2026 Maths Games Senior - Years 7 & 8
Resource Kit 1
Teaching Problem Solving

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

Problems with fully worked solutions.

Set Green

Problems similar to Set Yellow, but with fewer difficult elements.

Preparation Tasks

Tasks designed to encourage discussion and collaboration in problem solving.

Set Orange

More challenging problems to extend students.

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

How to use these problems

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

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

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

Preparation Kit

Guess, Check and Refine

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

Draw a Diagram

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

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

Resource Kit 1

Find a Pattern

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

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

Build a Table

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

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

Resource Kit 2

Work Backwards

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

Make an Organised List

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

How students organise the data often reveals additional information.

Resource Kit 3

Solve a Simpler Related Problem

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

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

Eliminate All But One Possibility

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

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

Resource Kit 4

Convert to a More Convenient Form

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

Divide a Complex Shape

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

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Set Yellow

1.1) 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 ?

1.2) Water bottles come in two sizes, small (150 mL) and large (250 mL).
I have ten bottles, which can hold a total of 2.2 litres of water.
How many small bottles do I have?

1.3) Casey plays hockey every third Saturday morning.
He plays basketball every second Saturday afternoon.
The next date on which Casey will play both sports is May 25 (25th of May).
What was the date the last time Casey played both sports on the same day?

1.4) Nat and Scott want to buy a particular jigsaw puzzle.
Nat needs another $18 before she can afford the puzzle on her own.
Scott needs another $10 before he can afford the puzzle on his own.
If they combine their money, they still cannot afford to buy the puzzle.
The puzzle costs a whole number of dollars.
What is the most that the puzzle could cost?

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Set Yellow

1.5) 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.

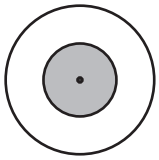
What is the fiftieth number to be inserted?

1.6) At a cafeteria, you have a choice of:

- either onion soup or pea soup for the starter, then
- a choice of meat, fish or vegetarian for the main course, and
- ice cream or cake for dessert.

How many choices do you have for your complete meal, including a starter, a main course and a dessert?

1.7) Kris and Asher are throwing darts at a target.



Kris landed two darts in the outer ring and two darts in the inner ring.
He scored 20 points.

Asher landed one dart in the outer ring and three darts in the inner ring.
He scored 24 points.

How many points are given for a dart landing in the inner ring?

1.8) The whole numbers from 100 down to 0 are arranged in columns *P*, *Q*, *R*, *S*, and *T* as indicated.

Write the letter of the column that contains the number 25.

P	*Q*	*R*	*S*	*T*
	100	99	98	97
93	94	95	96	
	92	91	90	89
85	86	87	88	
	84	83	82	81
77	78	79	80	

and so on ...

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Set Green

1.1) 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?

1.2) Paper cups come in two sizes, small (100 mL) and large (200 mL).
I have ten cups, which can hold a total of 1.6 litres of water.
How many small cups do I have?

1.3) Casey plays hockey every third Saturday morning.
He plays basketball every second Saturday afternoon.
The next date on which Casey will play both sports is May 25 (25th of May).
What would be the first date after May 25 when Casey will play both sports?

1.4) Kat and Matt want to buy a particular board game.
Kat needs another $3 before she can afford the board game on her own.
Matt needs another $7 before he can afford the board game on his own.
If they combine their money, they have just enough to afford the board game.
How much does the board game cost?

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Set Green

1.5) Harry's Number Recycling Machine obeys exactly two rules:

If the inserted number has just 1 digit, double the number and print out the result.
Otherwise, if the inserted number has 2 digits, remove the tens digit and print out the result.

The first number Harry inserts is 2.

Then every answer he gets is inserted back into the machine until twenty numbers are inserted.

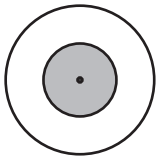
What is the twentieth number to be inserted?

1.6) At a cafeteria, you have a choice of:

- either onion soup or pea soup for the starter, then
- a choice of meat, fish or vegetarian for the main course.

How many choices do you have for your complete meal, including a starter and a main course?

1.7) Kris and Asher are throwing darts at a target.



Kris landed one dart in the outer ring and one dart in the inner ring.
He scored 10 points.

