2023 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.

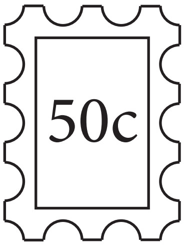
Divide a Complex Shape

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) Admission to the local cinema is $3 for each child and $7 for each adult.
A group of 12 people pay $64 admission.
How many children are in this group?

1.2) Jessie has $5.10 worth of stamps.
She has equal numbers of 50 cent, 20 cent, 10 cent and 5 cent stamps.
She has no other stamps.
How many 50 cent stamps does she have?



1.3) A scientist has labelled a row of plants with numbers from 1 to 40.
He gives extra water to every second plant, starting with plant number 2.
He gives extra fertiliser to every third plant, starting with plant number 3.
He shades every fourth plant, starting with plant number 4.
What is the number of the first plant to receive all three treatments?

1.4) The school canteen offers four sandwich fillings: Cheese, Vegemite, Jam and Salad.
There are three types of bread: White, Brown, and Grain.
You can’t have a sandwich with more than one filling, or more than one type of bread.
How many different kinds of sandwich can you get from the canteen?

Set Yellow

1.5) If it's 2:00 p.m. right now, what time will it be 50 hours from now?
Include a.m. or p.m. in your answer.

1.6) Summer holidays last for 76 days.
During the summer holidays, what is the greatest number of Fridays that could occur?

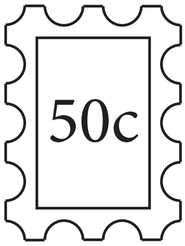
1.7) Rachel left home for school at 7:45 one morning.
She returned home at 4:05 that afternoon.
How many hours and minutes was she gone?
(The number of minutes in your answer must be less than 60.)

1.8) The product of 1 × 3 × 5 × 7 × 9 × ... × 99 is written as a counting number.
What is the last digit of that counting number?

Set Green

1.1) Admission to the local cinema is $3 for each child and $7 for each adult.
A group of 6 people pay $26 admission.
How many children are in this group?

1.2) Jessie has $4.20 worth of stamps.
She has equal numbers of 50 cent and 20 cent stamps.
She has no other stamps.
How many 50 cent stamps does she have?



1.3) A scientist has labelled a row of plants with numbers from 1 to 40.
He gives extra water to every second plant, starting with plant number 2.
He gives extra fertiliser to every third plant, starting with plant number 3.
What is the number of the first plant to receive both treatments?

1.4) The school canteen offers four sandwich fillings: Cheese, Vegemite, Jam and Salad.
There are two types of bread: White and Brown.
You can't have a sandwich with more than one filling, or more than one type of bread.
How many different kinds of sandwich can you get from the canteen?

Set Green

1.5) If it's 2:00 p.m. right now, what time will it be 48 hours from now?
Include a.m. or p.m. in your answer.

1.6) Sam is planning to go on a 16 day trip.
During Sam's trip, what is the greatest number of Fridays that could occur?

1.7) Rachel left home for school at 7:45 one morning.
She returned home at 3:45 that afternoon.
How many hours was she gone?

1.8) The product of $1 \times 3 \times 5 \times 7 \times 9$ is written as a counting number.
What is the last digit of that counting number?

Set Orange

1.1) Josephine purchased some 25c erasers and some 16c pencils for a total of $3.62.
What is the least number of 16c pencils Josephine could have purchased?

1.2) In the USA, they have 25c coins (called quarters), and 10c coins (called dimes).
In how many different ways can you make up $1.95 using just quarters and dimes?

1.3) Two years ago my age was a multiple of 6.
Last year it was a multiple of 5.
I am less than 50 years old.
How old am I now?

1.4) The school canteen offers "snack packs" consisting of a piece of fruit, a muesli bar, and a drink.
There are three types of fruit: apple, banana, or mandarin.
There are two types of muesli bar: chewy or crunchy.
There are two types of drink: orange juice or water.
How many different kinds of "snack pack" can you get from the canteen?

Set Orange

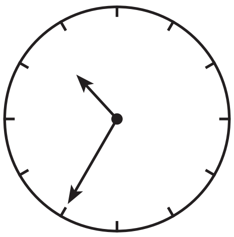
1.5) A standard clock is set correctly at 1:00 p.m.

