Planning a successful Number Partner Challenge

What does the Challenge involve?

The Number Partner Challenge consists of four weeks of activities based on problem solving, mental maths, team work and logic, adapted from those available on the **NRICH** website.

Each challenge is designed to fit into a normal Number Partner session and so should be completed in a maximum of 30 minutes. Business volunteers should help their team complete as much as possible in the time, but incomplete entries can still be submitted and marked.

The Challenge Pack contains a volunteer explanation sheet with tips, an entry form for final solutions, and any other resources needed (e.g. hundred square) for each part of the challenge.

Who can take part?

Number Partner volunteers or teachers can register teams of 2-4 children. Make sure all the adult helpers involved provide their email address and understand that the activities and information will be emailed to them weekly.

The challenges are designed so that different ages and abilities can take part because they do not necessarily have to complete the task to be in with a chance of getting the best score. However, we recommend the challenge for pupils aged 8-11.

What happens each week?

Each week, the tip sheet and entry form should be sent round to volunteers and teachers at the schools taking part. You should set a deadline for when entries must be submitted by, for example 3pm on Friday of the same week.

After 3 weeks, all of the scores will be added up and the top teams will be invited to a Grand Final. Instructions and a tip sheet for your Final are included in the Challenge Pack.

Your Grand Final could be held in the offices of a business taking part in the challenge, or you could ask a school to host. You will need approximately 2 hours to set up, deliver the Grand Final activity, mark entries and award prizes.

What does the winning team receive?

In Tower Hamlets, where the Challenge first ran, the winning team and runners up won a trip to a University for an aspiration day. Runners up teams received Number Partner board games for their school, as well as small individual prizes. All those that took part received a certificate and badge (even if they don't reach the final).

The Challenges

Week 1 – Domino Patterns

Teams will be given a worksheet containing 8 sets of dominoes. The middle domino in each set is blank, and teams will need look for a pattern to work out what the missing domino should be.

Week 2 – QR Code

A series of mental maths questions using all 4 functions need to be answered, before the answers are plotted onto an incomplete QR code grid. Once the grid is completed, it can be scanned to discover a YouTube clip!

Week 3 – Shape Shifting

Work out and plot coordinates to translate and rotate shapes on a grid. Knowledge of coordinates and axes is needed here, as well as accuracy when drawing.

Week 4 – Noah's Ark

Noah has been watching pairs of animals come onto his ark all day, and counting their legs. He is quite forgetful and needs help remembering how many of each animal he has seen. From the number of legs given, teams must work out all the possible combinations that there could have been.

The problem can be distributed to volunteers in advance so that they are confident to support their teams. Judges (either teachers or extra volunteers) and team leaders have a judging criteria sheet to guide pupils to present the correct information and mark answers. While the entry sheets are being marked, the teams can have a break and a snack, before a winning team is announced.

If you need any advice or extra guidance about running your Number Partner Challenge, please contact;

Becky Feetham
Primary Project Manager
Tel: 020 7655 0302
Email: Becky.Feetham@thebp.co.uk

Tower Hamlets Education Business Partnership
First Floor, Norvin House
45-55 Commercial Street
London
E1 6BD
Registered Charity No: 1040962

Number Partner Challenge
Partner Tip Sheet
Round One: Domino Patterns

There are 16 points up for grabs in this challenge! You will need to use your number skills to look for patterns. You should **spend no more than 30 minutes** on the challenge as a whole – try and get as far as you can, but incomplete entries can still be submitted.

You will need:

- Entry sheet
- Set of dominoes and scrap paper (optional)

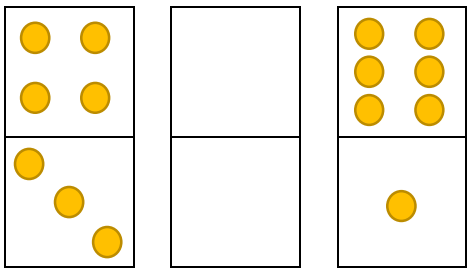
Tips for volunteers

Start by presenting the sheet with the domino sets on. Teams need to decide which domino would fit in between each pair by looking for a sensible pattern.

