## Using Numberless Prompts to Deconstrucł Word Questions, Y4 $\rightarrow \mathbf{Y} 6$

Build understanding of the deep structure of multi-step word questions. Focus thinking on structures, give all children success, break questions into small steps, vary the challenge.


potatoes
$£ 1.50$ per kg

carrots
$£ 1.80$ per kg

potatoes
$£ 1.50$ per kg

carrots
$£ 1.80$ per kg

Jack buys $\square \mathrm{kg}$ of potatoes and $\bigsqcup \mathrm{kg}$ of carrots.

potatoes
$£ 1.50$ per kg

carrots
$£ 1.80$ per kg

Jack buys $\square \mathrm{kg}$ of potatoes and $\bigsqcup \mathrm{kg}$ of carrots.
How much change does he get from $£ 5$ ?

potatoes
$£ 1.50$ per kg

carrots
$£ 1.80$ per kg

Jack buys $1 \frac{1}{2} \mathrm{~kg}$ of potatoes and $\frac{1}{2} \mathrm{~kg}$ of carrots.
How much change does he get from $£ 5$ ?

A box contains 2.6 kg of washing powder.


Jack uses 65 grams of powder for each wash.
He uses all the powder.

## A box has 500 of cereal.

How many washes did Jack do?

## One bowl of cereal is 508 .

## Question:

 How manyhave

When students are presented with a mathematics word problem, their first response often is to try to compute an answer, even before they have tried to understand the problem.

Studies of expertise have shown that experts attend more to the underlying structure of a problem, whereas novices rely more on surface features.

Expert problem solvers typically spend more time thinking about problems and trying to understand them than do novices, who tend to immediately execute a solution.

Removing Opportunities to Calculate Improves Students' Performance on Subsequent Word Problems. Givvin and Stigler (2019)

A group of tourists planned a 3-day walking trip from Big Rock to Eagles Landing, a total of 66 km . On the first day they walked 22 km . On the second day they walked 20 km . How far would they have to walk on the third day of their trip?

A group of tourists planned a 3-day walking trip from Big Rock to Eagles Landing. On the first day they walked one third of the total distance. On the second day they walked a little less. How far would they have to walk on the third day of their trip?

Removing Opportunities to Calculate Improves Students' Performance on Subsequent Word Problems. Givvin and Stigler (2019)

Participants who explained the non-calculable problems performed significantly better on the transfer test than participants who explained the calculable problems.

We hypothesized that the mechanism at play was a reduction in instrumental thinking and an increase in relational thinking.

Removing Opportunities to Calculate Improves Students' Performance on Subsequent Word Problems. Givvin and Stigler (2019)

Lola gives $£ 655$ to two charities.


She shares it so that the 'Donkey Rescue Centre' gets 4 times as much as the 'Home for Stray Dogs'.

How much does each charity receive?

Lola gives $£ \mathbf{2 4}$ to two charities.


She shares it so that the 'Donkey Rescue Centre' gets $\mathbf{2}$ times as much as the 'Home for Stray Dogs'.

How much does each charity receive?

Lola gives $\mathbf{£ 2 4}$ to two charities.


Home for Stray Dogs

She shares it so that the 'Donkey Rescue Centre' gets $\mathbf{2}$ times as much as the 'Home for Stray Dogs'.

How much does each charity receive?

Lola gives $£ \mathbf{2 4}$ to two charities.


She shares it so that the 'Donkey Rescue Centre' gets $\mathbf{3}$ times as much as the 'Home for Stray Dogs'.

How much does each charity receive?

Lola gives £24 to two charities.


Home for Stray Dogs

She shares it so that the 'Donkey Rescue Centre' gets $\mathbf{3}$ times as much as the 'Home for Stray Dogs'.

How much does each charity receive?

Lola gives $\square$ to two charities.

| Donkey Rescue <br> Centre |
| :---: |



She shares it so that the 'Donkey Rescue Centre' gets $\mathbf{3}$ times as much as the 'Home for Stray Dogs'.

She gives $£ 24$ to the Home for Stray Dogs.


She shares it so that the 'Donkey Rescue Centre' gets $\mathbf{3}$ times as much as the 'Home for Stray Dogs'.