If it loses 3 minutes every hour, what will the clock show when the correct time is 10:00 a.m. the next day?

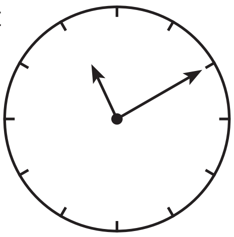
(*Note: the number of minutes in your answer must be less than 60.)*

1.6) What is the greatest number of Mondays that can occur in 45 consecutive days?

1.7) When Soshana looked at her clock, the face looked like this:



How many minutes later will it be when it looks like this?



1.8) Michelle's Number Recycling Machine obeys exactly two rules:

1. *If an inserted number has exactly 1 digit, double the number.*
2. *If an inserted number has exactly 2 digits, compute the sum of the digits.*

The first number Michelle inserts is 1.

Then every answer she gets is inserted back into the machine until fifty numbers are inserted.

What is the fiftieth number to be inserted?

Maths Games – Example Problem 1.1

Example Problem 1.1 - Green

Admission to the local cinema is $3 for each child and $7 for each adult.

A group of 6 people pay $26 admission.

How many children are in this group?

Example Problem 1.1 - Yellow

Admission to the local cinema is $3 for each child and $7 for each adult.

A group of 12 people pay $64 admission.

How many children are in this group?

Example Problem 1.1 - Orange

Josephine purchased some 25c erasers and some 16c pencils for a total of $3.62.

What is the least number of 16c pencils Josephine could have purchased?

Maths Games Example Solution 1.1 - Yellow

Admission to the local cinema is $3 for each child and $7 for each adult.

A group of 12 people pay $64 admission.

How many children are in this group?

Strategy 1: Build a Table, and Find a Pattern

There are **12** people in total.

If all of the people were children, then the total cost for the tickets would be

12 × $3 = $36.

Suppose we exchange child tickets, one at a time, for adult tickets.

We can see that the total cost of the tickets increases by $4 each time we exchange one child ticket for an adult ticket.

By following the pattern, we reach a total price of **$64** when we have **5** child tickets and **7** adult tickets.

Let's check:

5 × $3 = $15.

7 × $7 = $49.

$15 + $49 = $64.

No. of child tickets	No. of adult tickets	Total price	
12	0	12 × $3 + 0 × $7 = $36	+$4
11	1	11 × $3 + 1 × $7 = $40	+$4
10	2	10 × $3 + 2 × $7 = $44	+$4
9	3	9 × $3 + 3 × $7 = $48	+$4
8	4	$52 ?	+$4
7	5	$56 ?	+$4
6	6	$60 ?	+$4
5	7	$64 ?	

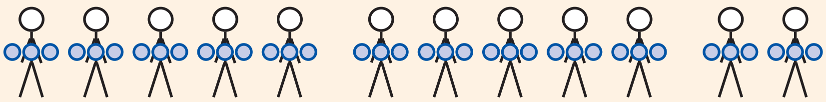
That matches the question, so there were **5** children in this group.

Strategy 2: Draw a Diagram

We have twelve people going to the cinema.

Each person is going to need at least $3 for their ticket.

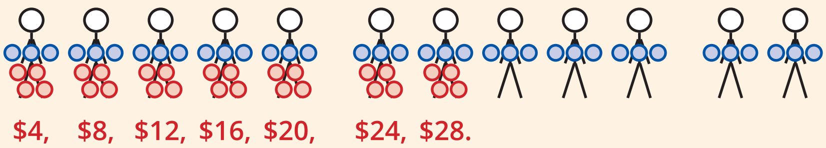
So far, that comes to 12 × $3 = $36.



However, some of the people will need tickets that cost $7.

Each of those people will need an additional $7 – $3 = $4 to be able to buy the $7 ticket.

With **$64** – $36 = $28 remaining, we can distribute $4 each to **7** people.



We now have **12** people who, together, pay **$64** to go to the cinema. That matches the question.

There are **5** children in this group.

Answers

1.1 - Green: 4

1.1 - Orange: 7

1.1 - Yellow: 5

Maths Games – Example Problem 1.2

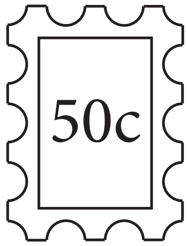
Example Problem 1.2 - Green

Jessie has $4.20 worth of stamps.