Give them a few minutes to study the picture to see if they can spot any patterns straight away. It may help to use real dominoes so they can be moved around. The following questions may help to prompt;

- What numbers are at the top of the dominoes - what number could come between them?
- What numbers are at the bottom of the dominoes - what number could come between them?

You could work through the following example together first, before asking them to have a go at the ones on the entry form.



You could also represent the problem numerically;

4		6
3		1

(Answers; top row = 5, bottom row = 2)

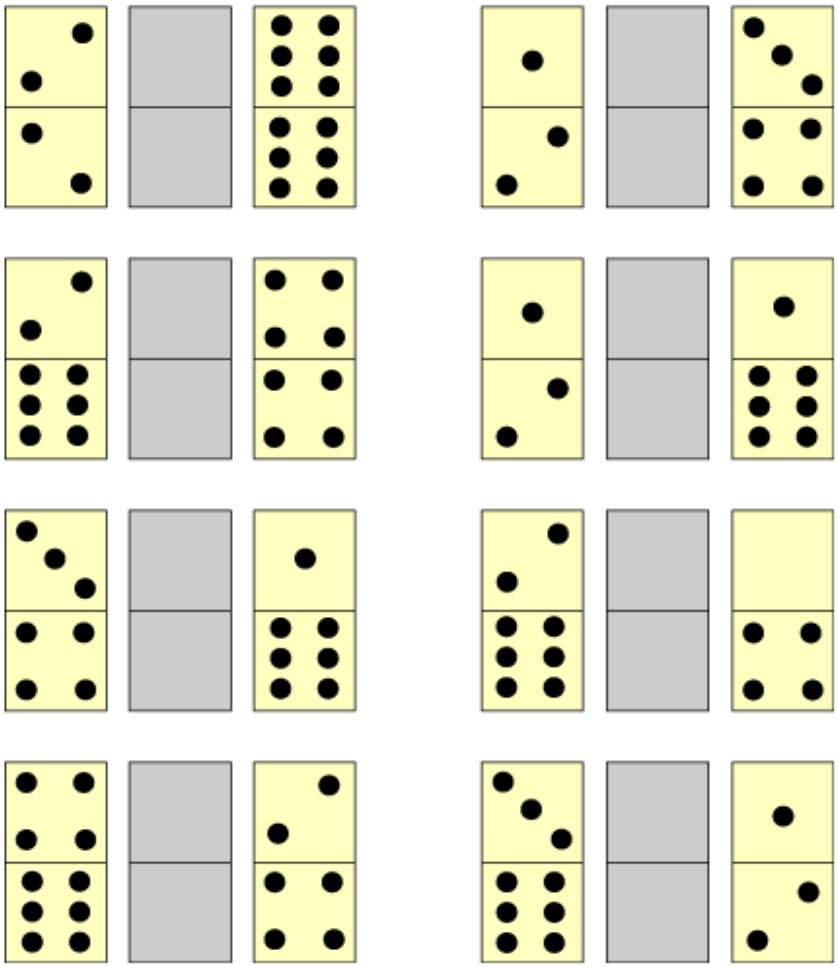
Send your entry to:

Number Partner Challenge
Team Entry Sheet Round One

Team Name:		
School Name	**Pupil Names**	**Volunteer & Company Name**

Can you work out the domino pieces which would go in the middle of each set to complete the pattern?

Fill in your answers in the spaces.



TOTAL SCORED	**/16**

Number Partner Challenge
Partner Tip Sheet
Round Two: QR Code

There are 21 points up for grabs in this activity! You will need your mental maths skills to calculate the answers to a set of sums using all four functions; **+ – ÷ ×**. You should **spend no more than 30 minutes** on the challenge as a whole – try and get as far as you can, but incomplete entries can still be submitted.

You will need:

- Entry sheet with 20 sums
- Black and white grid (QR code)
- Black marker pen
- Smart phone/QR reader (if available)

Tips for volunteers

There are 20 simple sums for teams to work through. You could divide up the sums between members of the team so they each have some to answer.

If the answer is even, find the corresponding square on the grid and colour it in. If the answer is odd, leave the square blank.