She gives $£ 24$ to the Home for Stray Dogs.

Lola gives $\square$ to two charities.

| Donkey Rescue <br> Centre |
| :---: |



She shares it so that the 'Donkey Rescue Centre' gets $\mathbf{3}$ times as much as the 'Home for Stray Dogs'.

She gives $£ 24$ to the Donkey Rescue Centre.


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She gives $£ 24$ to the Donkey Rescue Centre.

1. Tom splits $£ 300$ between two charities. He gives Oxfam twice as much as Barnardo's. How much money does he give to Oxfam?
2. Amy splits £300 between two charities. She gives RSPCA three times as much as Age Concern. How much money does she give to RSPCA?
3. Raj spends three times as much on music as on computer games. He spends $£ 60$ on computer games. How much does he spend on music?
4. Hannah spends 60 minutes longer cycling than running per week. She spends three times as much time cycling compared to running. How much time does she spend running per week?
£60


## Small Difference Questions

Question 1: For every 2 boys in Year 4, there are 3 girls. There are 30 girls in Year 4. How many children in Year 4?
Question 2: For every 2 girls in Year 5, there are 3 boys. There are 30 boys in Year 5. How many girls in Year 5?
Question 3: For every 2 boys in Year 6, there are 3 girls.
There are 30 children in Year 6. How many boys in Year 6?
Extend: write your own question to continue this sequence.


## Small Difference Questions

Question 1: For every 2 boys in Year 4, there are 3 girls. There are 30 girls in Year 4. How many children in Year 4?
Question 2: For every 2 girls in Year 5, there are 3 boys. There are 30 boys in Year 5. How many girls in Year 5?
Question 3: For every 2 boys in Year 6, there are 3 girls.
There are 30 children in Year 6. How many boys in Year 6?
Extend: write your own question to continue this sequence.


## Small Difference Questions

Question 1: For every 2 boys in Year 4, there are 3 girls. There are 30 girls in Year 4. How many children in Year 4?
Question 2: For every 2 girls in Year 5, there are 3 boys. There are 30 boys in Year 5. How many girls in Year 5?
Question 3: For every 2 boys in Year 6, there are 3 girls.
There are 30 children in Year 6. How many boys in Year 6?
Extend: write your own question to continue this sequence.


Question 2: There were 18 children at running club. There were two girls for every boy at running club. Then, two boys left running club.
Now, how many girls for every boy at running club?


Laura has a bag of jelly beans.
She eats $\frac{3}{8}$ of them.
She has 15 left.
How many jelly beans were in the bag?

## $\square$ jelly beans in the bag. Laura eats $\square$ of them. She has $\square \mathrm{left}$.

36 jelly beans in the bag. Laura eats 19 of them. She has $\square$ left.


36 jelly beans in the bag. Laura eats $\frac{3}{4}$ of them. She has $\square$ left.

$\square$ jelly beans in the bag. Laura eats $\frac{3}{5}$ of them. She has 12 left.


1. Sam's book is 300 pages long. He has read 160 pages. How many pages does he have left?
2. Ava's has read 126 pages of her book. She has 63 pages left. How many pages are there in the book?
3. Emma's book is 120 pages long. She has read $\frac{1}{4}$ of her book. How many pages does she have left?
4. Dan's book is 120 pages long. He has read $\frac{3}{4}$ of his book. How many pages does he have left?
5. Harry has read $\frac{3}{4}$ of his book. He has 50 pages left. How long is Harry's book?

## ABDE is a rectangle on coordinate axes.

The sides of the rectangle are parallel to the axes.

$(10,12)$
$(18,5)$
$(11,8)$
$(22,16)$

## -

ABDE is a rectangle on coordinate axes.
The sides of the rectangle are parallel to the axes.


$$
\text { What are the coordinates of } \mathbf{B} \text { and } \mathbf{D} \text { ? }
$$

ABDE is a rectangle on coordinate axes.
The sides of the rectangle are parallel to the axes.


Point $\mathbf{C}$ is the centre of the rectangle.

What are the coordinates of $\mathbf{B}$ and $\mathbf{D}$ ?