She has equal numbers of 50 cent and 20 cent stamps.

She has no other stamps.

How many 50 cent stamps does she have?



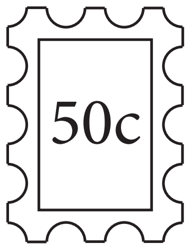
Example Problem 1.2 - Yellow

Jessie has $5.10 worth of stamps.

She has equal numbers of 50 cent, 20 cent, 10 cent and 5 cent stamps.

She has no other stamps.

How many 50 cent stamps does she have?

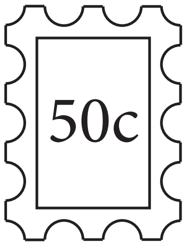


Example Problem 1.2 - Orange

In the USA, they have 25c coins (called quarters), and 10c coins (called dimes).

In how many different ways can you make up $1.95 using just quarters and dimes?

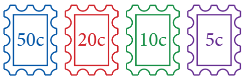
Maths Games Example Solution 1.2 - Yellow

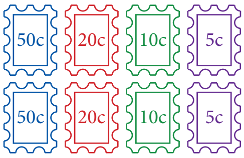


Jessie has $5.10 worth of stamps. She has equal numbers of 50 cent, 20 cent, 10 cent and 5 cent stamps. She has no other stamps. How many 50 cent stamps does she have?

Strategy 1: Build a Table

Jessie has equal numbers of 50 cent, 20 cent, 10 cent and 5 cent stamps.

If she has just one of each stamp, then her collection would look like this:		A stamp collection like this would be worth 50c + 20c + 10c + 5c = 85c.

If she has two of each stamp, then her collection would look like this:		A stamp collection like this would be worth 50c + 20c + 10c + 5c + 50c + 20c + 10c + 5c = $1.70.

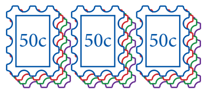
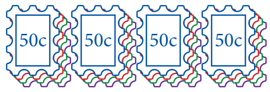
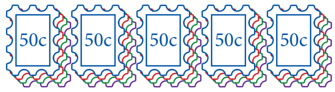
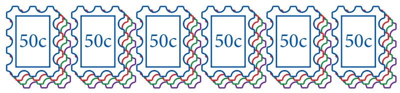
Since Jessie has equal numbers of 50 cent, 20 cent, 10 cent and 5 cent stamps, we can think of a single group of 50 cent, 20 cent, 10 cent and 5 cent stamps as a single "stamp group".

A "stamp group" is valued at
50c + 20c + 10c + 5c = 85c.

So the value of Jessie's collection must be a multiple of **85c**.

Jessie has **$5.10** worth of stamps.

Let's keep adding "stamp groups" until we reach a total of **$5.10** in value.

Number of Stamp Groups		Value of Collection
3		3 × 85c = $2.55
4		4 × 85c = $3.40
5		5 × 85c = $4.25
6		6 × 85c = $5.10

We can see that **six** "stamp groups" would have a value of **$5.10**. Each "stamp group" has **one** 50c stamp in it.

Jessie has **six (6)** 50c stamps.

Strategy 2: Guess, Check and Refine

Jessie has **$5.10** worth of stamps. If she had **ten 50c** stamps, that's already **10 × 50c = $5** worth of value.

This means that Jessie can't have more than **ten 50c** stamps.

Let's guess that Jessie has **eight 50c** stamps. Then Jessie will have **eight 20c**, **eight 10c**, and **eight 5c** stamps. 8 × 50c + 8 × 20c + 8 × 10c + 8 × 5c = $4.00 + $1.60 + 80c + 40c = **$6.80** in value. **$6.80** is more than **$5.10**.	Let's guess that Jessie has **four 50c** stamps. Then Jessie will have **four 20c**, **four 10c**, and **four 5c** stamps. 4 × 50c + 4 × 20c + 4 × 10c + 4 × 5c = $2.00 + 80c + 40c + 20c = **$3.40** in value. **$3.40** is less than **$5.10**.	**Four 50c** stamps is too few, and **eight 50c** stamps is too many. Let's guess **six 50c** stamps. Then Jessie will also have **six 20c**, **six 10c**, and **six 5c** stamps. 6 × 50c + 6 × 20c + 6 × 10c + 6 × 5c = $3.00 + $1.20 + 60c + 30c = **$5.10** in value.