Asher landed two darts in the outer ring.
He scored 6 points.

How many points are given for a dart landing in the inner ring?

1.8) The whole numbers from 100 down to 0 are arranged in columns *Q*, *R*, *S*, and *T* as indicated.

Write the letter of the column that contains the number 25.

Q	*R*	*S*	*T*
100	99	98	97
96	95	94	93
92	91	90	89
88	87	86	85
84	83	82	81
80	79	78	77

and so on ...

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Set Orange

1.1) 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?

1.2) Water bottles come in two sizes, small (150 mL) and large (250 mL).
Shane has twenty bottles, which can hold a total of 3.1 litres of water.
How many small bottles does Shane have?

1.3) Justin plays hockey every third Saturday morning.
He plays basketball every second Saturday afternoon.
He visits his grandparents every fourth Saturday evening.
The next date on which Justin will do all three activities is May 25 (25th of May).
What was the date the last time Justin did all three activities?

1.4) Mara and Tara each have some pencils.
If Mara gives four pencils to Tara, they will have the same number of pencils.
If Tara gives two pencils to Mara, Mara will have 3 times as many pencils as Tara.
How many pencils does Mara have?

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Set Orange

1.5) Harry is playing with Michelle's Number Recycling Machine, which 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 Harry inserts is 3.

Then every answer he gets is inserted back into the machine until a hundred numbers are inserted.

What is the one-hundredth number to be inserted?

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

There are four choices of fruit: apple, banana, mandarin or pear.

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

There are three choices of drink: orange juice, milk or water.

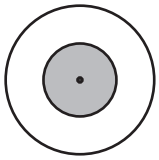
How many different kinds of "snack pack" can you get from the canteen?

1.7) Hitting the inner circle of a target scores 5 points.

Hitting the outer circle scores 3 points.

I scored a total of 26 points after 7 attempts.

How many times did I miss the target completely?



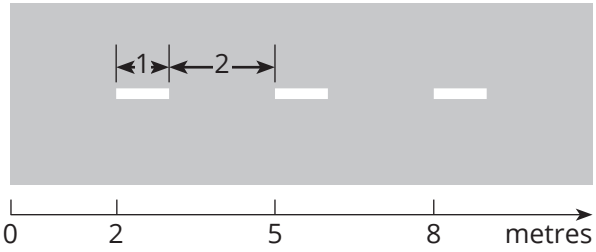
1.8) A council worker is painting a broken white line down the middle of a path.

He starts by measuring a two metre gap.

Then, he paints one metre and leaves another gap of two metres.

He keeps painting like this until he gets to the end of the path.

If the path is 62 metres long, how many one metre lines does he paint?



Maths Games - Example Problem 1.1

Example Problem 1.1 - 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 1.1 - 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 1.1 - 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?

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Maths Games Example Solution 1.1 - 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: Build a Table

Let's build a table to represent 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 (Alternative Approach)

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

... etc

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

... etc

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

... etc

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

Answers

1.1 - Green: 6

1.1 - Orange: 26

1.1 - Yellow: 12

Maths Games - Example Problem 1.2

Example Problem 1.2 - Green

Paper cups come in two sizes, small (100 mL) and large (200 mL).
I have ten cups, which can hold a total of 1.6 litres of water.
How many small cups do I have?

Example Problem 1.2 - Yellow

Water bottles come in two sizes, small (150 mL) and large (250 mL).
I have ten bottles, which can hold a total of 2.2 litres of water.
How many small bottles do I have?

Example Problem 1.2 - Orange

Water bottles come in two sizes, small (150 mL) and large (250 mL).
Shane has twenty bottles, which can hold a total of 3.1 litres of water.
How many small bottles does Shane have?

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Maths Games Example Solution 1.2 - Yellow

Water bottles come in two sizes, small (150 mL) and large (250 mL).

I have ten bottles, which can hold a total of 2.2 litres of water.

How many small bottles do I have?

In the question, the capacity of a water bottle is stated in millilitres, but the total amount of water is given in litres.

To avoid confusion, we will convert the total amount of water into a quantity measured in millilitres.

In total, the bottles have a capacity of **2200** mL.