ABDE is a rectangle on coordinate axes.
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## Small Variation, Sequences of Questions

Removing numbers, reducing language, making different questions by varying the unknown
Questions to use, visual representations, planning questions, differentiation

Sequences of questions that gradually increase in challenge
Finding/writing the sequences, benefits, drawbacks, adding depth

## Building Questions

For each question, give the missing information:

Melons: 90p
Pineapples: 75p
Mangoes: 55p

| Information | Question | Answer |
| :---: | :---: | :---: |
|  | How much <br> change did <br> she get? | $75 p$ |
|  | How much <br> more money <br> does he need? | $15 p$ |
|  | How many <br> melons can <br> she afford? | melons |

## Building Questions

Draw lines to join the blue information to matching the red question.

Raja buys three apples and three bananas.

Mo has $£ 2$.
Ben has $£ 2$. He wants four oranges and three apples.

Matt has $£ 2$. He wants four oranges and three bananas.

Apples Oranges Bananas

$15 p$

How much change does he get?

How much does it cost him?
How many oranges can he afford?

How much more money does he need?

## Small Difference Questions

1. Zack bought a sandwich, an apple and a drink. How much did it cost?
2. Nada wants a sandwich, an apple and a drink. She has £2. How much more money does she need?
3. Jen bought a sandwich, an apple and a drink. She paid £3. How much change did she get?
4. Tom has £2.

How many apples can he afford?
5. Joy has £2.

How many oranges can she afford?
6. Andy spent £2 on 3 items. He got 80p

Sandwiches: $£ 1.80$
Oranges: 35p
Apples: 25p
Drinks: 50p change. What does he buy?

## Explore

At the market, apples cost 25 p each.
At the shop, it costs $£ 1.10$ for a bag of 6 apples.
Using this information, think of a question that involves:
(a) Multiplication
(b) Multiplication and addition
(c) Multiplication and subtraction
(d) Division

## Contexts

Which operation(s) does each question involve?
addition subtraction multiplication division
(a) Tim is years old. Jack is $\square$ years old.

When Tim is , how old will Jack be?
(b) Zara has $\square$ t-shirts, $\square$ pairs of trousers and $\square$ hats. How many different outfits can Zara wear?
(c) Holly is saving for a bike that costs £ . She has $£$ Holly earns £ per week. How many weeks will Holly need to save up for?

## Explore

1500 people are travelling from Sheffield to Leeds to go to the match. They travel by car or by coach. 200 people fit in a coach. 5 people fit in a car.
Using this information, think of a question with the answer:
(a) 6 coaches
(b) 140 cars

Amina is making designs with two different shapes.
She gives each shape a value.


Total value is 147


Total value is 111

## Calculate the value of each shape.



## Agree or Disagree?

2 oranges and a pear cost $£ 1.25$


Pears cost 70p
Pears cost 35p

2 oranges and 3 pears cost $£ 1.95$


## Explore



A box of chocolates weighs 280g.
The box contains 8 identical chocolates.
Manish eats 3 chocolates.
The box of chocolates now weighs 199g.
If the box is empty, how much would it weigh?


$$
\square \square \square \square \square=199 \mathrm{~g}
$$

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If the box is empty, how much would it weigh?


Tony and his 5 friends buy tickets for a musical.
They each pay £17.50

How much do they pay altogether?

Tony and his friends buy tickets for a musical.
They each pay


How much do they pay altogether?

Tony and his $\mathbf{3}$ friends buy tickets for a musical.
They each pay $\mathbf{£ 2 0}$
£20
£80

How much do they pay altogether?

## Misconceptions



Tick $(\checkmark)$ the times the clock is showing.


## Misconceptions



Tick $(\checkmark)$ the times the clock is showing.


## Misconceptions



Tick $(\checkmark)$ the times the clock is showing.
Twenty five minutes to twelve
11:35
Twenty five minutes to eleven
23:35


There are $\mathbf{2 0}$ big cats in the zoo altogether.


Here are some statements about the chart.

Tick the statements that are true.

There are more cheetahs than jaguars. $\square$

The total number of lions and tigers is 10

One-quarter of the big cats are cheetahs. $\square$

There are more than 5 jaguars.

