Investigations

Six things to find out properly, plus warm-ups, games and puzzles

THIS BOOK BELONGS TO

Colour a badge in each time you finish a mission

The Cake Problem Sheets 14–18	**The Soil Shake** Sheets 19–23	**Twelve Squares** Sheets 24–28
The Bridge That Holds Sheets 29–33	**Then and Now, Right Here** Sheets 34–38	**The Deep Dive** Sheets 39–44

Volume 1 practised. This one investigates. Every mission is a real question with a real answer you do not know yet. Some of them will not come out the way you expect, and that is the interesting part.

Why these six. Each mission targets something Grade 3 children reliably get stuck on, and fixes it physically rather than by explanation. The cake attacks the belief that one eighth is bigger than one third. Twelve Squares separates perimeter from area for good. The soil jar shows that soil is not just dirt. The bridge teaches a fair test. The last one runs on whatever your child already loves.

The only facts you have to know by heart

Twos, fives and tens. Not all the tables — those are next year. Fill these in until they are automatic.

recall | write

What Grade 3 actually asks for

Instant recall of the **2s, 5s and 10s**, and the divides that go with them. Everything from 1×1 to 10×10 is a **Grade 4** job. If somebody is drilling you on the sevens, they are a year early.

2 × 4 = _____	**5 × 3 = _____**	**10 × 4 = _____**
2 × 7 = _____	**5 × 6 = _____**	**10 × 7 = _____**
2 × 9 = _____	**5 × 8 = _____**	**10 × 9 = _____**
16 ÷ 2 = _____	**35 ÷ 5 = _____**	**60 ÷ 10 = _____**
2 × 6 = _____	**5 × 9 = _____**	**10 × 3 = _____**
18 ÷ 2 = _____	**45 ÷ 5 = _____**	**80 ÷ 10 = _____**

Which one was slowest?

Write the one you had to think hardest about. That is the one to practise.

For the grown-up. Automatic means answered without counting. If she counts up in fives on her fingers, she has the concept but not the recall, and only the recall saves her time in Grade 4.

What the little 1 actually is

You can already do the column method. This page is about why it works.

work it out · explain

The question that matters

When you carry a **1** into the tens column, what is that 1? It is not one. It is **one ten** — ten ones that got traded in because they would not fit.

Do it with blocks first

Draw 47 and 38 in base ten blocks. Then trade ten ones for one rod.

Then do it in columns

$$\begin{array}{r} 47 \\ +\ 38 \\ \hline \end{array}$$

The little 1 you wrote above the tens column — how many ones is it worth?

Say it in your own words

Why does the column method work?

For the grown-up. This is the most skipped expectation in the strand and the most expensive to skip. A child who can carry but cannot say what the 1 *is* has met half of B2.4.

The zero has a job

Some numbers have a zero in the middle. It is not nothing — it is holding a place open.

read it   write

Read these out loud

407   560   903

310   706   850

Break one apart

Take 407.

hundreds	tens	ones

If the zero were not there, what would the number say?

True or not true?

407 is the same as 47 _______________

560 has 6 tens _______________

903 has 0 tens _______________

850 is bigger than 805 _______________

For the grown-up. The reliable test is asking for the digits by name. “How many hundreds? How many tens?” makes the zero's job visible in a way that reading the number aloud does not.

Why would anyone round?

You know the rule. This page is about when rounding is actually the sensible thing to do.

round it · decide · write

Rounding is a choice, not a rule

Sometimes **close enough** is more useful than exact. “About 300 people came” is easier to hold in your head than “297 people came”, and for most purposes it is just as good.

the real number	to the nearest ten	to the nearest hundred
47		
152		
385		
608		
749		
896		

When would you round, and when would you not?

Write R if rounding is fine. Write E if you need the exact number.

How many people live in your town _______

How much change you are owed _______

How far it is to the next city _______

How many children are in your class _______

How many steps you walked today _______

For the grown-up. Ask “why would anyone round?” before any practice. The answer — because sometimes close enough is more useful — is the actual expectation. The rule is only the mechanism.

Is it true?

The equals sign does not mean “the answer comes next”. It means both sides are worth the same.

check both sides | true or not

A balance, not an arrow

Is 4 × 5 = 10 × 2 true? Work out each side on its own. Twenty and twenty. So yes — it is true, even though nothing gets “answered”.

the statement	left side	right side	true?
4 × 5 = 10 × 2			
6 + 7 = 20 − 7			
3 × 8 = 4 × 6			
15 − 9 = 2 × 4			
5 × 4 = 2 × 10			
9 + 9 = 3 × 6			

Make your own

Write one that is true, and one that is not true. Try them on somebody.