Litres	Millilitres
1	1000
2	2000
2.2	2200

Strategy 1: Build a Table, and Find a Pattern

Small bottles hold **150** mL.

If all **10** bottles were small, then the total capacity would be **10 × 150** mL **= 1500** mL.

Small bottles	10				
Large bottles	0				
Total water (mL)	1500				

With **9** small and **1** large bottle, the total capacity would be **9 × 150 + 1 × 250 = 1600** mL.

With **8** small and **2** large bottles, the total capacity would be **8 × 150 + 2 × 250 = 1700** mL.

Exchanging a single **150** mL bottle for a **250** mL bottle increases the total capacity by **100** mL.

(Why is this?)

		–1	–1		
Small bottles	10	9	8		
Large bottles	0	1	2		
Total water (mL)	1500	1600	1700		
		+100	+100		

The total capacity of my bottles is **2200** mL.

This is **2200 – 1700 = 500** mL more than we have when there are **8** small bottles.

We need to exchange a further **500 ÷ 100 = 5** small bottles for large bottles.

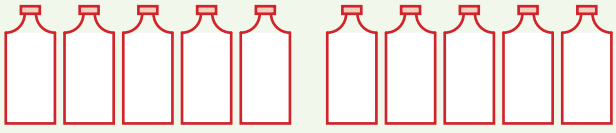
I have **8 – 5 = 3** small bottles in total.

		–1	–1	– 5 × 1		
Small bottles	10	9	8	...	3	
Large bottles	0	1	2	...	7	
Total water (mL)	1500	1600	1700	...	2200	
		+100	+100	+ 5 × 100		

Strategy 2: Draw a Diagram

Let's begin by assuming that all of the bottles have a capacity of **250** mL.

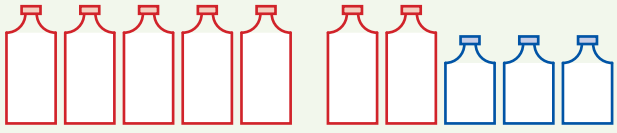
In total, they will hold **10 × 250 mL = 2500** mL.



Exchanging a **250** mL for a **150** mL bottle will reduce the total capacity by **250 – 150 = 100** mL.

We need to reduce the total capacity by **2500 – 2200 = 300** mL.

300 mL **= 3 × 100** mL, so we should exchange **3** bottles.



In total, I have **7** large bottles, and **3** small bottles.

Answers **1.2 - Green:** 4 **1.2 - Orange:** 19

1.2 - Yellow: 3

Maths Games - Example Problem 1.3

Example Problem 1.3 - Green

Casey plays hockey every third Saturday morning.
He plays basketball every second Saturday afternoon.
The next date on which Casey will play both sports is May 25 (25th of May).
What would be the first date after May 25 when Casey will play both sports?

Example Problem 1.3 - Yellow

Casey plays hockey every third Saturday morning.
He plays basketball every second Saturday afternoon.
The next date on which Casey will play both sports is May 25 (25th of May).
What was the date the last time Casey played both sports on the same day?

Example Problem 1.3 - Orange

Justin plays hockey every third Saturday morning.
He plays basketball every second Saturday afternoon.
He visits his grandparents every fourth Saturday evening.
The next date on which Justin will do all three activities is May 25 (25th of May).
What was the date the last time Justin did all three activities?

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Maths Games Example Solution 1.3 - Yellow

Casey plays hockey every third Saturday morning. He plays basketball every second Saturday afternoon.

The next date on which Casey will play both sports is May 25 (25th of May).

What was the date the last time Casey played both sports on the same day?

Strategy 1: Build a Table

Casey plays hockey every **3**rd Saturday, and basketball every **2**nd Saturday.

On **May 25**, Casey will play both hockey and basketball.

We can begin by constructing a calendar, with **May 25** occurring on a Saturday.

May						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
			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	

Let's circle the dates on which Casey played hockey, and colour in the dates on which he played basketball.

Since there are no other dates during May when Casey played both sports, we will have to extend the calendar back to April.

May						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
			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	

Since April has **30** days, we will construct the calendar to show that **April 30** occurs immediately before **May 1**.

April - May						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
	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	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	

Casey played both sports on **April 13**.