## Wilmslow Albion, 2020-2021 Season

 Won: 7Drawn: 3 Lost: 10



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Here is a train timetable.

| Halifax | $13: 47$ | $13: 59$ | $14: 14$ | $14: 25$ |
| :---: | :---: | :---: | :---: | :---: |
| Bradford | $14: 00$ | $14: 12$ | $14: 27$ | $14: 38$ |
| Leeds | $14: 22$ | $14: 34$ | $14: 49$ | $15: 00$ |
| Micklefield | $14: 43$ | $14: 55$ | $15: 10$ | $15: 21$ |
| York | $15: 07$ | $15: 19$ | $15: 34$ | $15: 45$ |

Hassan needs to be in Leeds by 14:45
What time does he need to get the train from Halifax?

Here is a train timetable.

| Halifax | $13: 47$ | $13: 59$ | $14: 14$ | $14: 25$ |
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| York | $15: 07$ | $15: 19$ | $15: 34$ | $15: 45$ |

At what time does the $3^{\text {rd }}$ train...
How long does it take to travel from...

Tim is going from... to... He needs to arrive at... At what time...

Here is a train timetable.

| Halifax | $13: 47$ | $13: 59$ | $14: 14$ | $14: 25$ |
| :---: | :---: | :---: | :---: | :---: |
| Bradford | $14: 00$ | $14: 12$ | $14: 27$ | $14: 38$ |
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| Micklefield | $14: 43$ | $14: 55$ | $15: 10$ | $15: 21$ |
| York | $15: 07$ | $15: 19$ | $15: 34$ | $15: 45$ |

## How long is the journey?

Here is a train timetable.

| Halifax | $13: 47$ | $13: 59$ | $14: 14$ | $14: 25$ |
| :---: | :---: | :---: | :---: | :---: |
| Bradford | $14: 00$ | $14: 12$ | $14: 27$ | $14: 38$ |
| Leeds | $14: 22$ | $14: 34$ | $14: 49$ | $15: 00$ |
| Micklefield | $14: 43$ | $14: 55$ | $15: 10$ | $15: 21$ |
| York | $15: 07$ | $15: 19$ | $15: 34$ | $15: 45$ |

Joy gets the $2^{\text {nd }}$ train from Bradford to York.
How long is the journey?

Here is a train timetable.

| Halifax | $13: 47$ | $13: 59$ | $14: 14$ | $14: 25$ |
| :---: | :---: | :---: | :---: | :---: |
| Bradford | $14: 00$ | $14: 12$ | $14: 27$ | $14: 38$ |
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| Micklefield | $14: 43$ | $14: 55$ | $15: 10$ | $15: 21$ |
| York | $15: 07$ | $15: 19$ | $15: 34$ | $15: 45$ |

## At what time does her train depart from Leeds?

Here is a train timetable.

| Halifax | $13: 47$ | $13: 59$ | $14: 14$ | $14: 25$ |
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| Bradford | $14: 00$ | $14: 12$ | $14: 27$ | $14: 38$ |
| Leeds | $14: 22$ | $14: 34$ | $14: 49$ | $15: 00$ |
| Micklefield | $14: 43$ | $14: 55$ | $15: 10$ | $15: 21$ |
| York | $15: 07$ | $15: 19$ | $15: 34$ | $15: 45$ |

Kelly arrives in York at 15:34
At what time does her train depart from Leeds?

Here is a train timetable.

| Halifax | $13: 47$ | $13: 59$ | $14: 14$ | $14: 25$ |
| :---: | :---: | :---: | :---: | :---: |
| Bradford | $14: 00$ | $14: 12$ | $14: 27$ | $14: 38$ |
| Leeds | $14: 22$ | $14: 34$ | $14: 49$ | $15: 00$ |
| Micklefield | $14: 43$ | $14: 55$ | $15: 10$ | $15: 21$ |
| York | $15: 07$ | $15: 19$ | $15: 34$ | $15: 45$ |

## What time does he need to get the train from Halifax?

Here is a train timetable.

| Halifax | $13: 47$ | $13: 59$ | $14: 14$ | $14: 25$ |
| :---: | :---: | :---: | :---: | :---: |
| Bradford | $14: 00$ | $14: 12$ | $14: 27$ | $14: 38$ |
| Leeds | $14: 22$ | $14: 34$ | $14: 49$ | $15: 00$ |
| Micklefield | $14: 43$ | $14: 55$ | $15: 10$ | $15: 21$ |
| York | $15: 07$ | $15: 19$ | $15: 34$ | $15: 45$ |

Hassan needs to be in Leeds by 14:45
What time does he need to get the train from Halifax?

