2025 Maths Games Senior - Years 7 & 8
Resource Kit 1
Teaching Problem Solving

MATHS GAMES

Problem Solving Strategies

This resource kit follows on from the Preparation Kit and its emphasis on:

Guess, Check and Refine

Draw a Diagram

The problems are sourced from previous Junior (Division J) Maths Olympiads and Maths Games papers.

They introduce two new problem solving strategies:

1. Find a Pattern

One of the most frequently used problem solving strategies is that of recognising and extending a pattern.

Students can often simplify a difficult problem by identifying a pattern in it, and then applying that pattern to the problem situation.

2. Build a Table

A table displays information so that it is easily located and understood, and missing information becomes obvious.

If students are not given the data for a problem, and must generate it themselves, a table is an excellent way to record what they have done so they don't have to repeat their efforts.

A table can also be invaluable for detecting significant patterns.

Resource Kit 1 focuses on:

Find a Pattern

Build a Table

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.

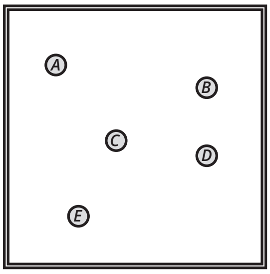
Set Yellow

1.1) When Karl climbed to the top of Mount Everest and then back down again, he spent fifty nights camping on the mountain.

If he started from the base on a Thursday, what day of the week was it when he got back down to the base of the mountain?

1.2) There are five thumb tacks on a noticeboard, as shown in the diagram.

How many different triangles can be made by stretching a rubber band across three of the thumb tacks?



1.3) Jeremy and Kaleb are building a fence around a paddock.

They start at one corner and work around in opposite directions to each other.

Jeremy takes 30 minutes to build one metre of fence.

Kaleb takes 10 minutes to build one metre of fence.

The perimeter of the paddock is 80 metres long.

How many more metres of fence will Kaleb build than Jeremy?

1.4) Sophia has three stickers for every two stickers that Ethan has.

If Sophia gives Ethan 16 of her stickers, then Ethan will have twice as many stickers as Sophia has.

How many stickers do Sophia and Ethan have all together?

Set Yellow

1.5) Mrs Waugh has between 10 and 35 students in her class.
She can put all of her students into groups of 3.
To put everyone into groups of 5, she would need to join one of the groups herself.
How many students are in her class?

1.6) Lamingtons come in boxes of 6, and boxes of 15.
In how many different ways can you buy exactly 96 lamingtons?

1.7) Find the sum of the first 20 multiples of 5:

$$5 + 10 + 15 + \ldots + 100.$$

1.8) Highlighters cost \$1.30 each.
Rulers cost 60c each.
Mr Stewart paid exactly \$10 for some highlighters and rulers for his class.
How many rulers did he buy?

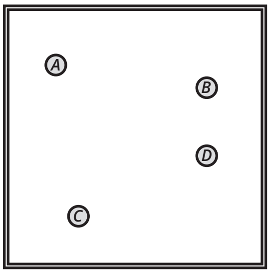
Set Green

1.1) When Patrick climbed to the top of Mount Everest and then back down again, he spent seventy nights camping on the mountain.

If he started from the base on a Thursday, what day of the week was it when he got back down to the base of the mountain?

1.2) There are four thumb tacks on a noticeboard, as shown in the diagram.

How many different lines can be made by stretching a rubber band across two of the thumb tacks?



1.3) Jeremy and Kaleb are building a fence around a paddock.

They start at one corner and work around in opposite directions to each other.

Jeremy takes 20 minutes to build one metre of fence.

Kaleb takes 10 minutes to build one metre of fence.

The perimeter of the paddock is 30 metres long.

How many more metres of fence will Kaleb build than Jeremy?

1.4) Sophia has two stickers for every sticker that Ethan has.

If Sophia gives Ethan 3 of her stickers, then they will each have the same number of stickers.

How many stickers do Sophia and Ethan have all together?

Set Green

1.5) Mrs Waugh has between 10 and 25 students in her class.
She can put all of her students into groups of 3.
To put everyone into groups of 4, she would need to join one of the groups herself.
How many students are in her class?

1.6) Lamingtons come in boxes of 6, and boxes of 15.
In how many different ways can you buy exactly 66 lamingtons?

1.7) Find the sum of the first 10 multiples of 5:

$$5 + 10 + 15 + \ldots + 50.$$

1.8) Pens cost $1.00 each.
Pencils cost 60c each.
Mr Stewart paid exactly $5 for some pens and pencils for his class.
How many pens did he buy?