Strategy 2: Build a Table (Alternative Approach)

Let's begin with a Saturday on which Casey plays both sports.

Saturday	1	2	3	4	5	6	7	8
Hockey	X							
Basketball	X							

Marking the table with Saturdays on which Casey plays hockey or basketball, we can see that Casey plays both sports on the same day, once every **6** weeks.

Saturday	1	2	3	4	5	6	7	8
Hockey	X			X			X	
Basketball	X		X		X		X	

The next date on which Casey will play both sports will be **May 25**.

3 weeks prior, the date was **May 4**.

Date				May 4	May 11	May 18	May 25
Saturday	1	2	3	4	5	6	7
Hockey	X			X			X
Basketball	X		X		X		X

Counting backwards from **May 4**, we find that **April 27** was the Saturday **4** weeks prior to **May 25.**

April 27	April 28	April 29	April 30	May 1	May 2	May 3	May 4
Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat

6 weeks prior to **May 25**, Casey played both sports on Saturday **April 13**.

Date	April 13	April 20	April 27	May 4	May 11	May 18	May 25
Saturday	1	2	3	4	5	6	7
Hockey	X			X			X
Basketball	X		X		X		X

Answers

1.3 - Green: July 6

1.3 - Orange: March 2

1.3 - Yellow: April 13

Maths Games - Example Problem 1.4

Example Problem 1.4 - Green

Kat and Matt want to buy a particular board game.
Kat needs another $3 before she can afford the board game on her own.
Matt needs another $7 before he can afford the board game on his own.
If they combine their money, they have just enough to afford the board game.
How much does the board game cost?

Example Problem 1.4 - Yellow

Nat and Scott want to buy a particular jigsaw puzzle.
Nat needs another $18 before she can afford the puzzle on her own.
Scott needs another $10 before he can afford the puzzle on his own.
If they combine their money, they still cannot afford to buy the puzzle.
The puzzle costs a whole number of dollars.
What is the most that the puzzle could cost?

Example Problem 1.4 - Orange

Mara and Tara each have some pencils.
If Mara gives four pencils to Tara, they will have the same number of pencils.
If Tara gives two pencils to Mara, Mara will have 3 times as many pencils as Tara.
How many pencils does Mara have?

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Maths Games Example Solution 1.4 - Yellow

Nat and Scott want to buy a particular jigsaw puzzle. Nat needs another $18 before she can afford the puzzle on her own. Scott needs another $10 before he can afford the puzzle on his own.

If they combine their money, they still cannot afford to buy the puzzle. The puzzle costs a whole number of dollars. What is the most that the puzzle could cost?

Strategy 1: Build a Table, and Find a Pattern

Let's guess the puzzle costs $30.
If so, Nat must have $30 – $18 = $12.
Scott must have $30 – $10 = $20.
Together, Nat and Scott would have $12 + $20 = $32.

Cost of Puzzle ($)	30					
Nat's Money ($)	12					
Scott's Money ($)	20					
Total ($)	32					

If the puzzle costs $30, Nat and Scott can combine their money and have enough to buy the puzzle.

Let's guess the puzzle costs $31.
If so, Nat must have $31 – $18 = $13.
Scott must have $31 – $10 = $21.
Together, Nat and Scott would have $13 + $21 = $34.

Cost of Puzzle ($)	30	31				
Nat's Money ($)	12	13				
Scott's Money ($)	20	21				
Total ($)	32	34				

If the puzzle costs $31, Nat and Scott's total will actually exceed the amount required, by even more than if the puzzle had cost less. Why might this occur?

We can reduce the cost of the puzzle until Nat and Scott's combined total is insufficient for buying the puzzle.

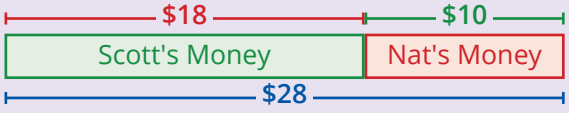
The most the puzzle could cost would be **$27**.

Cost of Puzzle ($)	30	31	29	28	27	
Nat's Money ($)	12	13	11	10	9	
Scott's Money ($)	20	21	19	18	17	
Total ($)	32	34	30	28	26	

Strategy 2: Draw a Diagram

Nat is $18 short, and Scott is $10 short.