For example, question 1 is 46 + 31. The answer is 77, so find number 1 on the grid – as the answer is odd, it should be left blank.

Question 20 is 2372 – 1484. The answer is 888, and even. Find number 20 on the grid, and colour that square in.

When correctly completed, the grid will form a QR code! Use a smart phone to read the code and you will be taken to a YouTube clip.

There is a bonus point available for explaining what the QR code leads to.

Number Partner Challenge
Team Entry Sheet Round Two

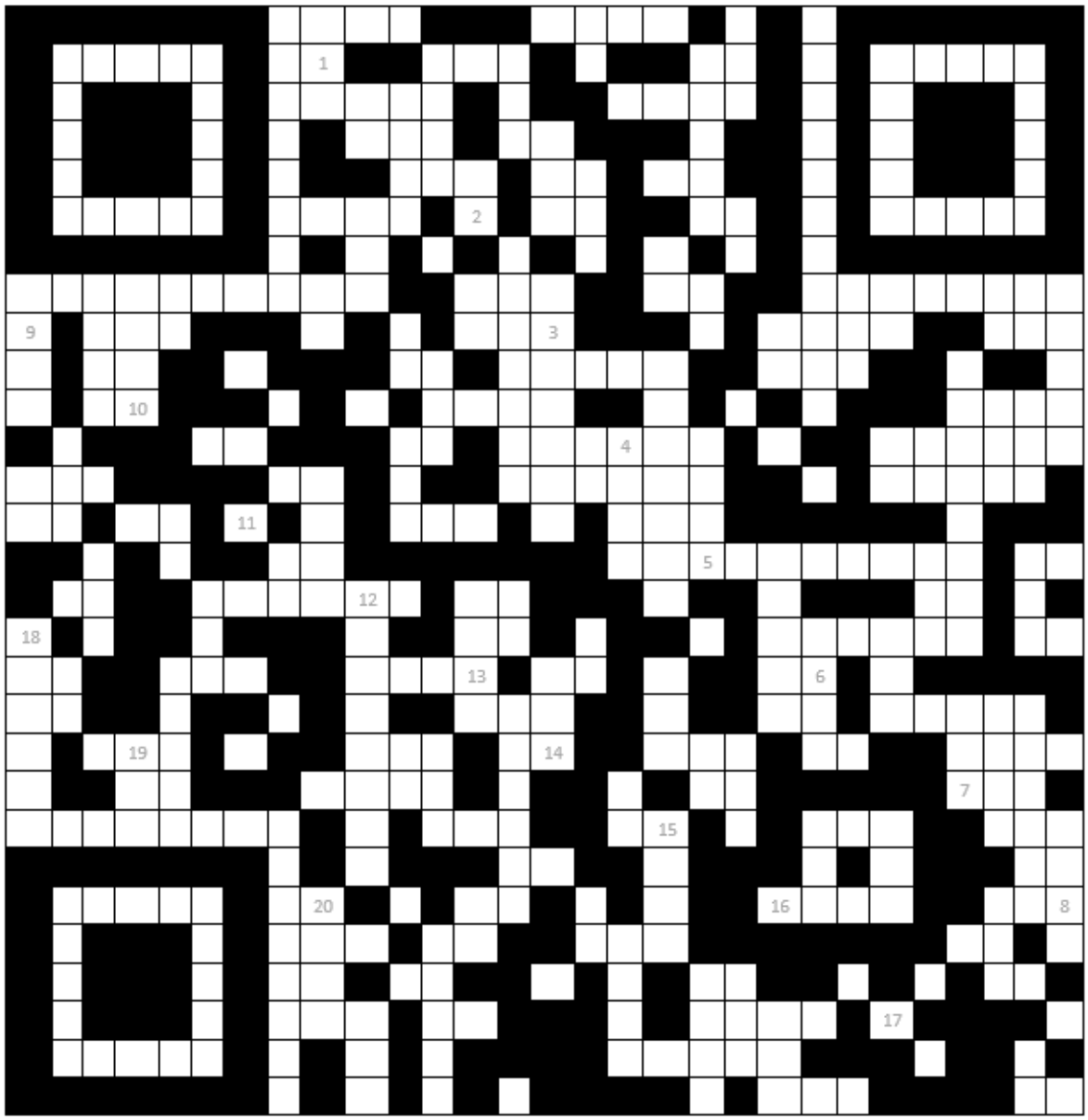
Team Name:		
School Name	**Pupil Names**	**Volunteer & Company Name**

Calculate the answers to the questions below. If the answer is **even**, colour in that square on the grid below. If the answer is **odd**, leave the square blank.