Set Orange

1.1) Olga has been asked to work for 25 days in a row.

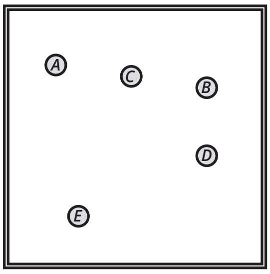
She gets paid more for working on weekends, either Saturday or Sunday, so she wants to include as many of those days as possible.

On what days of the week could Olga start working, in order to maximise the number of weekend days she works?

1.2) There are five thumb tacks on a noticeboard, as shown in the diagram.

Thumb tack "C" sits on a straight line between thumb tacks "A" and "B".

How many different triangles can be made by stretching a rubber band across three of the thumb tacks?



1.3) Karen can paint a wall in 2.5 hours.

Stephanie takes 1.25 hours to paint the same size wall.

How many minutes will it take for Karen and Stephanie working together to paint the same wall?

1.4) Emma has three stickers for every four stickers that Steven has.

Together they have more than 125 stickers, but less than 130 stickers.

How many stickers must Steven give Emma so that they each have the same number of stickers?

Set Orange

1.5) A group of children is trying to share a pile of stickers.
If every child gets two stickers, there will be seven stickers left over.
If two children do not get any stickers, then each of the remaining children will get exactly three stickers.
How many children are in the group?

1.6) Lin has 8 marbles. Each marble weighs either 20 grams or 40 grams or 50 grams.
He has a different number of marbles (at least one) of each weight.
What is the smallest possible total weight of Lin's marbles?

1.7) What is the value of $4321 + 3214 + 2143 + 1432$?

1.8) Asha has 5 more 40c stamps than 30c stamps.
The total value of her 40c stamps is $5.20 more than that of her 30c stamps.
How many of the 40c stamps does Asha have?

Maths Games – Example Problem 1.1

Example Problem 1.1 - Green

When Patrick climbed to the top of Mount Everest and then back down again, he spent seventy nights camping on the mountain.

If he started from the base on a Thursday, what day of the week was it when he got back down to the base of the mountain?

Example Problem 1.1 - Yellow

When Karl climbed to the top of Mount Everest and then back down again, he spent fifty nights camping on the mountain.

If he started from the base on a Thursday, what day of the week was it when he got back down to the base of the mountain?

Example Problem 1.1 - Orange

Olga has been asked to work for 25 days in a row.

She gets paid more for working on weekends, either Saturday or Sunday, so she wants to include as many of those days as possible.

On what days of the week could Olga start working, in order to maximise the number of weekend days she works?

Maths Games Example Solution 1.1 - Yellow

When Karl climbed to the top of Mount Everest and then back down again, he spent fifty nights camping on the mountain.

If he started from the base on a Thursday, what day of the week was it when he got back down to the base of the mountain?

Strategy 1: Build a Table, and Find a Pattern

We can draw a calendar.

Karl starts out on a Thursday, so his first sleep is on a Thursday night.

Let's mark the Thursday, but off towards the right to indicate that it's the night between Thursday and Friday.

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1		

We can keep numbering nights all the way down to **50**, but perhaps it would be easier if we find a pattern.

Since there are seven days in a week, we can use the **7** times table to get close to **50**.

The 49th night was Wednesday night.

The 50th night was Thursday night.

After camping on the 50th night, Karl returned to base on a **Friday**.

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
			21			
			28			
			35			
			42			
			49	50		

Strategy 2: Solve a Simpler Related Problem

Fifty nights isn't a very convenient number of nights to think about.

What would be a convenient number?

How about 7 nights?

Karl starts out on a Thursday.

After 7 nights, it's Thursday again.

After another 7 nights (14 nights in total), it's Thursday again.

⋮

We can keep going like this until we get to 49 nights.

⋮

After 49 nights, it's Thursday again.

After 50 nights, the day of the week is **Friday**.

Number of Nights	Day of Week
7	Thursday
14	Thursday
21	Thursday
28	Thursday
35	Thursday
42	Thursday
49	Thursday
50	Friday

Answers

1.1 - Green: Thursday

1.1 - Orange: Thu, Fri, Sat

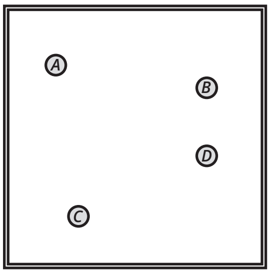
1.1 - Yellow: Friday

Maths Games – Example Problem 1.2

Example Problem 1.2 - Green

There are four thumb tacks on a noticeboard, as shown in the diagram.