For the grown-up. Believing = means “write the answer here” is the best single predictor of trouble with algebra later on. Grade 3 is a good year to kill it, and a pan balance is the fastest way.

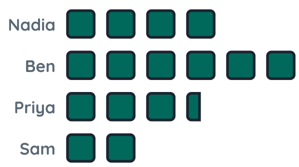
Read the key, not the pictures

On these graphs one picture stands for more than one thing. Look at the key first, every time.

read the key | work it out | write

The key

one ■ stands for 5 books



question	answer
How many books did Nadia read?	
How many did Ben read?	
How many did Priya read?	
How many more did Ben read than Sam?	
How many altogether?	

For the grown-up. Counting symbols instead of reading the scale is the standard error. Point at the key before every question until she does it herself. The half square is the part that catches people.

If everyone had the same

The mean is not really a sum. It is what everyone would get if you shared it all out equally.

share it out | write

✓ Do it by sharing first

Four children have 3, 5, 2 and 6 sweets. Put all sixteen in one pile. Share them back out one at a time until they are gone. Everyone ends up with **4**. That is the mean.

Share these out

Towers of 6, 2, 4 and 8 cubes. Make them all the same height.

they all end up at

Now the quick way

Add them all up, then share between how many.

6 + 2 + 4 + 8 = ________

________ ÷ 4 = ________

Same answer as the sharing? It always is.

Your turn

Find the mean of 5, 5, 8 and 6.

And of 10, 2, 3 and 9.

For the grown-up. Physically levelling four towers of cubes before ever writing the calculation is what makes the mean mean something. Otherwise it is a procedure with no idea attached.

The broken ruler

Rulers get chipped. Things do not always start at zero. You can still measure.

measure | work it out | write

Take the small number away from the big one

If something starts at **3 cm** and ends at **11 cm**, it is **8 cm** long, because 11 − 3 = 8. It is not 11 cm.

starts at	ends at	how long?
3 cm	**11 cm**	
5 cm	**14 cm**	
2 cm	**9 cm**	
7 cm	**20 cm**	
12 cm	**31 cm**	
4 cm	**18 cm**	

Do it for real

Find a pencil. Line the **3 cm** mark up with one end, on purpose. Read the other end. Now work out the real length.

ends at ___ take away 3 ___ real length ___

For the grown-up. Deliberately measuring from the wrong place is far more useful than being told to line it up with zero. It turns a rule into a subtraction she can always fall back on.

Faces, edges, vertices

"How many sides does a cube have?" is a question with no good answer. Use the proper words instead.

find one | count | write

Three different things

A **face** is a flat surface. An **edge** is where two faces meet. A **vertex** is a corner point. A cube has 6 faces, 12 edges and 8 vertices — and no "sides".

solid	faces	edges	vertices	found one at home?
cube				
rectangular prism				
square pyramid				
triangular prism				
cylinder				
cone				

The tricky ones

A cylinder has two flat faces and one curved surface. Does a curved surface count as a face? Ask a grown-up what they think, then say what you think.

For the grown-up. There is genuine disagreement about whether a curved surface is a face. Saying so is more honest than picking one, and arguing it out is exactly the reasoning the strand is after.

Cover the ending

Long words are not long. They are short words with bits stuck on.

break it up · write · say it

The finger trick

Put a finger over the ending. Read what is left. Then uncover it.
information → cover *-ation* → read **inform** → uncover. Two pieces, not eleven letters.

the long word	the base word	the bits
unhelpful		
rebuilding		
carefully		
disagreement		
unbreakable		
misunderstood		

Build a word family

Start with **help**. How many words can you make from it?

Now try **act**.

For the grown-up. Building a family from one base teaches a system. A spelling list teaches a list. This is the single highest-value reading habit in Grade 3.

Which words made you think that?

Some answers are written down. Others you work out. This page is about proving the second kind.

read it · write · explain

Priya put the letter back in the drawer and pushed it shut with her knee. She checked the hall twice before she went downstairs. At dinner she said everything was fine, and cut her food into very small pieces, and did not eat any of it.

question	my answer	the words that made me think it
Is Priya worried?		
Does she want anybody to know?		
Is the letter important to her?		
Was everything fine?		

The rule

The story never says Priya is worried. You worked it out from what she *did*. That is called **inference**, and it only counts if you can point at the words.

For the grown-up. "Which words made you think that?" after every single answer. This is what Grade 3 comprehension is actually assessed on, and asking the question is what builds it.

Draft now, fix later

Getting the ideas down and making it correct are two different jobs. Doing both at once stops the flow.

draft | then edit

Two jobs, two times

Revising changes what it says — adding a detail, cutting a bit that wanders off, swapping a dull word. **Editing** fixes spelling, capitals and full stops. Revising comes first, and it is the bigger job.