That matches the question, so Jessie has **six (6) 50c** stamps.

Answers

1.2 - Green: 6

1.2 - Orange: 4

1.2 - Yellow: 6

Maths Games – Example Problem 1.3

Example Problem 1.3 - Green

A scientist has labelled a row of plants with numbers from 1 to 40.
He gives extra water to every second plant, starting with plant number 2.
He gives extra fertiliser to every third plant, starting with plant number 3.
What is the number of the first plant to receive both treatments?

Example Problem 1.3 - Yellow

A scientist has labelled a row of plants with numbers from 1 to 40.
He gives extra water to every second plant, starting with plant number 2.
He gives extra fertiliser to every third plant, starting with plant number 3.
He shades every fourth plant, starting with plant number 4.
What is the number of the first plant to receive all three treatments?

Example Problem 1.3 - Orange

Two years ago my age was a multiple of 6.
Last year it was a multiple of 5.
I am less than 50 years old.
How old am I now?

Maths Games Example Solution 1.3 - Yellow

A scientist has labelled a row of plants with numbers from 1 to 40.
He gives extra water to every second plant, starting with plant number 2.
He gives extra fertiliser to every third plant, starting with plant number 3.
He shades every fourth plant, starting with plant number 4.
What is the number of the first plant to receive all three treatments?

Strategy 1: Find a Pattern

We begin by representing all of the plants.

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

Every 2nd plant gets extra water.

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

Every 3rd plant gets extra fertiliser.

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

Every 4th plant gets shaded.

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 we circle every 2nd, 3rd, or 4th plant on the same table, we find that plant numbers **12**, **24** and **36** get circled each time.

The first plant to receive all three treatments is plant number **12**.

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

Strategy 2: Build a Table

If we build a table with 2 plants in each row, then it is easy to mark every 2nd plant for extra watering.

1	2
3	4
5	6
7	8
9	10
11	12
13	14
15	16
17	18

If we build a table with 3 plants in each row, then it is easy to mark every 3rd plant for extra fertiliser.

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

If we build a table with 4 plants in each row, then it is easy to mark every 4th plant for shading.

Every plant in this group also received the extra water that was given to every 2nd plant.

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

The first plant to appear in all three lists is number **12**.

Answers

1.3 - Green: 6

1.3 - Orange: 26

1.3 - Yellow: 12

Maths Games – Example Problem 1.4

Example Problem 1.4 - Green

The school canteen offers four sandwich fillings: Cheese, Vegemite, Jam and Salad.

There are two types of bread: White and Brown.

You can't have a sandwich with more than one filling, or more than one type of bread.

How many different kinds of sandwich can you get from the canteen?

Example Problem 1.4 - Yellow

The school canteen offers four sandwich fillings: Cheese, Vegemite, Jam and Salad.

There are three types of bread: White, Brown, and Grain.

You can't have a sandwich with more than one filling, or more than one type of bread.

How many different kinds of sandwich can you get from the canteen?

Example Problem 1.4 - Orange

The school canteen offers "snack packs" consisting of a piece of fruit, a muesli bar, and a drink.

There are three types of fruit: apple, banana, or mandarin.

There are two types of muesli bar: chewy or crunchy.

There are two types of drink: orange juice or water.

How many different kinds of "snack pack" can you get from the canteen?

Maths Games Example Solution 1.4 - Yellow

The school canteen offers four sandwich fillings: Cheese, Vegemite, Jam and Salad.

There are three types of bread: White, Brown, and Grain.

You can't have a sandwich with more than one filling, or more than one type of bread.

How many different kinds of sandwich can you get from the canteen?

Strategy: Build a Table

We will begin by listing all of the different kinds of white bread sandwich:

- White bread with Cheese
- White bread with Vegemite
- White bread with Jam
- White bread with Salad

If we list them like this, we'll need to do the same thing for all of the types of bread.