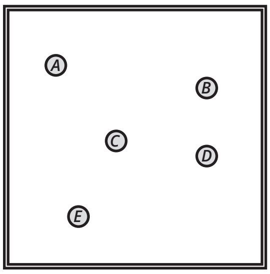
How many different lines can be made by stretching a rubber band across two of the thumb tacks?



Example Problem 1.2 - Yellow

There are five thumb tacks on a noticeboard, as shown in the diagram.

How many different triangles can be made by stretching a rubber band across three of the thumb tacks?

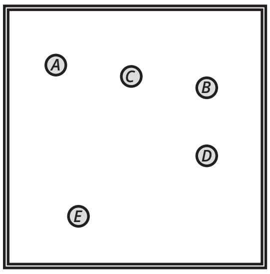


Example Problem 1.2 - Orange

There are five thumb tacks on a noticeboard, as shown in the diagram.

Thumb tack "C" sits on a straight line between thumb tacks "A" and "B".

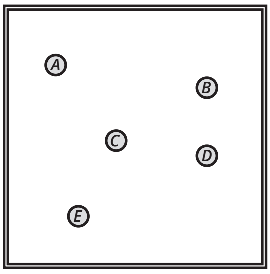
How many different triangles can be made by stretching a rubber band across three of the thumb tacks?



Maths Games Example Solution 1.2 - Yellow

There are five thumb tacks on a noticeboard, as shown in the diagram.

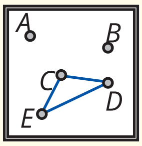
How many different triangles can be made by stretching a rubber band across three of the thumb tacks?



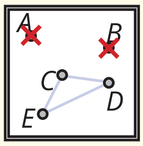
Strategy 1: Build a Table

Since a triangle is formed over **3** thumb tacks, then we can just count the combinations of **5 – 3 = 2** thumb tacks that are *not* in use for each triangle.

For example, instead of listing the triangle ***CDE***, we could just as well say "the triangle that does not include either point ***A*** or point ***B***".



CDE



Not *A*, Not *B*

Using a table, we can see that there are **20** ways to list the **2** points that will *not* be included.

	A	*B*	*C*	*D*	*E*
A	*AA*	*AB*	*AC*	*AD*	*AE*
B	*BA*	*BB*	*BC*	*BD*	*BE*
C	*CA*	*CB*	*CC*	*CD*	*CE*
D	*DA*	*DB*	*DC*	*DD*	*DE*
E	*EA*	*EB*	*EC*	*ED*	*EE*

However, when we list them in this way, each combination is counted twice.

For example, we can see that ***AB*** and ***BA*** are the same combination, but both are included on this list.

So now we need to remove all of the duplicate combinations.

	A	*B*	*C*	*D*	*E*
A	*AA*	*AB*	*AC*	*AD*	*AE*
B	*BA*	*BB*	*BC*	*BD*	*BE*
C	*CA*	*CB*	*CC*	*CD*	*CE*
D	*DA*	*DB*	*DC*	*DD*	*DE*
E	*EA*	*EB*	*EC*	*ED*	*EE*

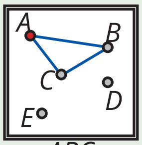
With **20 ÷ 2 = 10** different sets of **2** points, there must be **10** different sets of **3** points.

Since a triangle is defined by **3** points, there must be **10** different triangles.

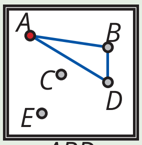
Strategy 2: Make an Organised List

We shall begin by considering triangles that have the first vertex at ***A***.

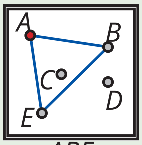
There are three possibilities where the second vertex is at ***B***.



ABC

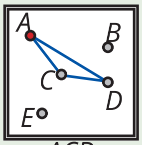


ABD

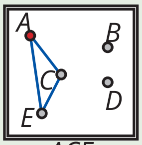


ABE

There are two further triangles where the second vertex is at ***C***,

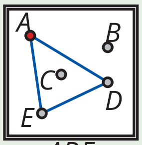


ACD



ACE

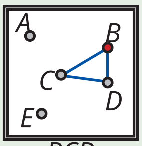
and one where the second vertex is at ***D***.



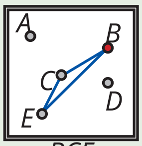
ADE

Next, we'll consider triangles that have the first vertex at ***B***.

There are two possibilities with the second vertex at ***C***,

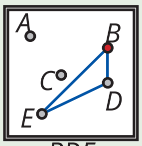


BCD



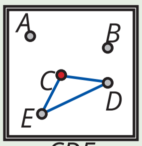
BCE

and one where the second vertex is at ***D***.