Sort these

Write R for revising or E for editing.

Adding a sentence that was missing _______ **Fixing a spelling** _______

Cutting a part that wanders off _______ **Adding a capital letter** _______

Swapping *nice* for a better word _______ **Putting in a full stop** _______

Write a draft, on purpose, badly

Three sentences about what you did yesterday. Do not stop for spelling. Do not cross anything out.

Now edit it

Read it out loud. Reading aloud catches more than looking does. Tick each one when you have checked it.

capital letters | full stops | spellings I am unsure of | does it make sense out loud

For the grown-up. Correcting spelling mid-draft is the most common way a piece of writing dies. Separating the jobs, and naming them, is what makes it survivable.

MISSION ONE

The Cake Problem

Settle the biggest argument in primary maths: is one eighth bigger than one third?

Read all the steps first. You do not have to start today.

	Step 1	Guess first, and write your guess down before you find out
	Step 2	Share one real thing between 3, and then between 8
	Step 3	Line all the slices up and put them in order
	Step 4	Work out the rule, and test it on a fraction you have not tried

One step is a whole session. Tick each step when it is done. Stopping between two steps is fine, even for a week.

For the grown-up. You need one thing that can be cut evenly — a tortilla, a slice of bread, a strip of paper, a banana. The guess in step 1 matters: writing down a wrong prediction and then disproving it yourself is what makes this stick. Do not correct the guess.

Guess first

Before you cut anything. Write what you think, even if you are not sure.

predict | say why

The question

You have one cake. You could share it between **3** people, or between **8** people.
Which way gives each person a **bigger** slice?

shared between 3 | **shared between 8** | **they would be the same**

Circle your guess above. Now say why you think that.

Draw your guess

Draw both cakes as you think they will look.

shared between 3

shared between 8

Do not turn over yet. The next page is where you find out. Being wrong here is completely fine — most people guess wrong, including a lot of grown-ups.

For the grown-up. Resist correcting the guess. A prediction she disproves herself is worth ten explanations. Many children reason “8 is bigger than 3, so an eighth is bigger”, and that is the misconception this whole mission exists to kill.

Now actually cut it

Two identical things. Cut one into 3 equal pieces and the other into 8.

cut it | compare | write

- Find two things exactly the same size — two slices of bread, or two strips of paper
- Cut the first into 3 pieces as equal as you can manage
- Cut the second into 8 pieces as equal as you can manage
- Put one piece from each next to the other

One third, drawn actual size

One eighth, drawn actual size

So which is bigger?

the bigger piece is one

Was your guess right?

For the grown-up. Equal-ish is fine. The point survives wonky cutting. If she cut the thirds badly and one is tiny, that is worth talking about too — fair shares have to be equal or the fraction is not a fraction.

Line them all up

Cut more strips. Fold them into halves, thirds, quarters, sixths and eighths.

fold | count | order them

How to fold each one

Halves — fold once. **Quarters** — fold twice. **Eighths** — fold three times. **Thirds** and **sixths** are harder; curl the strip into an S first.

Stick your strips here, longest piece at the top

Put them in order

Smallest piece first.

Now look at the bottom numbers. What do you notice?

For the grown-up. The strips are worth keeping. Taped inside a cupboard door they answer every fraction question for the rest of the year without anybody having to explain anything.

The rule, and one surprise

You have found something. Write it down properly, then test it on something new.

write the rule · test it

The rule you found

Finish this sentence.

The bigger the bottom number, the...

And why does that happen?

Test it on one you have not tried

Which is bigger? Circle one. Then check with your strips.

$\frac{1}{3}$ or $\frac{5}{8}$ **$\frac{1}{2}$ or $\frac{1}{3}$**   **$\frac{1}{4}$ or $\frac{1}{8}$**

The surprise

Put your **one third** strip next to **two sixths**. Look carefully.

what do you find?

Two different-looking fractions can be exactly the same amount. That is worth knowing.

Mission one is finished. Colour in the first badge.

For the grown-up. One third equals two sixths is a named Grade 3 expectation (B1.7) and it lands much better as a surprise she discovers with paper than as a fact.

MISSION TWO

The Soil Shake

Prove that soil is not just dirt, using three jars and a lot of patience.

Read all the steps first. You do not have to start today.

- [ ] **Step 1** Collect soil from three different places and label them
- [ ] **Step 2** Shake each one up with water and leave it completely alone
- [ ] **Step 3** Measure the layers when they have settled
- [ ] **Step 4** Work out why the three jars came out different

One step is a whole session. Tick each step when it is done. Stopping between two steps is fine, even for a week.

For the grown-up. Three clear jars with lids. Soil from genuinely different places — a garden bed, under a tree, a path edge. Step 2 needs several hours of not touching it, ideally overnight, which is the hardest part of the whole mission.