If the puzzle cost $18 + $10 = $28, then Nat and Scott together would have exactly the right amount of money to buy the puzzle.



Together, Nat and Scott cannot afford the puzzle.

This would be the case if the puzzle cost **$1** less.

The most the puzzle could cost would be **$27**.



Strategy 3: Reason Algebraically

Let's say that the puzzle costs p dollars.

Nat is $18 short, so Nat has $p - 18$ dollars.

Scott is $10 short, so Scott has $p - 10$ dollars.

Together, Nat and Scott would have:

$(p - 18) + (p - 10) = 2p - 28$ dollars.

Nat and Scott cannot afford the puzzle, even if they combine their money.

Expressing this as an inequality: $2p - 28 < p$

Subtracting p from both sides: $p - 28 < 0$

Adding **28** to both sides: $p < 28$

The puzzle costs a whole number of dollars less than **$28**.

Therefore the most the puzzle could cost would be **$27**.

Answers

1.4 - Green: $10

1.4 - Orange: 16

1.4 - Yellow: $27

Maths Games - Example Problem 1.5

Example Problem 1.5 - Green

Harry's Number Recycling Machine obeys exactly two rules:

If the inserted number has just 1 digit, double the number and print out the result.
Otherwise, if the inserted number has 2 digits, remove the tens digit and print out the result.

The first number Harry inserts is 2.

Then every answer he gets is inserted back into the machine until twenty numbers are inserted.

What is the twentieth number to be inserted?

Example Problem 1.5 - Yellow

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?

Example Problem 1.5 - Orange

Harry is playing with Michelle's Number Recycling Machine, which 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 Harry inserts is 3.

Then every answer he gets is inserted back into the machine until a hundred numbers are inserted.

What is the one-hundredth number to be inserted?

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Maths Games Example Solution 1.5 - Yellow

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?

Strategy: Find a Pattern, and Build a Table

The first number Michelle inserts is 1.

1 has exactly **1** digit, so the machine doubles the number.

1 → 2 × 1 = 2 → 2

The answer she gets is 2. She inserts 2 back into the machine.

2 has exactly **1** digit, so the machine doubles the number.

2 → 2 × 2 = 4 → 4

The answer she gets is 4. She inserts 4 back into the machine.

4 has exactly **1** digit, so the machine doubles the number.

4 → 2 × 4 = 8 → 8

The answer she gets is 8. She inserts 8 back into the machine.

8 has exactly **1** digit, so the machine doubles the number.

8 → 2 × 8 = 16 → 16

The answer she gets is 16. She inserts 16 back into the machine.

16 has **2** digits, so the machine computes the sum of the digits.

16 → 1 + 6 = 7 → 7

The answer she gets is 7. She inserts 7 back into the machine.

7 has exactly **1** digit, so the machine doubles the number.

7 → 2 × 7 = 14 → 14

The answer she gets is 14. She inserts 14 back into the machine.

14 has **2** digits, so the machine computes the sum of the digits.

14 → 1 + 4 = 5 → 5

The answer she gets is 5. She inserts 5 back into the machine.

5 has exactly **1** digit, so the machine doubles the number.

5 → 2 × 5 = 10 → 10

The answer she gets is 10. She inserts 10 back into the machine.

10 has **2** digits, so the machine computes the sum of the digits.

10 → 1 + 0 = 1 → 1

We've seen 1 before; and the machine always does the same thing when Michelle inserts 1.

So the numbers she inserts will go like this:

1, 2, 4, 8, 16, 7, 14, 5, 10,
1, 2, 4, 8, 16, 7, 14, 5, 10,
1, ...

By arranging the pattern in a table, we can see that every **9th** number is a 10.

This means that the **9th**, **18th**, **27th**, **36th**, and **45th** numbers are all 10.

Continuing the pattern, the following numbers are 1, 2, 4, 8, 16.