White bread with:	Cheese	Vegemite	Jam	Salad
Brown bread with:	Cheese	Vegemite	Jam	Salad
Grain bread with:	Cheese	Vegemite	Jam	Salad

The table can also be represented in a different way.

This saves writing the names of the fillings so many times.

Each space in the table represents a different sandwich.

	Cheese	Vegemite	Jam	Salad
White bread				
Brown bread				
Grain bread				

With three types of bread, and four sandwich fillings, the canteen sells **3** × **4** = **12** different kinds of sandwich.

Maths Games Example Solution 1.4 - Orange

Building on from the sandwich idea, we can start each snack pack with just the fruit and the muesli bar.

	Apple	Banana	Mandarin
Chewy Muesli Bar			
Crunchy Muesli Bar			

We can see that there are **6** types of snack pack so far.

We can now treat each partially completed snack pack as an option in itself, and add the drinks.

	Apple & Chewy	Banana & Chewy	Mandarin & Chewy	Apple & Crunchy	Banana & Crunchy	Mandarin & Crunchy
Orange Juice						
Water						

With three types of fruit, two types of muesli bar, and two different drinks, there are **3** × **2** × **2** = **12** different snack pack combinations.

Answers

1.4 - Green: 8

1.4 - Orange: 12

1.4 - Yellow: 12

Maths Games – Example Problem 1.5

Example Problem 1.5 - Green

If it's 2:00 p.m. right now, what time will it be 48 hours from now?
Include a.m. or p.m. in your answer.

Example Problem 1.5 - Yellow

If it's 2:00 p.m. right now, what time will it be 50 hours from now?
Include a.m. or p.m. in your answer.

Example Problem 1.5 - Orange

A standard clock is set correctly at 1:00 p.m.
If it loses 3 minutes every hour, what will the clock show when the correct time is 10:00 a.m. the next day?
(*Note: the number of minutes in your answer must be less than 60.)*

Maths Games Example Solution 1.5 - Yellow

If it's 2:00 p.m. right now, what time will it be 50 hours from now?

Include a.m. or p.m. in your answer.

Strategy 1: Build a Table, and Find a Pattern

To add 50 hours, we can add 10 hours five times.

	Hours from now	Time
2:00 p.m. + 10 hours = 12 midnight.	10	12:00 a.m.
12:00 a.m. + 10 hours = 10:00 a.m.	20	10:00 a.m.
10:00 a.m. + 10 hours = 20:00, or 8:00 p.m.	30	8:00 p.m.

We may be able to find a pattern here.

To add 10 hours, it is like:

- Going back 2 hours, and then
- Adding 12 hours, which means switching a.m./p.m.

Using this two-step procedure to work what time it is in 50 hours' time:

Time now	2 hours ago	12 hours later	Hours from now
2:00 p.m.	12:00 p.m.	12:00 a.m.	10
12:00 a.m.	10:00 p.m.	10:00 a.m.	20
10:00 a.m.	8:00 a.m.	8:00 p.m.	30
8:00 p.m.	6:00 p.m.	6:00 a.m.	40
6:00 a.m.	4:00 a.m.	4:00 p.m.	50

It will be **4:00 p.m.** in 50 hours' time.

Strategy 2: Solve a Simpler Related Problem

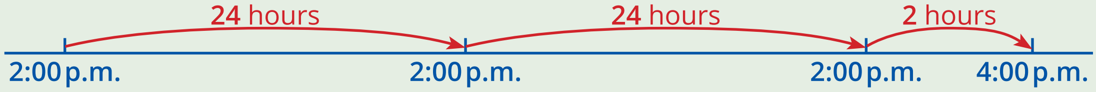
50 hours is not a convenient amount to add. What is an easy number of hours to add?

How about 24 hours? This might be more convenient, because there are 24 hours in a whole day.

If it's 2:00 p.m. now, in 24 hours it will be 2:00 p.m. again.

24 hours after that, it will be 2:00 p.m. again.

2 more hours makes 24 + 24 + 2 = 50 hours in total.



50 hours from now, it will be **4:00 p.m.**

Strategy 3: Convert to a More Convenient Form

We might be able to work this out more easily using 24 hour time.