BDE

There is one final triangle with the first vertex at ***C***.



CDE

Therefore we can be sure that there are **10** different triangles, because we listed them in an organised way.

Answers

1.2 - Green: 6

1.2 - Orange: 9

1.2 - Yellow: 10

Maths Games – Example Problem 1.3

Example Problem 1.3 - Green

Jeremy and Kaleb are building a fence around a paddock.

They start at one corner and work around in opposite directions to each other.

Jeremy takes 20 minutes to build one metre of fence.

Kaleb takes 10 minutes to build one metre of fence.

The perimeter of the paddock is 30 metres long.

How many more metres of fence will Kaleb build than Jeremy?

Example Problem 1.3 - Yellow

Jeremy and Kaleb are building a fence around a paddock.

They start at one corner and work around in opposite directions to each other.

Jeremy takes 30 minutes to build one metre of fence.

Kaleb takes 10 minutes to build one metre of fence.

The perimeter of the paddock is 80 metres long.

How many more metres of fence will Kaleb build than Jeremy?

Example Problem 1.3 - Orange

Karen can paint a wall in 2.5 hours.

Stephanie takes 1.25 hours to paint the same size wall.

How many minutes will it take for Karen and Stephanie working together to paint the same wall?

Maths Games Example Solution 1.3 - Yellow

Jeremy and Kaleb are building a fence around a paddock.
They start at one corner and work around in opposite directions to each other.
Jeremy takes 30 minutes to build one metre of fence.
Kaleb takes 10 minutes to build one metre of fence.
The perimeter of the paddock is 80 metres long.
How many more metres of fence will Kaleb build than Jeremy?

Strategy 1: Build a Table, and Find a Pattern

Kaleb builds **1** metre of fence every **10** minutes.

Since there are **6 × 10 = 60** minutes in an hour, in one hour Kaleb would build **6** metres of fence.

Fence Length	1 m	1 m 1 m 1 m 1 m 1 m 1 m
Time	10 mins	6 × 10 = 60 mins (= 1 hour)

Jeremy builds **1** metre of fence every **30** minutes.

Since there are **2 × 30 = 60** minutes in an hour, in one hour Jeremy would build **2** metres of fence.

Fence Length	1 m	1 m 1 m
Time	30 mins	2 × 30 = 60 mins (= 1 hour)

Working together, in one hour Kaleb and Jeremy will build **6** metres + **2** metres = **8** metres of fence.

1 m 1 m 1 m 1 m 1 m 1 m 1 m 1 m

If Kaleb and Jeremy build **8** metres of fence in an hour, then in **10** hours they will build **10 × 8 = 80** metres of fence.

80 metres is the amount required to go around the paddock.

Time (hours)	1	2	3	...	10
Kaleb's Fence (m)	6	12	18	...	60
Jeremy's Fence (m)	2	4	6	...	20
Total Fence (m)	8	16	24	...	80

In **10** hours, Kaleb builds **60** metres of fence, and Jeremy builds **20** metres of fence.

So Kaleb would build **60 – 20 = 40** more metres of fence than Jeremy.

Strategy 2: Build a Table, and Find a Pattern (Alternative Method)

Jeremy builds **1** metre of fence in **30** minutes.

Kaleb builds **1** metre of fence in **10** minutes, so in **3 × 10 = 30** minutes he will build **3 × 1 = 3** metres of fence.

Jeremy's Fence (m)	1				
Kaleb's Fence (m)	3				
Total Fence (m)	4				
Difference (m)	2				

When Kaleb and Jeremy build **3 + 1 = 4** metres of fence together, Kaleb ends up building **3 – 1 = 2** metres more than Jeremy.

The difference is **half** of the total amount of fence built so far.

If we continue the table, we can see that the difference continues to be **half** of the total amount of fence built so far.

Why does this pattern occur?

Jeremy's Fence (m)	1	2	3	...	
Kaleb's Fence (m)	3	6	9	...	
Total Fence (m)	4	8	12	...	80
Difference (m)	2	4	6	...	40

When the **80** m fence is complete, Kaleb will have built **80 ÷ 2 = 40** metres more than Jeremy.

Answers

1.3 - Green: 10

1.3 - Orange: 50

1.3 - Yellow: 40

Maths Games – Example Problem 1.4

Example Problem 1.4 - Green

Sophia has two stickers for every sticker that Ethan has.
If Sophia gives Ethan 3 of her stickers, then they will each have the same number of stickers.
How many stickers do Sophia and Ethan have all together?