The fiftieth number to be inserted is **16.**

1st	2nd	3rd	4th	5th	6th	7th	8th	9th
1,	2,	4,	8,	16,	7,	14,	5,	10,
10th	11th	12th	13th	14th	15th	16th	17th	18th
1,	2,	4,	8,	16,	7,	14,	5,	10,
19th	...							27th
1,	...							10,
								36th
								10,
								45th
								10,
46th	47th	48th	49th	50th				
1,	2,	4,	8,	16				

Answers

1.5 - Green: 4

1.5 - Orange: 3

1.5 - Yellow: 16

Maths Games - Example Problem 1.6

Example Problem 1.6 - Green

At a cafeteria, you have a choice of:

- either onion soup or pea soup for starters, then
- a choice of meat, fish or vegetarian for the main course.

How many choices do you have for your complete meal, including a starter and a main course?

Example Problem 1.6 - Yellow

At a cafeteria, you have a choice of:

- either onion soup or pea soup for starters, then
- a choice of meat, fish or vegetarian for the main course, and
- ice cream or cake for dessert.

How many choices do you have for your complete meal, including a starter, a main course and a dessert?

Example Problem 1.6 - Orange

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

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Maths Games Example Solution 1.6 - Yellow

At a cafeteria, you have a choice of:

- either onion soup or pea soup as a starter, then
- either meat, fish or vegetarian for the main course, and
- either ice cream or cake for dessert.

How many choices do you have for your complete meal, including a starter, a main course and a dessert?

Strategy 1: Build a Table

Let's use a table to list all of the combinations for the starter and the main course.

There are **2** possible starters, and **3** possible main courses.

Starter choices	Main Course choices: Meat	Fish	Veg
Onion Soup	Onion, Meat	Onion, Fish	Onion, Veg
Pea Soup	Pea, Meat	Pea, Fish	Pea, Veg

There are **2 × 3 = 6** combinations for the starter and the main course.

To add the dessert, we can construct a new table that combines the **6** choices of starter and main course with the **2** choices for dessert.

Starter and Main Course choices	Dessert Choices: Ice cream	Cake
Onion, Meat	Onion, Meat, Ice cream	Onion, Meat, Cake
Onion, Fish	Onion, Fish, Ice cream	Onion, Fish, Cake
Onion, Veg	Onion, Veg, Ice cream	Onion, Veg, Cake
Pea, Meat	Pea, Meat, Ice cream	Pea, Meat, Cake
Pea, Fish	Pea, Fish, Ice cream	Pea, Fish, Cake
Pea, Veg	Pea, Veg, Ice cream	Pea, Veg, Cake

There are **6 × 2 = 12** different choices for the meal.

Strategy 2: Make an Organised List

You can begin by choosing either onion or pea soup.

Starter
Onion Soup
Pea Soup

For each of these options, you can follow it up with meat, fish or vegetarian.

Starter	Main Course
Onion Soup	Meat
Onion Soup	Fish
Onion Soup	Vegetarian
Pea Soup	Meat
Pea Soup	Fish
Pea Soup	Vegetarian

After choosing one of these combinations, you have one more choice: either ice cream or cake for dessert.

Starter	Main Course	Dessert
Onion Soup	Meat	Ice Cream
Onion Soup	Meat	Cake
Onion Soup	Fish	Ice Cream
Onion Soup	Fish	Cake
Onion Soup	Vegetarian	Ice Cream
Onion Soup	Vegetarian	Cake
Pea Soup	Meat	Ice Cream
Pea Soup	Meat	Cake
Pea Soup	Fish	Ice Cream
Pea Soup	Fish	Cake
Pea Soup	Vegetarian	Ice Cream
Pea Soup	Vegetarian	Cake

We can be sure we listed all of the choices because we did it in an organised way.

There are **12** different choices for the complete meal.

Answers

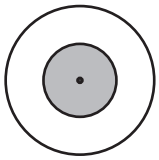
1.6 - Green: 6

1.6 - Orange: 24

1.6 - Yellow: 12

Maths Games - Example Problem 1.7

Example Problem 1.7 - Green



Kris and Asher are throwing darts at a target.

Kris landed one dart in the outer ring and one dart in the inner ring.
He scored 10 points.

Asher landed two darts in the outer ring.
He scored 6 points.

How many points are given for a dart landing in the inner ring?

Example Problem 1.7 - Yellow



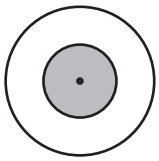
Kris and Asher are throwing darts at a target.