12 hour time	24 hour time
12:00 p.m.	12:00
1:00 p.m.	13:00
2:00 p.m.	14:00
3:00 p.m.	15:00
4:00 p.m.	16:00

... and so on.

2:00 p.m. is 14:00 in 24 hour time.

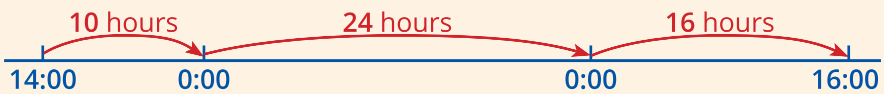
With 24 hours in a day, there are 24 – 14 = 10 hours from 14:00 until the end of Day 1.

24 hours later, it will be the end of Day 2.

This is 10 + 24 = 34 hours after 14:00 on Day 1.

There are 50 – 34 = 16 hours left to go.

16 hours after 0:00 is 16:00.



50 hours after 14:00 the time will be **16:00, or 4:00 p.m.**

Answers

1.5 - Green: 2:00 p.m.

1.5 - Orange: 8:57 a.m.

1.5 - Yellow: 4:00 p.m.

Maths Games – Example Problem 1.6

Example Problem 1.6 - Green

Sam is planning to go on a 16 day trip.

During Sam's trip, what is the greatest number of Fridays that could occur?

Example Problem 1.6 - Yellow

Summer holidays last for 76 days.

During the summer holidays, what is the greatest number of Fridays that could occur?

Example Problem 1.6 - Orange

What is the greatest number of Mondays that can occur in 45 consecutive days?

Maths Games Example Solution 1.6 - Yellow

Summer holidays last for 76 days.

During the summer holidays, what is the greatest number of Fridays that could occur?

Strategy 1: Build a Table, Find a Pattern, and Reason Logically

We don't know what day of the week summer holidays start on.

Let's suppose they start on a **Sunday**.

We can then start numbering the calendar.

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3	4	5	6	7
8	9	10	11	12	13	14

It looks like **Saturdays** are being numbered with multiples of 7.

We can use this to fill out the rest of the calendar more efficiently.

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3	4	5	(6)	7
8	9	10	11	12	(13)	14
					○	21
					○	28
					○	35
					○	42
					○	49
					○	56
					○	63
					○	70
71	72	73	74	75	(76)	

We can see that, if they start on a **Sunday**, there would be **11 Fridays** during the summer holidays.

Let's see if we can get more **Fridays** by starting on a different weekday.

We can remove as many days as possible before the first **Friday**, and add them to the end of the holidays.

Sun	Mon	Tue	Wed	Thu	Fri	Sat
~~1~~	~~2~~	~~3~~	~~4~~	~~5~~	(6)	7
8	9	10	11	12	(13)	14
					○	21
					○	28
					○	35
					○	42
					○	49
					○	56
					○	63
					○	70
71	72	73	74	75	(76)	1
2	3	4	5			

Moving those five days to the end doesn't change the number of **Fridays** in the summer holiday period.

The greatest number of **Fridays** must be **11**.

Strategy 2: Find a Pattern

Suppose summer holiday was a 1-day break.

The greatest number of **Fridays** would then be 1 (if that 1 day happened to be a **Friday**).

To get another **Friday**, we have to add a week - making the holiday at least 1 + 7 = 8 days.

We can keep adding **Fridays** by adding 7 day blocks to the length of the holidays.

To get **11 Fridays**, the holidays would need to be at least 71 days long.

To get **12 Fridays**, the holidays would need to be at least 78 days long.

Since the holidays last for 76 days, there won't be enough days to fit in **12 Fridays**.

The greatest number of **Fridays** will be **11**.

Fridays	Min. Days
1	1
2	8
3	15
:	:
11	71
12	78

Answers

1.6 - Green: 3

1.6 - Orange: 7

1.6 - Yellow: 11

Maths Games – Example Problem 1.7

Example Problem 1.7 - Green

Rachel left home for school at 7:45 one morning.

She returned home at 3:45 that afternoon.

How many hours was she gone?

Example Problem 1.7 - Yellow

Rachel left home for school at 7:45 one morning.

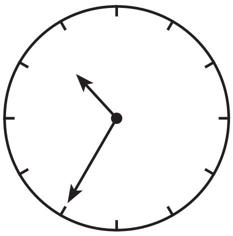
She returned home at 4:05 that afternoon.