Example Problem 1.4 - Yellow

Sophia has three stickers for every two stickers that Ethan has.
If Sophia gives Ethan 16 of her stickers, then Ethan will have twice as many stickers as Sophia has.
How many stickers do Sophia and Ethan have all together?

Example Problem 1.4 - Orange

Emma has three stickers for every four stickers that Steven has.
Together they have more than 125 stickers, but less than 130 stickers.
How many stickers must Steven give Emma so that they each have the same number of stickers?

Maths Games Example Solution 1.4 - Yellow

Sophia has three stickers for every two stickers that Ethan has.

If Sophia gives Ethan 16 of her stickers, then Ethan will have twice as many stickers as Sophia has.

How many stickers do Sophia and Ethan have all together?

Strategy: Build a Table, and Find a Pattern

Before giving any stickers to Ethan, Sophia must have a number of stickers that is:

- a multiple of **3**, and
- greater than **16**.

Let's start the table with **18** stickers for Sophia.

Before		After		Final Ratio
Sophia	Ethan	Sophia	Ethan	
18	12	2	28	1:14

This final ratio is quite far off from the one we are trying to reach, of **1:2**.

Let's fill in the next few rows by adding **3** to Sophia's initial number of stickers each time.

This means in the next row Sophia would start with **18 + 3 = 21** stickers.

We can keep adding **3** to Sophia's initial number of stickers until the final ratio is correct.

Before		After		Final Ratio
Sophia	Ethan	Sophia	Ethan	
18	12	2	28	1:14
21	14	5	30	1:6
24	16	8	32	1:4
27	18	11	34	11:34
30	20	14	36	7:18
33	22	17	38	17:38
36	24	20	40	1:2

When Sophia starts with 36 stickers, the final ratio is correct.

Therefore, the total number of stickers that Sophia and Ethan have together is **36 + 24 = 60**.

Strategy: Use Algebra

Suppose Sophia began with $3N$ stickers.

Ethan began with $2N$ stickers.

All together, they had $5N$ stickers.

After the transfer, Ethan has $2N + 16$, and Sophia has $3N - 16$.

Ethan now has twice as many stickers as Sophia.

We can write this as an equation:

$2 \times (3N - 16) = 2N + 16$

Now we can expand and simplify this equation to solve for N.

$$2 \times (3N - 16) = 2N + 16$$
$$6N - 32 = 2N + 16$$
$$4N = 48$$
$$N = 12$$

Therefore, Sophia and Ethan began with **5 × 12 = 60** stickers.

Answers

1.4 - Green: 18

1.4 - Orange: 9

1.4 - Yellow: 60

Maths Games – Example Problem 1.5

Example Problem 1.5 - Green

Mrs Waugh has between 10 and 25 students in her class.

She can put all of her students into groups of 3.

To put everyone into groups of 4, she would need to join one of the groups herself.

How many students are in her class?

Example Problem 1.5 - Yellow

Mrs Waugh has between 10 and 35 students in her class.

She can put all of her students into groups of 3.

To put everyone into groups of 5, she would need to join one of the groups herself.

How many students are in her class?

Example Problem 1.5 - Orange

A group of children is trying to share a pile of stickers.

If every child gets two stickers, there will be seven stickers left over.

If two children do not get any stickers, then each of the remaining children will get exactly three stickers.

How many children are in the group?

Maths Games Example Solution 1.5 - Yellow

Mrs Waugh has between 10 and 35 students in her class.

She can put all of her students into groups of 3.

To put everyone into groups of 5, she would need to join one of the groups herself.

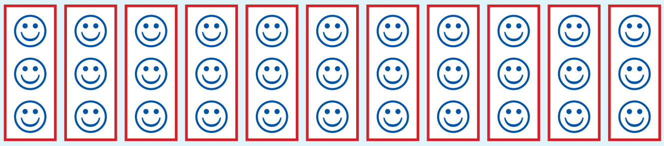
How many students are in her class?

Strategy 1: Draw a Diagram, and Build a Table

Mrs Waugh has between **10** and **35** students.

She can put all of her students into groups of **3**.

Let's draw a diagram showing groups of **3** students.



We can use a table to keep track of the possible numbers of students in Mrs Waugh's class.

Then, we can work out how many people might be in the class if we count Mrs Waugh as well.

Possible class size	12	15	18	21	24	27	30	33
Class including Mrs Waugh	13	16	19	22	25	28	31	34

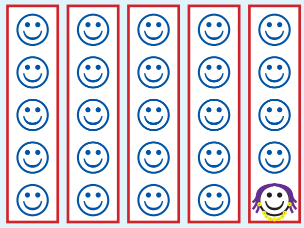
Mrs Waugh can put everyone into groups of **5** if she joins one of the groups herself.