Collect three soils

Three places that are properly different from each other. A trowel's worth of each.

go outside | look closely | label them

Jar 1

Where from?

What does it look like dry?

Colour

Jar 2

Where from?

What does it look like dry?

Colour

Jar 3

Where from?

What does it look like dry?

Colour

Places that give really different soil

a garden bed | under a big tree | the edge of a path | a plant pot | a field | a molehill

Before you shake anything, predict

Which jar do you think will have the most stuff floating on top? Why?

For the grown-up. Under a tree gives lots of humus; a path edge gives almost none. That contrast is what makes the results worth looking at, so it is worth walking a bit further for a genuinely different third sample.

Shake it and wait

This is the step where you have to leave it alone. That is genuinely the hard bit.

set it up | wait

- [ ] Put soil into each jar until it is about a third full
- [ ] Fill the rest with water, leaving a gap at the top
- [ ] Screw the lid on tight and shake hard for a whole minute
- [ ] Put all three somewhere they will not be knocked
- [ ] Leave them overnight. Do not shake them again, however tempting.

What time did you start?

jar 1 ______ jar 2 ______ jar 3 ______

Have a look after ten minutes

Do not shake. Just look. What has happened already?

Stop here for today. The next page needs the jars to have settled completely, which takes at least a night. Come back tomorrow.

For the grown-up. The heaviest particles drop first, so sand settles within minutes and clay can take a full day. Anything still floating after a night is organic matter, and that is the part most people are surprised by.

Measure the layers

Hold a ruler against the side of each jar. Measure each layer in millimetres.

measure · draw · write

✓ What the layers are

Bottom to top: **gravel and sand** (heaviest, drops first), then **silt**, then **clay** (finest, takes longest). Anything **floating** is humus — the rotted remains of things that were alive.

Jar 1

draw the layers

layer	mm
floating	
clay	
silt	
sand	

Jar 2

draw the layers

layer	mm
floating	
clay	
silt	
sand	

Jar 3

draw the layers

layer	mm
floating	
clay	
silt	
sand	

Which jar had the most floating stuff?

jar

Was that the one you predicted?

For the grown-up. Millimetres are new this year and a jar is a good reason to need them — the layers are often only three or four millimetres thick, and centimetres would lose the difference entirely.

Why were they different?

Three jars, three different answers. Work out what caused it.

explain talk look again

	jar 1	jar 2	jar 3
most sand			
most clay			
most floating humus			
where it came from			

Put it together

Which soil came from a place with the most plants growing? What did its jar look like?

So what is soil made of?

List everything you found in it.

And what would happen to a plant in the jar with almost no humus?

Mission two is finished. Colour in the second badge.

For the grown-up. The finding is that soil under plants is richer, because plants feed the soil that feeds them. That loop is the heart of the Soils strand and it is much better discovered than told.

MISSION THREE

Twelve Squares

Same amount of grass, different amount of fence. Separate perimeter from area for good.

Read all the steps first. You do not have to start today.

	Step 1	Cut out twelve squares and find every rectangle you can make
	Step 2	Measure the fence round each one and fill in the table
	Step 3	Work out which shape needs the least fence, and why
	Step 4	Design a real garden with the fence you are allowed

One step is a whole session. Tick each step when it is done. Stopping between two steps is fine, even for a week.

For the grown-up. Twelve identical squares — squared paper, sticky notes, crackers, Lego. This is the demonstration the curriculum guide calls “once seen, never forgotten”: same area, different perimeters, in front of her.

Every rectangle you can make

Twelve squares, no gaps, no overlaps. How many different rectangles are there?

cut them out | arrange | draw

The rules

Use all twelve every time. They must make a proper rectangle — no gaps and no bits sticking out. A 3 × 4 and a 4 × 3 are the **same** rectangle turned round, so only count it once.

Rectangle 1

Rectangle 2

Rectangle 3

Rectangle 4

How many did you find?

There are exactly three. If you found four, check whether two of them are the same one turned sideways.

For the grown-up. The three are 1×12, 2×6 and 3×4. Finding that there are only three, and being sure, is a genuine piece of reasoning — it connects straight to the factors of 12.

Measure the fence

Every rectangle has the same amount of grass inside. Now count the fence around each.

count · measure · write

Two different questions

Area is the grass inside — how many squares it covers. **Perimeter** is the fence around the edge — how far you would walk to get all the way round.

rectangle	across	down	area (squares)	perimeter (sides)
1				
2				
3				

What stayed the same?

What changed?

Which shape needs the least fence?

And which needs the most?

least

most

Look at their shapes. What do you notice about the one that needs least?