How many hours and minutes was she gone?

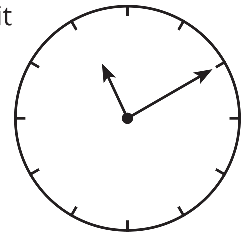
(The number of minutes in your answer must be less than 60.)

Example Problem 1.7 - Orange

When Soshana looked at her clock, the face looked like this:



How many minutes later will it be when it looks like this?



Maths Games Example Solution 1.7 - Yellow

Rachel left home for school at 7:45 one morning.

She returned home at 4:05 that afternoon.

How many hours and minutes was she gone?

Strategy 1: Build a Table

If Rachel left home at 7:45 in the morning, at 8:45 am she would have been gone for 1 hour.

One hour after that, it's 9:45 am, and she has been gone for 2 hours.

We can continue the table until we get close to 4:05 pm.

By 3:45 pm we're getting very close.

Since there are 60 minutes in an hour, and 45 minutes has elapsed since 3 pm, let's add 60 - 45 = 15 minutes to Rachel's time to get to 4 pm.

To get to 4:05 pm we need to add another 5 minutes to Rachel's time.

Therefore Rachel was gone for **8 hours and 20 minutes**.

Time of Day	Rachel was gone for
8:45 am	1 hour
9:45 am	2 hours
10:45 am	3 hours
11:45 am	4 hours
12:45 pm	5 hours
1:45 pm	6 hours
2:45 pm	7 hours
3:45 pm	8 hours
4:00 pm	8 hours 15 minutes
4:05 pm	8 hours 20 minutes

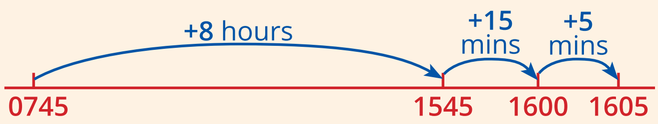
Strategy 2: Convert to a More Convenient Form

4:00 pm is **4** hours after **12:00**. In 24-hour time, **4:00 pm** would be **12 + 4 = 16 o'clock**.

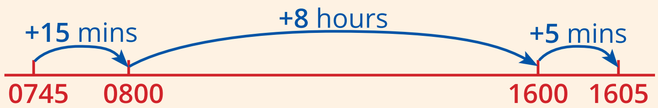
So,
- **7:45 am** is **45** minutes past **7 o'clock** (and we would write it as **0745**, or **0745 h**).
- **4:05 pm** is **5** minutes past **16 o'clock** (and we would write it as **1605**, or **1605 h**).

Option 1: Number Line Representation

We can use a time line to represent Rachel's time away from home.



Rachel was gone for 8 hours + 15 mins + 5 mins
= **8 hours 20 minutes.**



Rachel was gone for 15 mins + 8 hours + 5 mins
= **8 hours 20 minutes.**

Option 2: Subtraction

We can use subtraction with a "written algorithm" to find the difference between the two times.

	Hrs	Mins
	16	5
–	7	45

You can't subtract 45 minutes from 5 minutes.

	Hrs	Mins
	15 ~~16~~	65
–	7	45

Let's take 1 hour from the Hours column, and add 60 minutes to the Minutes column.

	Hrs	Mins
	15 ~~16~~	65
–	7	45
	8	20

65 - 45 mins
= 20 minutes.

15 - 7 hours
= 8 hours.

Rachel was gone for **8 hours 20 minutes**.

Answers

1.7 - Green: 8

1.7 - Orange: 35

1.7 - Yellow: 8 hours 20 minutes

Maths Games – Example Problem 1.8

Example Problem 1.8 - Green

The product of 1 × 3 × 5 × 7 × 9 is written as a counting number.
What is the last digit of that counting number?

Example Problem 1.8 - Yellow

The product of 1 × 3 × 5 × 7 × 9 × … × 99 is written as a counting number.
What is the last digit of that counting number?