Of all of the possible class sizes, the only one for which this works is the class of **24**.

When Mrs Waugh joins in, there would be **25** people.

This makes five groups of **5**. None of the other options results in a multiple of **5**.

So there must be **24** students in Mrs Waugh's class.



Strategy 2: Build a Table

Let's draw a hundreds chart.

We'll stop short of **100** though, since Mrs Waugh's class only has between **10** and **35** students.

1	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
31	32	33	34	35	36	37	38	39	40

The number of students must be a multiple of **3**, since Mrs Waugh can put all of her students into groups of **3**.

1	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
31	32	33	34	35	36	37	38	39	40

If Mrs Waugh joins a group, the class can form groups of **5**.

This means that the number of students must be one less than a multiple of **5**.

1	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
31	32	33	34	35	36	37	38	39	40

We can see that **24** is both:

- a multiple of **3**, and
- one less than a multiple of **5**.

Mrs Waugh must have **24** students in her class.

1	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
31	32	33	34	35	36	37	38	39	40

Answers

1.5 - Green: 15

1.5 - Orange: 13

1.5 - Yellow: 24

Maths Games – Example Problem 1.6

Example Problem 1.6 - Green

Lamingtons come in boxes of 6, and boxes of 15.
In how many different ways can you buy exactly 66 lamingtons?

Example Problem 1.6 - Yellow

Lamingtons come in boxes of 6, and boxes of 15.
In how many different ways can you buy exactly 96 lamingtons?

Example Problem 1.6 - Orange

Lin has 8 marbles. Each marble weighs either 20 grams or 40 grams or 50 grams.
He has a different number of marbles (at least one) of each weight.
What is the smallest possible total weight of Lin's marbles?

Maths Games Example Solution 1.6 - Yellow

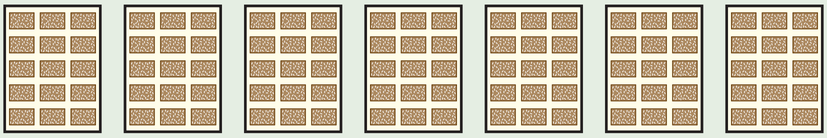
Lamingtons come in boxes of 6, and boxes of 15.

In how many different ways can you buy exactly 96 lamingtons?

Strategy 1: Build a Table

Suppose we just buy boxes that each contain **15** lamingtons.

The quantities of lamingtons we might have are:



15 30 45 60 75 90 **105**, etc.

To end up with exactly **96** lamingtons, we could have:

No. of boxes of **15** lamingtons	0	1	2	3	4	5	6
No. of lamingtons in boxes of **15**	0	15	30	45	60	75	90
Remaining lamingtons, bought in boxes of **6**	96	81	66	51	36	21	6
No. of boxes of **6** lamingtons	16		11		6		1

There are some quantities of "remaining lamingtons", that are not multiples of **6**.

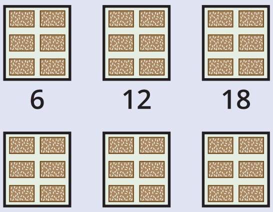
For example, **21** is not a multiple of **6**, and so we cannot buy exactly **21** lamingtons in boxes of **6**.

There are **4** ways to buy exactly **96** lamingtons.

Strategy 2: Find the Lowest Common Multiple of 15 and 6, and Build a Table

From Strategy 1, we can see that **15, 30, 45, 60, 75** and **90** are all multiples of **15**.

Multiples of **6** include:

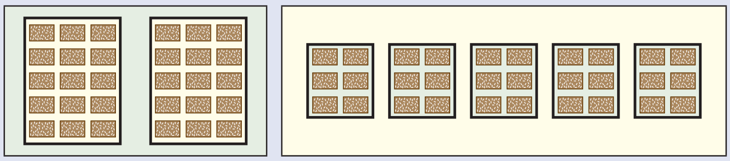


6 12 18

24 30 36, etc.

The lowest common multiple of **15** and **6** is **30**.

There are **2** different ways to buy **30** lamingtons.



To buy **96** lamingtons, we can buy **3 lots of 30**, and then another **6**.

We can now list the **4** different ways to buy exactly **96** lamingtons.