For the grown-up. The squarer the rectangle, the shorter the perimeter for the same area. She does not need that sentence — she needs to notice that the long thin one needed almost twice as much fence.

Now the other way round

Same fence, different grass. This is the one that catches people out.

build · count · write

Fourteen sides of fence

Make a rectangle whose perimeter is **14**. Then make a different one, also **14**. Draw both.

area ____ area ____

So is this true or not true?

A bigger perimeter always means a bigger area _______________

Two shapes with the same area must have the same perimeter _______________

A wide shape always has more area than a tall one _______________

You have already proved all three of these on this page.

For the grown-up. All three are false, and she has the evidence in front of her. This is the tangle that lasts for years if it is never taken apart properly.

Design a real garden

You have 20 metres of fence. Design the garden with the most growing space.

design · work it out · explain

What you are choosing between

The fence is fixed at **20 m**. The garden must be a rectangle with whole-metre sides. You want as much space inside as you can get.

across (m)	down (m)	fence used (m)	growing space (m^2)
1			
2			
3			
4			
5			
6			
7			
8			
9			

Draw your best one

Which won?

Why did that shape win?

Mission three is finished. Colour in the third badge.

For the grown-up. The answer is 5 × 5, and square metres are the right unit. Filling the table in fully is the point — the pattern only becomes visible across all nine rows.

MISSION FOUR

The Bridge That Holds

Build a paper bridge, load it until it fails, change one thing, and prove the change worked.

Read all the steps first. You do not have to start today.

- [ ] **Step 1** Build your first bridge and find out how much it holds
- [ ] **Step 2** Learn what a strut is and what a tie is, then look at real bridges
- [ ] **Step 3** Change one thing only, test again, and record both results
- [ ] **Step 4** Run the test three times and work out the mean

One step is a whole session. Tick each step when it is done. Stopping between two steps is fine, even for a week.

For the grown-up. Paper or card, two piles of books for the supports, and coins as the load. Failure is the data here, so let it collapse. Step 4 is where the mean stops being a procedure and becomes useful.

Build it and break it

One sheet of paper across a gap. Add coins until it gives way.

build · count · record

- [ ] Make two towers of books, 15 cm apart
- [ ] Lay one flat sheet of paper across the gap
- [ ] Add coins to the middle, one at a time, counting as you go
- [ ] Stop when it touches the table. Write down the number of coins.

Draw it from the side, before and after

before

after

The numbers

gap between the books (cm)	
coins it held	
how far it sagged (mm)	

A flat sheet usually holds very few. That is expected.

What went wrong?

Where did it fail, and what was it doing just before?

For the grown-up. A flat sheet holds almost nothing, and that is the useful starting point. If it holds a lot, the gap is too small — widen it until the first test fails quickly.

Struts and ties

Every part of a structure is being either squashed or stretched. Which one tells you what it is.

look | label | talk

Two jobs

A **strut** is being **squashed** — pushed in at both ends. It holds things apart.
A **tie** is being **stretched** — pulled at both ends. It holds things together.

part	squashed or stretched?	so it is a...
a table leg		
a washing line		
the rope on a swing		
a tent pole		
a guy rope on a tent		
a chair back		

Go and look at a real bridge

A photo counts. Draw it and label one strut and one tie.

Why triangles?

Push the corner of a square made of straws. Now push a triangle.

which one keeps its shape?

For the grown-up. Struts and ties are genuinely new in Grade 3 (D2.7). The squashed-or-stretched question is the whole test, and it works on anything in the room.

Change one thing

One change. Test it. Write down both numbers. Never change two things at once.

rebuild · test · record

Why only one thing

Suppose you fold the paper *and* shorten the gap, and it suddenly holds twenty coins. Which change did it? You cannot tell. The test proved nothing.

Pick one change

fold it into a zigzag · roll it into tubes · make an arch · add a strut underneath · fold the edges up

	bridge 1 (flat)	bridge 2 (changed)
what I changed		
gap (cm) — must be the same		
paper — must be the same		
coins it held		

Did it work?

How many more coins? And why do you think the change helped?

For the grown-up. Keeping the gap and the paper identical is the whole of a fair test. If she changes the gap too, say so and let her rerun it — noticing an unfair test is the skill.

Three goes, and the mean

> One test is luck. Three tests is evidence.

test three times · find the mean · write

go	coins held
1	
2	
3	
all three added together	
shared between 3 — the mean	

Why bother with three?

Were your three numbers the same? What made them different?

Say what you found

Finish this properly, like a scientist would.

I changed ___________________________ .

The flat bridge held _______ coins on average.

My changed bridge held _______ coins on average.

So ____ .

Mission four is finished. Colour in the fourth badge.