Kris landed two darts in the outer ring and two darts in the inner ring.
He scored 20 points.

Asher landed one dart in the outer ring and three darts in the inner ring.
He scored 24 points.

How many points are given for a dart landing in the inner ring?

Example Problem 1.7 - Orange



Hitting the inner circle of a target scores 5 points.

Hitting the outer circle scores 3 points.

I scored a total of 26 points after 7 attempts.

How many times did I miss the target completely?

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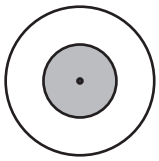
Maths Games Example Solution 1.7 - Yellow

Kris and Asher are throwing darts at a target.

Kris landed two darts in the outer ring and two darts in the inner ring. He scored 20 points.

Asher landed one dart in the outer ring and three darts in the inner ring. He scored 24 points.

How many points are given for a dart landing in the inner ring?



Strategy 1: Find a Pattern

Kris has **20** points after landing 2 darts in the outer ring, and 2 in the inner ring.

Asher has **24** points.

He landed 1 dart in the outer ring, and 3 in the inner ring.

	2	1
	2	3
Score	20	24

Is there a pattern here?

It appears that, when there is:

- 1 less outer ring dart,
- and 1 more inner ring dart,
- the score increases by **4**.

	2 (−1)	1	
	2 (+1)	3	
Score	20 (+4)	24	

Filling in values according to the pattern, it appears that:

- 4 outer ring darts would score **12**.
- If so, 1 outer ring dart scores **12 ÷ 4 = 3**.
- 4 inner ring darts would score **28**.
- If so, 1 inner ring dart scores **28 ÷ 4 = 7**.

	4 (−1)	3 (−1)	2 (−1)	1 (−1)	0
	0 (+1)	1 (+1)	2 (+1)	3 (+1)	4
Score	12 (+4)	16 (+4)	20 (+4)	24 (+4)	28

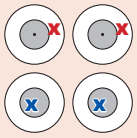
Let's check:

- With 2 outer ring darts and 2 inner ring darts, Kris would score **2 × 3 + 2 × 7 = 20** points.
- With 1 outer ring dart and 3 inner ring darts, Asher would score **1 × 3 + 3 × 7 = 24** points.

Both results match the question. A dart landing in the inner ring scores **7** points.

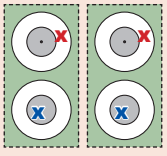
Strategy 2: Reason Logically

Kris landed 2 darts in the outer ring and 2 in the inner ring, and scored **20** points.



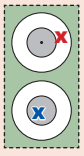
= 20

We can group these darts into 2 identical scoring pairs.



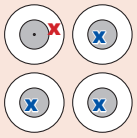
= 20

If two pairs scored **20** points, then one pair must score **20 ÷ 2 = 10** points.



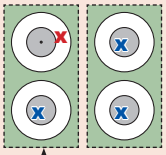
= 10

Asher landed 1 dart in the outer ring and 3 in the inner ring, and scored **24** points.



= 24

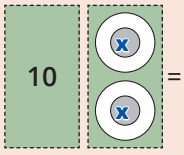
We can group these darts into 2 groups.



= 24

We know that this combination scores **10** points.

Putting it all together, we have



= 24

so two darts in the inner ring must score **24 - 10 = 14** points.



= 14

Therefore one dart in the inner ring must score **14 ÷ 2 = 7** points.



= 7

Answers

1.7 - Green: 7

1.7 - Orange: 1

1.7 - Yellow: 7

Maths Games - Example Problem 1.8

Example Problem 1.8 - Green

The whole numbers from 100 down to 0 are arranged in columns *Q*, *R*, *S*, and *T* as indicated.

Write the letter of the column that contains the number 25.

Q	*R*	*S*	*T*
100	99	98	97
96	95	94	93
92	91	90	89
88	87	86	85
84	83	82	81
80	79	78	77

and so on ...

Example Problem 1.8 - Yellow

The whole numbers from 100 down to 0 are arranged in columns *P*, *Q*, *R*, *S*, and *T* as indicated.

Write the letter of the column that contains the number 25.

P	*Q*	*R*	*S*	*T*
	100	99	98	97
93	94	95	96	
	92	91	90	89
85	86	87	88	
	84	83	82	81
77	78	79	80	

and so on ...