	30	30	30	6
Method 1	5 boxes of 6	5 boxes of 6	5 boxes of 6	1 × 6
Method 2	2 boxes of 15	5 boxes of 6	5 boxes of 6	1 × 6
Method 3	2 boxes of 15	2 boxes of 15	5 boxes of 6	1 × 6
Method 4	2 boxes of 15	2 boxes of 15	2 boxes of 15	1 × 6

Strategy 3: Construct an Algebraic Equation

Let there be x boxes of **15**, and y boxes of **6** lamingtons.

All together, there are **96** lamingtons. $15x + 6y = 96$

Subtract $15x$ from both sides. $6y = 96 - 15x$

Divide both sides by **6**. $y = 16 - \frac{5}{2}x$

For this to work, x must be even, and y must be non-negative.

x	0	2	4	6
y	16	11	6	1

There are **4** possible solutions.

Answers

1.6 - Green: 3

1.6 - Orange: 230 grams

1.6 - Yellow: 4

Maths Games – Example Problem 1.7

Example Problem 1.7 - Green

Find the sum of the first 10 multiples of 5:

$5 + 10 + 15 + \ldots + 50$.

Example Problem 1.7 - Yellow

Find the sum of the first 20 multiples of 5:

$5 + 10 + 15 + \ldots + 100$.

Example Problem 1.7 - Orange

What is the value of $4321 + 3214 + 2143 + 1432$?

Maths Games Example Solution 1.7 - Yellow

Find the sum of the first 20 multiples of 5:

5 + 10 + 15 + ... + 100.

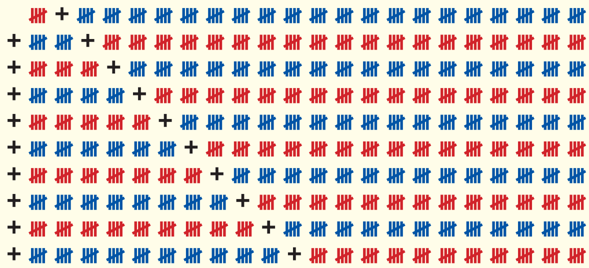
Strategy 1: Find a Pattern

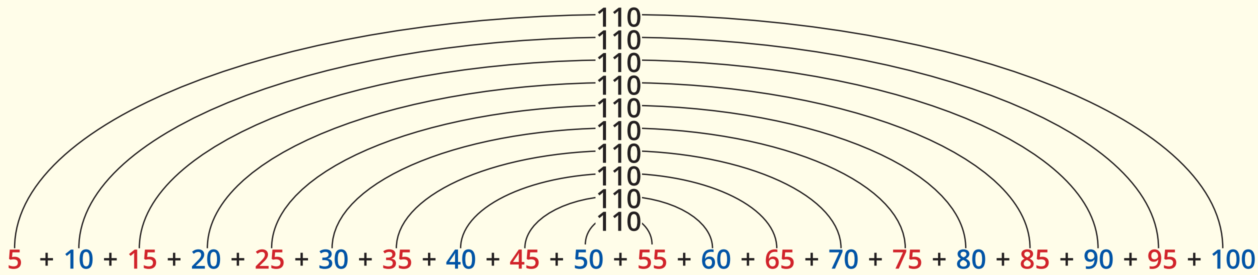
Method 1: Add values from either end.

Adding the smallest value 5, and the largest value 100, gives a sum of **105**.

There are **10** pairs of values that each add up to **105**.

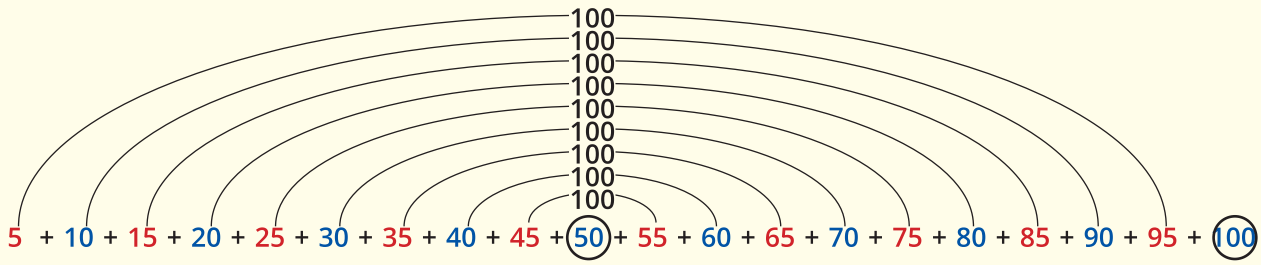
This method can be shown in many ways - for example, as an array, or by using "rainbows".





The sum is therefore 10 × 105 = **1050**.

Method 2: Combine to make multiples of 100.



10 × 100 + 50 = **1050**.