For the grown-up. This is the mean doing an actual job rather than being a sum. Three results that differ, and one number that summarises them, is exactly why the average was invented.

MISSION FIVE

Then and Now, Right Here

Find out what your own street was like before anybody now alive can remember.

Read all the steps first. You do not have to start today.

	Step 1	Work out how old your area is, and who was here first
	Step 2	Ask the oldest person you can find what it was like when they were your age
	Step 3	Find out what was here in about 1830, before living memory
	Step 4	Draw the same place three times: 1830, your grown-up's childhood, and today

One step is a whole session. Tick each step when it is done. Stopping between two steps is fine, even for a week.

For the grown-up. History outside living memory is new in Grade 3 and it is genuinely hard — 1830 is not a story anybody can tell her first-hand. The interview in step 2 bridges that gap. A local library or the town's website will have more than you expect.

Who was here first?

Long before any street was built, people were already living here.

find out · write · ask

Three layers of history

First — the First Nations who have lived here for thousands of years, and still do. **Then** — settlers arriving from about 1780. **Then** — everybody since.

The land you live on

Which First Nations are connected to where you live? Many schools and town websites say this at the top of the page.

Is there a treaty covering your area? What is it called?

When was your town or city started?

How many years ago is that?

What is the oldest building near you?

Roughly what year?

For the grown-up. Land acknowledgements are usually the quickest route to the first question and are worth reading together properly rather than skimming. The point is that the history did not start in 1780.

Ask somebody who was there

Find the oldest person who will talk to you. Ask them what it was like when they were eight.

interview · write down · listen

How to interview somebody

Ask the question, then **be quiet** and let them think. The best bit almost always comes after the pause. Write down what they actually said, not what you expected them to say.

Who did you ask, and how old were they?

What did you do after school when you were my age?

What is here now that was not here then?

What was here then that has gone?

What has not changed at all?

The most surprising thing they said

For the grown-up. Recording it on a phone takes the pressure off the writing entirely and she can transcribe the best line afterwards. Grandparents and neighbours in their eighties reach back to the 1950s, which is most of the way to living memory's edge.

Back before anybody remembers

About 1830. Nobody alive can tell you. You have to find it out another way.

research | write | work it out

Where to look

- the town or city website
- a local library
- a museum
- an old map online
- a street name that gives it away
- the plaque on an old building

in about 1830, near here...	what I found out
was there a town here at all?	
what did people do for work?	
how did people travel?	
was there a school?	
what was the land covered in?	

Do the arithmetic

the year now ____ 1830 ____ years between ____

Roughly how many grown-up lifetimes is that? Count about 70 years to a lifetime.

____

One thing that genuinely surprised you

____

____

For the grown-up. If your area was not settled until much later, that is a real and interesting finding — write down what *was* here instead. Forest, farmland, or nothing marked on any map at all.

The same place, three times

One spot near your home. Draw it as it is now, as your grown-up described it, and as it was in 1830.

draw · label · show somebody

About 1830

from what you found out

When they were eight

from the interview

Today

go and look

What changed the most?

What is still exactly the same?

Mission five is finished. Colour in the fifth badge.

For the grown-up. The land itself — a river, a hill, the direction the sun sets — is usually the answer to the second question, and noticing that is the beginning of geography.

MISSION SIX

The Deep Dive

Pick the one thing you already know most about, and become the person who really knows it.

Read all the steps first. You do not have to start today.

- [ ] **Step 1** Choose your subject and write down what you already know
- [ ] **Step 2** Find out five things you did not know, and where each one came from
- [ ] **Step 3** Build a word family from the words your subject uses
- [ ] **Step 4** Write one proper paragraph, with a topic sentence and evidence
- [ ] **Step 5** Teach it to somebody, in whatever way suits you

One step is a whole session. Tick each step when it is done. Stopping between two steps is fine, even for a week.

For the grown-up. This mission runs on whatever she is already deep in — trains, sharks, a game, weather, a period of history. Depth of interest is an asset here, not a distraction. Step 5 offers four ways to present, including one that involves no talking at all.

Choose it, and empty your head

One subject. Something you already like. Write down everything you already know, before you look anything up.

brain dump | talk

My subject is

Everything I already know

Do not stop to check anything. Do not worry about spelling. Just get it all down.

Three things I am not sure about

These become your questions for the next page.

For the grown-up. Emptying her head first does two things: it shows how much she already has, and the gaps she finds herself are far better research questions than any you could set.

Find out five new things

Five things you did not know. And for each one, where you found it.

research · write · check it

Where it came from matters

A fact with no source is just a rumour. Write down where each one came from, so you could find it again. If two places disagree, that is worth writing down too.

what I found out	where from

Which one surprised you most?

Did anything you already believed turn out to be wrong?