Example Problem 1.8 - Orange

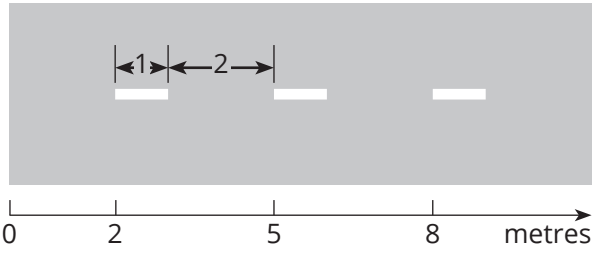
A council worker is painting a broken white line down the middle of a path.

He starts by measuring a two metre gap.

Then, he paints one metre and leaves another gap of two metres.

He keeps painting like this until he gets to the end of the path.

If the path is 62 metres long, how many one metre lines does he paint?



Maths Games Example Solution 1.8 - Yellow

The whole numbers from 100 down to 0 are arranged in columns *P*, *Q*, *R*, *S*, and *T* as indicated.

Write the letter of the column that contains the number 25.

P	*Q*	*R*	*S*	*T*
	100	99	98	97
93	94	95	96	
	92	91	90	89
85	86	87	88	
	84	83	82	81
77	78	79	80	

and so on ...

Strategy 1: Find a Pattern

In this table, the numbers are counting down, but:

- Some rows are going from left to right, and
- Other rows are going from right to left.

We can follow the pattern and continue filling in the table.

P	*Q*	*R*	*S*	*T*
	100	99	98	97
93	94	95	96	↙
↘	92	91	90	89
85	86	87	88	↙
↘	84	83	82	81
77	78	79	80	↙
↘	76	75	74	73
69	70	71	72	↙
↘	68	67	66	65
61	62	63	64	↙
↘	60	59	58	57
53	54	55	56	↙
↘	52	51	50	49
45	46	47	48	↙
↘	44	43	42	41
37	38	39	40	↙
↘	36	35	34	33
29	30	31	32	↙
↘	28	27	26	25

We can see that 25 is in the column labelled ***T***.

Strategy 2: Convert to a More Convenient Form

Instead of using the table as presented, we can try rearranging every other row so that the table always counts down.

P	*Q*	*R*	*S*	*T*
	100	99	98	97
93	94	95	96	↙
↘	92	91	90	89
85	86	87	88	↙
↘	84	83	82	81
77	78	79	80	↙

→

P	*Q*	*R*	*S*	*T*	*T*	*S*	*R*	*Q*	*P*
	100	99	98	97	→	96	95	94	93
→	92	91	90	89	→	88	87	86	85
→	84	83	82	81	→	80	79	78	77

We can now tidy this up to create a single table where the numbers count down sequentially.

Q	*R*	*S*	*T*	*S*	*R*	*Q*	*P*
100	99	98	97	96	95	94	93
92	91	90	89	88	87	86	85
84	83	82	81	80	79	78	77

and so on ...

Since there are now **8** numbers in each row, the numbers in each column must count down by **8**s.

This means that there will be a column that just contains multiples of **8**.

Q	*R*	*S*	*T*	*S*	*R*	*Q*	*P*
100	99	98	97	96	95	94	93
92	91	90	89	88	87	86	85
84	83	82	81	80	79	78	77
				72			
				64			
				56			
				48			
				40			
				32			
			25	24			

We can see that this column has the **8** times table in it.

We can continue filling in multiples of **8** until we get to a number that is close to **25**.

From then on, we can just count up or down by **1**s.

Therefore, 25 must be in column ***T***.

Answers

1.8 - Green: *T*

1.8 - Orange: 20

1.8 - Yellow: *T*

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Answers

Set Green	
1.1	6
1.2	4
1.3	July 6
1.4	$10
1.5	4
1.6	6
1.7	7
1.8	*T*

Set Yellow	
1.1	12
1.2	3
1.3	April 13
1.4	$27
1.5	16
1.6	12
1.7	7
1.8	*T*

Set Orange	
1.1	26
1.2	19
1.3	March 2
1.4	16
1.5	3
1.6	24
1.7	1
1.8	20

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