When correctly completed, the grid will form a QR code! Use a smart phone to read the code and see what happens.

1.	46 + 31	**=**	**11.**	29 – 8	
2.	83 + 39		**12.**	7 x 6	
3.	237 + 143		**13.**	53 – 17	
4.	40 ÷ 8		**14.**	9 x 3	
5.	11 x 11		**15.**	Subtract the number of minutes in an hour from the number of cm in a metre	
6.	Add together the number of days in September and April		**16.**	220 – 56	
7.	23 + 31 + 45		**17.**	569 – 125	
8.	62 + 43 + 87		**18.**	What is half of 50?	
9.	234 + 72 + 6		**19.**	Add the number of days in the week, to the number of months in the year.	
10	93 + 74 + 149		**20.**	2372 – 1484	

A bonus point will be awarded if you can tell us what the QR code leads to!	
TOTAL SCORED	**/21**


1
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16
8
17

Number Partner Challenge
Round Two: QR Code
Answer Sheet

1.	46 + 31	**77**	**11.**	29 – 8	**21**
2.	83 + 39	**122**	**12.**	7 x 6	**42**
3.	237 + 143	**380**	**13.**	53 – 17	**36**
4.	40 ÷ 8	**5**	**14.**	9 x 3	**27**
5.	11 x 11	**121**	**15.**	Subtract the number of minutes in an hour from the number of cm in a metre	**40**
6.	Add together the number of days in September and April	**60**	**16.**	220 – 56	**164**
7.	23 + 31 + 45	**99**	**17.**	569 – 125	**444**
8.	62 + 43 + 87	**192**	**18.**	What is half of 50?	**25**
9.	234 + 72 + 6	**312**	**19.**	Add the number of days in the week, to the number of months in the year.	**19**
10.	93 + 74 + 149	**316**	**20.**	2372 – 1484	**888**

Number Partner Challenge
Partner Tip Sheet
Round Three: Shape Shifting

There are 21 points up for grabs in this activity! You will need to work with coordinates and use your accuracy skills to rotate and translate a shape on a grid. You should **spend no more than 30 minutes** on the challenge as a whole – try and get as far as you can, but incomplete entries can still be submitted. There is a lot to get through – we don't expect every team to complete this week's challenge!

You will need:

- Entry sheet (2 pages)
- Set of axes showing the original ABCD shape
- Blank grids and axes for workings out
- Mirrors (optional, to help explain reflections)

Tips for volunteers

- There is some tricky vocabulary and terminology used in this challenge – it might be useful to go through and highlight any words your team are not sure about and explain them before starting the activity. These might include; axes, quadrant, translate, reflect, trapezium.

- Even if children have not worked with axes before, they can still complete the activity. Remind them of the rule for coordinates – 'Along the corridor and up the stairs' – so they know that the first number in a set of coordinates is the x (horizontal) axis, the second number is the y (vertical) axis.

- Print a copy of the grid showing the shape ABCD. You may also want to print multiple blank grids and axes to do workings out and allow all of the team members to have a go at drawing the translated shapes.

- Some of the questions ask about what you can notice about the coordinates. To help with this, you could ask; can they see any patterns between the sets of numbers? Are the numbers positive or negative?

Reflecting the shape – you may want to use a mirror to help demonstrate and visualise what the shape will look like when reflected along one of the axes

Number Partner Challenge
Team Entry Sheet Round Three

Team Name:		
School Name	**Pupil Names**	**Volunteer & Company Name**

Look at the set of axes with a shape drawn in the first quadrant.

Use this set of axes and the blank grids to help you answer the questions below. Talk to your team mates and use scrap paper to help. See how many questions you can answer!