This happens to everybody who looks properly. It is a good sign.

For the grown-up. Naming the source is the beginning of judging one. If she uses a video, the channel counts as the source. Two sources disagreeing is the most useful thing that can happen here.

The words your subject uses

Every subject has its own words. Take one and build its whole family.

build it | break it up | say them

One base, a whole family

From **volcano**: volcanic, volcanically, volcanology. From **construct**: construction, constructing, reconstruct, deconstruct, constructive.
Cover the ending with a finger, read the base, then uncover.

A long word from my subject

the base

front bits

end bits

The whole family

How many can you make from that one base?

Five words a beginner would not know

Write the word, then explain it in your own words.

word	what it means

For the grown-up. Building a family from one base teaches a system rather than a list, and doing it inside a subject she cares about is why the words stick.

Write one proper paragraph

Not a whole report. One paragraph, built properly.

draft · then edit

What a paragraph is made of

A **topic sentence** says what the paragraph is about. **Detail sentences** back it up with evidence. A **closing sentence** rounds it off. Every sentence has to be about the topic sentence.

My topic sentence

The draft

Three or four detail sentences and a closing one. Do not stop for spelling. That is the next job, not this one.

Now edit it

- capital letters
- full stops
- spellings I checked
- every sentence is about the topic
- read it out loud

For the grown-up. Drafting and editing are separated on purpose. If she corrects while writing, the ideas stop. Reading it out loud at the end catches more than proofreading does.

Teach it to somebody

You know more about this than they do. Pick the way that suits you.

or not · or draw · or make

Choose how

	Tell them	out loud, with your paragraph in front of you if you want it
	Show them	a poster or a diagram, and let them read it while you point
	Make them something	a model, a map, a quiz, a comic
	Record it	say it into a phone once, on your own, and play it to them

All four count. Speaking out loud to a person is not better than the others — it is just one of them.

Who did you teach?

What did they ask you?

Something you know now that you did not know three sessions ago

That is all six missions. Colour in the last badge.

For the grown-up. Offering four ways to present, and saying plainly that none is better, removes the single biggest barrier to this kind of task. The recording option is often the one that gets chosen, and it is a real presentation.

Four games worth keeping

No board, no pieces, no timer. All of these can be played in a car.

play count

1 · Is It True?

One person says something like **6 × 5 = 3 × 10**. The other says true or not true, and has to say why.

Sneaky ones are the good ones. **4 × 5 = 10 × 2** is true. **7 + 8 = 8 + 7** is true and does not need working out at all.

2 · Round It

Somebody says a number under 1000. Everybody else says it rounded to the nearest hundred. Then swap.

Harder version: say whether rounding would be sensible for that number in real life, and why.

3 · Cover the Ending

Say a long word. The other person has to find the base word inside it. *Unbelievable* → **believe**.

Score a point for the base and a bonus for naming all the bits.

4 · Which Words Made You Think That?

Read anything out loud, stop, and ask a question the text does not answer directly. The other person answers and then has to point at their evidence.

Works on a novel, a cereal packet, or a road sign.

For the grown-up. These four target the four things the curriculum guide says matter most, and none of them needs anybody to sit at a table. Is It True? is the one worth playing all year.

Work it out

Take these slowly. Read each one twice before you write anything.

think · write

1 · The four cousins

Ada, Bo, Cai and Dee are 7, 8, 9 and 10.
Bo is older than Cai. Ada is the youngest. Dee is not 10. Cai is younger than Dee.
How old is each one?

Ada	Bo	Cai	Dee

2 · The fence and the grass

A rectangle has an area of 24 squares.
One side is 4 squares long. How long is the fence all the way round?

perimeter

3 · The coins

You have four coins that add up to 85¢.
None of them is a penny. Which four?

4 · The missing week

Five days of rain: 3 mm, 0 mm, 7 mm, 2 mm and one day missing.
The mean was 3 mm. How much rain fell on the missing day?

For the grown-up. Number four is the mean run backwards, which is much harder than finding one. If she is stuck, ask what all five days must add up to for the mean to be 3.

Word benders

More than one answer is fine on most of these.

write | look for parts

Break them up

Front bits, base, end bits.

unbreakable ________________

rediscovering ________________

thoughtlessly ________________

disappearance ________________

One base, many words

How many can you make from **port**? It means *carry*.

Hidden inside

A smaller word is hiding in each. Circle it.

understand **friendship**

important **somewhere**

grandmother **carpet**

Say what you mean

Replace *nice* and *good* with a sharper word.

a nice day ________________

a good book ________________

a nice person ________________

a good idea ________________

For the grown-up. *Ningredient* is a typo on purpose — see if she spots it. If she does, that is better proof of close reading than any of the answers.