Strategy 2: Convert to a More Convenient Form

We begin by determining that **1 + 2 + 3 + ... + 20 = 210.**

Method 1: 5 + 10 + 15 + ... + 100 is five times the value of **1 + 2 + 3 + ... + 20 = 210.**

5 + 10 + 15 + ... + 100 = 5 × 210 = 1050.

Method 2: 5 + 10 + 15 + ... + 100 is half the value of **10 + 20 + 30 + ... + 200 = 2100.**

5 + 10 + 15 + ... + 100 = 2100 ÷ 2 = 1050.

Answers

1.7 - Green: 275

1.7 - Orange: 11110

1.7 - Yellow: 1050

Maths Games – Example Problem 1.8

Example Problem 1.8 - Green

Pens cost $1.00 each.

Pencils cost 60c each.

Mr Stewart paid exactly $3.80 for some pens and pencils for his class.

How many pens did he buy?

Example Problem 1.8 - Yellow

Highlighters cost $1.30 each.

Rulers cost 60c each.

Mr Stewart paid exactly $10 for some highlighters and rulers for his class.

How many rulers did he buy?

Example Problem 1.8 - Orange

Asha has 5 more 40c stamps than 30c stamps.

The total value of her 40c stamps is $5.20 more than that of her 30c stamps.

How many 40c stamps does Asha have?

Maths Games Example Solution 1.8 - Yellow

Highlighters cost $1.30 each. Rulers cost 60c each.

Mr Stewart paid exactly $10 for some highlighters and rulers for his class.

How many rulers did he buy?

Strategy 1: Build a Table, and Use Number Sense

Highlighters cost **$1.30** each, and rulers cost **60c** each.

Since Mr Stewart bought highlighters and rulers worth a total of **$10**, he could not have bought very many highlighters.

We can build a table listing the amounts Mr Stewart might have spent on highlighters, and the amount of change he would have left over from **$10**.

No. of highlighters	0	1	2	3	4	5	6	7	8
Cost of highlighters	$0.00	$1.30	$2.60	$3.90	$5.20	$6.50	$7.80	$9.10	too high
Change from **$10**	$10.00	$8.70	$7.40	$6.10	$4.80	$3.50	$2.20	$0.90	

Mr Stewart spent all of the change on **60c** rulers.

Since each **60c** ruler can be bought using three **20c** coins, the change must be a multiple of **20c**.

No. of highlighters	0	1	2	3	4	5	6	7	8
Cost of highlighters	$0.00	$1.30	$2.60	$3.90	$5.20	$6.50	$7.80	$9.10	too high
Change from **$10**	$10.00	~~$8.70~~	$7.40	~~$6.10~~	$4.80	~~$3.50~~	$2.20	~~$0.90~~	

Ten **60c** rulers can be bought with **10** × **60c** = **$6**.

Mr Stewart can buy **10** rulers at a time until there is less than **$6** change remaining.

No. of highlighters	0	1	2	3	4	5	6	7	8
Cost of highlighters	$0.00	$1.30	$2.60	$3.90	$5.20	$6.50	$7.80	$9.10	too high
Change from **$10**	$10.00	~~$8.70~~	$7.40	~~$6.10~~	$4.80	~~$3.50~~	$2.20	~~$0.90~~	
After buying sets of **10** rulers	$4.00		$1.40		$4.80		$2.20		

By inspection, we can see that **$4.80** is the only remainder that is a multiple of **60c**.

Mr Stewart must have bought **$4.80 ÷ 60c = 8** rulers.

Strategy 2: Build a Table, and Use Number Sense (Alternate Method)

Suppose we think of a combination with one highlighter and one ruler, costing **$1.30** + **60c** = **$1.90**.

No. of combinations	0	1	2	3	4	5	6
Cost of combinations	$0.00	$1.90	$3.80	$5.70	$7.60	$9.50	too high
Change from **$10**	$10.00	$8.10	$6.20	$4.30	$2.40	$0.50	

By inspection, we can see that **$2.40** is a multiple of **60c**.

It would buy another **$2.40 ÷ 60c = 4** rulers.

Mr Stewart bought **4** highlighter-ruler combinations, plus another **4** rulers, for a total of **4 + 4 = 8** rulers.

Answers

1.8 - Green: 2

1.8 - Orange: 37

1.8 - Yellow: 8

Answers

	Set Green	Set Yellow	Set Orange
1.1	Thursday	Friday	Thu, Fri, Sat
1.2	6	10	9
1.3	10	40	50
1.4	18	60	9
1.5	15	24	13
1.6	3	4	230 grams
1.7	275	1050	11110
1.8	2	8	37