## Agree or Disagree? Train timetable:

| Manchester | $7: 15$ | $8: 31$ | $9: 44$ | $11: 02$ |
| ---: | :---: | :---: | :---: | :---: |
| Huddersfield | $7: 43$ | $9: 01$ | $10: 15$ | $11: 33$ |
| Dewsbury | $7: 55$ | $9: 11$ | $10: 25$ | $11: 42$ |
| Leeds | $8: 10$ | $9: 27$ | $10: 39$ | $11: 57$ |
| York | $8: 34$ | $9: 52$ | $11: 04$ | $12: 23$ |

> The first train arrives in York at 11:02

It takes 26 minutes for the second train to get from Huddersfield to Leeds

It takes 15 minutes to travel from Dewsbury to Leeds

If I get to Manchester station at 8:40 and get the next train, I will arrive in York at 9:52

## Read the Table

Train timetable:

| Manchester | $7: 15$ | $8: 31$ | $9: 44$ | $11: 02$ |
| ---: | :---: | :---: | :---: | :---: |
| Huddersfield | $7: 43$ | $9: 01$ | $10: 15$ | $11: 33$ |
| Dewsbury | $7: 55$ | $9: 11$ | $10: 25$ | $11: 42$ |
| Leeds | $8: 10$ | $9: 27$ | $10: 39$ | $11: 57$ |
| York | $8: 34$ | $9: 52$ | $11: 04$ | $12: 23$ |

1. At what time does the third train arrive at Dewsbury?
2. How long does the fourth train take to go from Manchester to Leeds?
3. I arrive in Huddersfield at $10: 25$. At what time does the next train leave?
4. I arrive in Dewsbury at 9:40. How long until the next train leaves?

Extend: Write two different 'how long...' questions.
Write two different 'at what time...' questions.

## What's the Question?

At Oak Vale Junior School, children are split into five different teams. They earn team points for their team.
Here are the team points for this term:

|  | Blue | Red | Green | Yellow | Orange |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Year 3 | 31 | 25 | 40 | 36 | 28 |
| Year 4 | 29 | 36 | 28 | 30 | 39 |
| Year 5 | 24 | 27 | 31 | 28 | 28 |
| Year 6 | 34 | 33 | 35 | 31 | 37 |

Create a question with the answer...
(a) 34
(b) 2
(c) blue
(d) Year 5

Create a question where, to find the answer, you need...
(e) ...four pieces of information
(f) ...five pieces of information

## Explain

Serena Williams is one of the greatest female tennis players of all time. Here are her results in the 2012-2016 seasons:

| Year | Matches <br> Won | Matches <br> Lost | Tournaments <br> Played | Tournaments <br> Won |
| :---: | :---: | :---: | :---: | :---: |
| $\mathbf{2 0 1 2}$ | 58 | 4 | 11 | 7 |
| $\mathbf{2 0 1 3}$ | 78 | 4 | 15 | 11 |
| $\mathbf{2 0 1 4}$ | 52 | 8 | 15 | 7 |
| $\mathbf{2 0 1 5}$ | 53 | 3 | 8 | 5 |
| $\mathbf{2 0 1 6}$ | 38 | 6 | 8 | 2 |

1. How many matches did Serena play in 2016 ?
2. How many tournaments did Serena win between 2012-2016?
3. Which was Serena's most successful year? Explain why.
4. What was Serena's second most successful year? Explain why.

Predicting questions, identifying required information Removing numbers, exploring inverses

Representing key ideas, addressing misconceptions
Writing sequences of questions with small differences
Deepening or opening up challenges

