram

Let's draw a tree diagram to show all of the possible games.



Each line in this diagram represents a possible game.

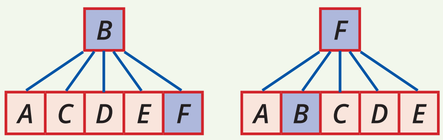
Since each of the **6** participants played **5** other players, there were **6 × 5 = 30** pairings.

However, by doing it this way, we have counted each pair twice.

For example, the game ***BF*** is played by the same players as the game ***FB***.

Since each pair was counted twice, there were only **30 ÷ 2 = 15** pairings.

With each pair playing **3** games, there were **3 × 15 = 45** games played in the tournament.



Strategy 3: Build a Table

If we use a table to list all of the possible pairings, we would need to cross out pairs where a player is playing himself.

	A	*B*	*C*	*D*	*E*	*F*
A	X					
B		X				
C			X			
D				X		
E					X	
F						X

There are **30** possible pairs.

	A	*B*	*C*	*D*	*E*	*F*
A	X	o	o	o	o	o
B	o	X	o	o	o	o
C	o	o	X	o	o	o
D	o	o	o	X	o	o
E	o	o	o	o	X	o
F	o	o	o	o	o	X

As with Strategy 2, each pair occurs twice, so there are actually **30 ÷ 2 = 15** pairings in total.

There were **3 × 15 = 45** games played in the tournament.

	A	*B*	*C*	*D*	*E*	*F*
A	X	o	o	o	o	o
B	~~o~~	X	o	o	o	o
C	~~o~~	~~o~~	X	o	o	o
D	~~o~~	~~o~~	~~o~~	X	o	o
E	~~o~~	~~o~~	~~o~~	~~o~~	X	o
F	~~o~~	~~o~~	~~o~~	~~o~~	~~o~~	X

Answers

2.8 - Green: 18

2.8 - Orange: 27

2.8 - Yellow: 45

Answers

Set Green

2.1	\$7
2.2	26
2.3	90
2.4	6 (cm^2)
2.5	180 (grams)
2.6	6
2.7	18
2.8	18

Set Yellow

2.1	\$7
2.2	26
2.3	80
2.4	26 (cm^2)
2.5	180 (grams)
2.6	18
2.7	50
2.8	45

Set Orange

2.1	\$22
2.2	7
2.3	48
2.4	144 (cm)
2.5	237
2.6	6
2.7	$5\frac{1}{3}$ or $\frac{16}{3}$
2.8	27