What is the shape called?	/1
What are the coordinates of the points which form the corners of the shape?	**A =** (,) **B =** (,) **C =** (,) **D =** (,) /4
Translate (or move) the shape 3 squares to the left and 4 squares up. What are its new coordinates?	**A =** (,) **B =** (,) **C =** (,) **D =** (,) /4
Compare the new coordinates to the original ones. What do you notice about the numbers?	/1
Start with the original shape again. Reflect it in the x axis. What are the coordinates of the corners now?	**A =** (,) **B =** (,) **C =** (,) **D =** (,) /4
What do you notice about the new coordinates when you compare them to the original ones?	/1

Extension Questions **Complete these if you still have time in your 30 minutes!**	
Plot these three points on the graph: (-7, 7) (0, 0) (7, -7) Join the points to make a straight line.	/1
Reflect the original shape in the line you have drawn.	/1
What are the coordinates for A, B, C and D in this reflected shape?	**A =** (,) **B =** (,) **C =** (,) **D =** (,) /4

Main Activity	**/15**
Extension Activity	**/6**
TOTAL SCORED	**/21**

Don’t forget to submit both pages of this entry form!

Number Partner Challenge
Round Three Answer Sheet

What is the shape called?	Trapezium /1
What are the coordinates of the points which form the corners of the shape?	A (4,2) B (6,2) C (7,1) D (3,1) /4
Translate (or move) the shape 3 squares to the left and 4 squares up. What are its new coordinates?	A (1,6) B (3,6) C (4,5) D (0,5) /4
Compare the new coordinates to the original ones. What do you notice about the numbers?	**E.g.** x coordinate of the new number was 3 less than the original coordinate and the y coordinate was 4 more than the original coordinate /1
Start with the original shape again. Reflect it in the x axis. What are the coordinates of the corners now?	A (4,-2) B (6,-2) C (7,-1) D (3,-1) /4
What do you notice about the new coordinates when you compare them to the original ones?	**E.g.** The x coordinate stayed the same but the y coordinate now has a minus in front of it /1

Extension Questions	
Plot these three points on the graph: (-7, 7) (0, 0) (7, -7) Join the points to make a straight line.	(Look at the entry form to see if they have done this accurately) /1
Reflect the original shape in the line you have drawn.	(Look at the entry form to see if they have done this accurately) /1
What are the coordinates for A, B, C and D in this reflected shape?	A (-2,-4) B (-2,-6) C (-1,-7) D (-1,-3) /4

Main Activity	**/15**
Extension Activity	**/6**
TOTAL SCORED	**/21**

Number Partner Challenge
Partner Tip Sheet

The Final Challenge: Noah's Ark

Congratulations on making it to the final round of the Number Partner Challenge!

Teams will need to work together to calculate the answers to the problem as well as present their findings clearly. You will have 45 minutes to get as far as you can before each team will be judged and a winner announced!

You will need:

- A3 paper and pens
- Entry sheet
- Noah's Problem

Noah was watching animals go into his ark. He was counting the legs of the animals and by midday he had reached 12 - but he couldn't remember which animals he had seen! One of Noah's sons thinks he saw a giraffe and snails, and another says he saw penguins and a spider. Can you work out the different combinations of animals that could have hidden on his ark that morning?

The challenge is to **investigate the different combinations** of animals that could make up the 12 legs, and then answer the follow up questions. There will be marks for correct answers, team work and clear explanations.

After 20 minutes, we will introduce a new rule – if the animals have only gone into the ark in pairs, how does this affect their combinations?

The aim is to encourage children to **think logically and creatively** about the problem. Try not to direct them too much once they understand what to do, and let them know there is **no right or wrong way for them to display their findings.**

Starting Tip - Use the pictures and record how many legs each animal has. If they are unsure how to start after they have discussed the problem, suggest making a table or visual way of recording the different combinations. Only once they have spent some time looking at the combinations and investigating the problem should you direct them to the entry sheet and answer the questions.

Additional Tip – As the snail has no legs, Noah could have seen an infinite number of snails go in to the Ark. If pupils recognise this, suggest just including **one** snail in your combinations, and then just **one pair** later on.