Number benders

Some of these have more than one answer. Find as many as you can.

work it out | write

Missing digits

2 □ 4 + 1 3 □ = 4 0 0

□ 6 5 − 1 4 □ = 2 2 0

5 × □ = 4 5

□ ÷ 10 = 8

Make 100

Use two of these each time.

25 | 35 | 40 | 45 | 55 | 60 | 65 | 75

□ + □ = 100

□ + □ = 100

□ + □ = 100

The rounding trap

Two numbers both round to **400** to the nearest hundred. One of them is 351. What is the biggest the other one could be?

□

And what is the smallest number that rounds to 400?

□

For the grown-up. The rounding trap is genuinely hard and worth doing together. 449 rounds down to 400; 450 rounds up to 500. The boundary is the interesting bit.

The test in Grade 3

Some time this year you will do EQAO. Here is what it actually is.

read together | write

What it is for

EQAO checks how **the whole province** is doing. It is a measure of schools, not a measure of you.

Your teacher already knows what you can do. They have watched you all year. One morning in the spring does not tell them anything they do not know.

Things that genuinely help

______	Sleep. It helps more than any revision does.
______	Read the question twice. Most lost marks are misread questions, not unknown answers.
______	Watch for words like NOT and EXCEPT — they flip the whole meaning.
______	If you are stuck, skip it and come back. Leaving it blank is worse than a guess.
______	Feeling nervous is normal. Nearly everybody does, and it passes.

If it feels like too much

Tell somebody. There are things a school can do — a quieter room, more time, breaks. Asking for them is allowed and it is not cheating.

Write down one thing that would make it easier for you.

____

____

For the grown-up. If your child has an IEP, accommodations apply to EQAO and are worth confirming with the school well before the week itself. Saying out loud that the test measures the school rather than the child is more reassuring than it sounds.

Twelve things to go and do

None of these need this book. Tick them off in any order, over any length of time.

go · look · talk

- [ ] Share one biscuit fairly between three people, then between five. Look at the pieces.
- [ ] Measure something with a broken ruler on purpose, starting at 4 cm.
- [ ] Find something in the kitchen that is about one kilogram. Then check it.
- [ ] Count something in fifties until you get past 500.
- [ ] Find a triangle holding something up, somewhere outdoors.
- [ ] Dig a small hole and look at how the soil changes going down.
- [ ] Time yourself doing something, to the nearest second.
- [ ] Work out the perimeter of a room by walking round it heel to toe.
- [ ] Find a graph in a newspaper or on a packet, and read its key out loud.
- [ ] Ask somebody over seventy what has changed most in their lifetime.
- [ ] Take one long word off a food packet and break it into parts.
- [ ] Explain something you understand well to somebody who does not.

The one you liked best, and why

For the grown-up. Every one of these is a Grade 3 expectation doing its job away from a worksheet. The last one is the most valuable and the least like school.

You got to the end

Six investigations, twelve warm-ups, four games and a pile of puzzles.

Which mission taught you the most?

The Cake Problem · The Soil Shake · Twelve Squares · The Bridge That Holds · Then and Now · The Deep Dive

What did it teach you?

Something you believed at the start that turned out to be wrong

A question you still want to answer

✓ Answers, for the pages that have them

Sheet 4.	407 is not 47. 560 has 6 tens. 903 has 0 tens. 850 is bigger than 805.	**Sheet 5.**	47→50, 0 · 152→150, 200 · 385→390, 400 · 608→610, 600 · 749→750, 700 · 896→900, 900.	**Sheet 6.**	True, true, true, not true (6 and 8), true, true.	**Sheet 7.**	Nadia 20, Ben 30, Priya 17 or 18, Ben 20 more than Sam, 77 or 78 altogether.	**Sheet 8.**	The towers all level at 5. Your turn: both sets come to 6.	**Sheet 9.**	8, 9, 7, 13, 19, 14 cm.	**Sheet 10.**	Cube 6/12/8 · rect prism 6/12/8 · square pyramid 5/8/5 · triangular prism 5/9/6 · cylinder 2 flat faces, 2 edges, 0 vertices · cone 1 flat face, 1 edge, 1 vertex.	**Sheet 46.**	Ada 7, Cai 8, Dee 9, Bo 10. Perimeter 20. Coins: 25+25+25+10. (50+25+5+5 also works if you have a fifty-cent piece, which most people do not.) Missing day 3 mm.	**Sheet 47.**	Hidden words include under, stand and and in	*understand*	; friend, end and ship in	*friendship*	; impor port and ant in

What next? Every mission in here can be run again and come out differently. Soil from a different place settles into different layers. A deep dive into a new subject is a completely new mission. Doing one twice is not going backwards.