Example Problem 1.8 - Orange

Michelle's Number Recycling Machine obeys exactly two rules:

1. *If an inserted number has exactly 1 digit, double the number.*
2. *If an inserted number has exactly 2 digits, compute the sum of the digits.*

The first number Michelle inserts is 1.
Then every answer she gets is inserted back into the machine until fifty numbers are inserted.
What is the fiftieth number to be inserted?

Maths Games Example Solution 1.8 - Yellow

The product of 1 × 3 × 5 × 7 × 9 × ... × 99 is written as a counting number.

What is the last digit of that counting number?

Strategy 1: Find a Pattern

The product of **1 × 3 × 5 × 7 × 9 × ... × 99** must be a really big number.

However, the question is only asking for the last digit.

Let's try to work out the answer. As we do it, we will keep watching to see what happens to the last digit.

Working	1 × 3 = 3	3 × 5 = 15	15 × 7 (carry 3) = 105	105 × 9 (carry 4) = 945	945 × 11 (carry 4): 945 + 9450 = 10395
Product so far	3	15	105	945	10395
Last digit	3	5	5	5	5

The last digit has been 5 for a few results now.

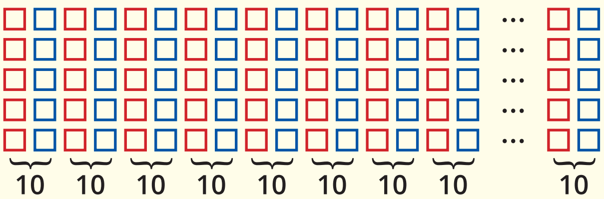
Why might this be the case?

Following the pattern, we can infer that the last digit of the product will be **5**.

Strategy 2: Reason Logically, and Draw a Diagram

It appears that multiplying any number by 5 results in a number that ends in either 5 or 0.

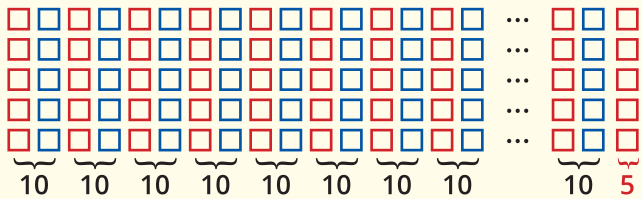
This makes sense because any multiple of 5 can be drawn as an array. The array could be like this:



resulting in a multiple of **10**.

This happens when there are an even number of 5s.

Alternatively, the array could be like this:

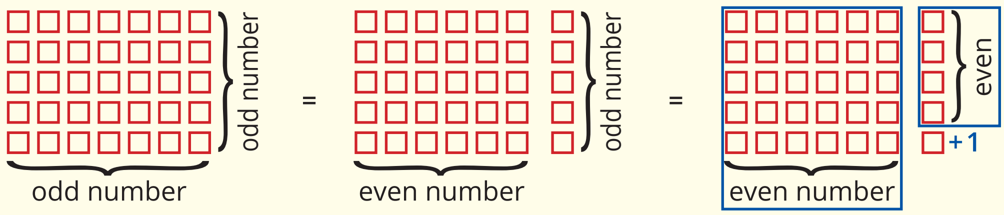


resulting in a multiple of **10**, plus another 5.

This happens when there are an odd number of 5s.

We also know that multiplying two odd numbers always makes an odd number.

We can represent this visually as follows.



1 × 3 × 5 × 7 × 9 × ... × 99 = 5 × (1 × 3 × 7 × 9 × ... × 99).

Since **(1 × 3 × 7 × 9 × ... × 99)** only multiplies odd numbers together, the result must be odd.

An odd multiple of 5 must end in 5.

Therefore the product **1 × 3 × 5 × 7 × 9 × ... × 99** must be a number that ends in **5**.

Answers

1.8 - Green: 5

1.8 - Orange: 16

1.8 - Yellow: 5

Answers

Set Green

1.1	4
1.2	6
1.3	6
1.4	8
1.5	2:00 p.m.
1.6	3
1.7	8
1.8	5

Set Yellow

1.1	5
1.2	6
1.3	12
1.4	12
1.5	4:00 p.m.
1.6	11
1.7	8 hours, 20 minutes
1.8	5

Set Orange

1.1	7
1.2	4
1.3	26
1.4	12
1.5	8:57 a.m.
1.6	7
1.7	35
1.8	16