Number Partner Challenge
Final Challenge Answer Sheet

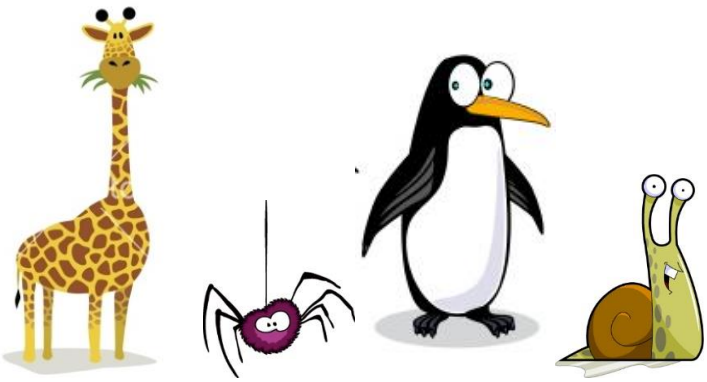
School Name	Team Name	Volunteer Company

Noah was watching animals go into his ark. He was counting the legs of the animals and by midday he had reached 12 - but he couldn't remember which animals he had seen! One of Noah's sons thinks he saw a giraffe and snails, and another says he saw penguins and a spider. Can you work out the different combinations of animals that could have hidden on his ark that morning?

What if we knew the animals came in pairs? Does this change the combinations that are possible?

The challenge is to investigate the different combinations of giraffes, snails, penguins and spiders that could make up the 12 legs, and then answer some questions.

Present your ideas and workings out on the A3 paper provided, then answer the questions on the entry sheet. You will get marks for clear explanations and team work, as well as correct answers. **You will have 45 minutes.**



Questions	Answer and explanation
1. How many different combinations of animals could make up the 12 legs?	
2. Which combination gives the highest number of animals Noah could have seen go on to the Ark?	
3. What is the combination that gives the fewest animals?	
4. What is the maximum number of **different** animals in any of the combinations? Give an example.	
5. Which **combinations** have only one type of animal going into the Ark?	

Noah's wife tells us that there were definitely no snails, and that all of the animals came in pairs. How does this change the combinations that are possible?

Questions	Answer and explanation
6. What animal can Noah not have seen go on to the Ark? (apart from snails) Give a reason	
7. Which combination gives the most number of animals?	
8. What is the total number of possible combinations? What are they?	

Number Partner Challenge
Final Challenge Judges Sheet

School Name	Team Name	Volunteer Company

Question	Answer	Points Awarded
1. How many different combinations of animals could make up the 12 legs?	12 combinations (using only one snail at a time – could have an infinite number of snails)	/1
Give one point if the team mention that there could be an infinite number of snails		/1
2. Which combination gives the highest number of animals Noah could have seen go on to the Ark?	1 point for; 6 penguins = 12 legs Additional point for mentioning that this could also be 6 penguins plus any number of snails	/2
3. What is the combination that gives the fewest animals?	1 giraffe and 1 spider	/1
4. What is the maximum number of **different** animals in any of the combinations? Give an example.	3 different types of animal E.g. 1 snail, 2 penguins, 1 spider 1 snail, 2 penguins, 2 giraffes 2 snail, 4 penguins, 1 giraffe	/2 **(1 point for answer, 1 point for correct example)**
5. Which **combinations** have only one type of animal going into the Ark?	3 giraffes, or 6 penguins	/2 **(1 point for each combination)**
6. What animal can Noah not have seen go on to the Ark? (apart from snails) Give a reason.	Spiders, because a pair of them would have a total of 16 legs	/2 **(1 point for correct answer, 1 point for explanation)**
7. Which combination gives the most number of animals?	6 penguins (3 pairs)	/1

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8. What is the total number of possible combinations? What are they?	2 6 penguins, or 2 penguins and 2 giraffes	**/3** **(1 point for correct answer, 1 point for each correct combination)**
Award up to 5 marks for a clear visual display of workings out and methodical working e.g. using a table		**/5**
Award up to 5 marks for good demonstration of team work throughout		**/5**
Total		**/25**