**MATHS STORY WRITING ENHANCEMENT GROUP**

**SUGGESTED LESSON IDEAS**

**NOTES**

These lesson ideas are designed by the research team with the support of the project’s Steering Committee which is made up of Headteachers, Deputy Headteachers and Maths Co-ordinators of primary schools across Berkshire, Buckinghamshire, Hampshire and Oxfordshire. The lessons are designed not to be too labour intensive for teachers to prepare and deliver while still helping pupils to master the mathematical concept(s) in question.

These weekly lesson ideas are merely meant to be a rough guideline, and not meant to be prescriptive. We fully acknowledge that different schools and classes have different ways of doing things. Thus, you are encouraged to use the suggested lesson ideas below as a basis for you to build your own more-detailed plan and resources to suit the learning needs of pupils in your class. That said, from the research perspective, it can be very useful for teachers in the same cohort to teach in the similar way during the three-week period for the sake of cohort-wide consistency and to ensure the study is a fair test.

As some Year 4 classes in this study are mixed age classes (e.g. Year 3/4 or Year 4/5), differentiation could be done by offering pupils different levels of support while the same tasks are offered to all pupils, for example.

Please mark children’s work and comment them as you would normally. (Your marking and comment are not the focus of our research.) That said, please do not mark or write any comment directly on the story picture books that the pupils created just yet as the research team will need to scan them first. Please keep them safe for collection by the research team as part of their post-test visit after the half-term.

For more information about the project and its Steering Committee, please visit <https://www.mathsthroughstories.org/research-project-2.html>

If you have any question or would like clarification about any of these lesson plans, please contact Dr. Natthapoj Vincent Trakulphadetkrai directly at n.trakulphadetkrai@reading.ac.uk.

**WEEK 1 (MON 27/01/20 – FRI 31/01/20)**

**TARGET MULTIPLICATIVE FACTS:** REVISION OF THE 2, 5 AND 10 MULTIPLICATION TABLES

**TARGET APPLICATION:** MULTIPLICATION AS REPEATED ADDITION (GROUPS OF OBJECTS)

**Statutory requirements:** Pupils should be taught to recall multiplication […] facts for multiplication tables up to 12 × 12; to solve problems involving multiplying

**For any references highlighted in green, refer to the corresponding PowerPoint**

**For any references highlighted in pink, refer to the corresponding worksheet**

**See the Resources webpage for more information**

<https://www.mathsthroughstories.org/research-project-resources.html>

**Lesson 1**

*First suggested initial teaching input (15 mins)*

* Sign in to TumbleMath.com, then go to the following page to access the ‘Where’s Albert?’ story: <https://www.tumblemath.com/BookLessonPlans.aspx?ProductID=436> Once on the page, click on the ‘Read online’ icon below the book cover. On the next page, click on ‘Start playing’ to start the story. (Ensure the volume of your projector / PC is on.) **The story takes around 10 minutes.**
* Before reading, teacher to introduce the story by telling pupils that Albert the Mouse, and his nine Squeak Scout friends are going camping, but Albert keeps wandering off! Let’s find out how they keep track of Albert.
* During the story, ask pupils to count with Agnes (the scout leader) as she is counting the Squeaky Scouts.
* After the story, invite a number of pupils to take turn to retell the story. Ensure that they cover key pieces of mathematical information e.g. the number of the Squeaky Scouts (‘10’); the number of cheesy puffs each Scout was given (‘2’); the number of pegs were given to each Scout to set up their tent (‘5’); and the number of twigs each Scout was asked to find in the woods to help create a big bonfire (‘10’).

*First suggested activity (10 mins)*

* Remind / explain to pupils that what Agnes (the scout leader) was doing is called ‘skip counting’. Ask pupils why skip counting can be useful (‘Make counting go faster and not having to count objects by 1s each time.’).
* Ask pupils how Agnes used skip counting to ensure that all the ten Squeaky Scouts were present. (i.e. ‘When Squeaky Scouts were asked to count by 2s, the final number should be 20. When Squeaky Scouts were asked to count by 5s, the final number should be 50. When Squeaky Scouts were asked to count by 10s, the final number should be 100.’)
* Ask pupils to pretend that they are also Squeaky Scouts! Ask them to confirm how many Scouts there are in the room that day (e.g. 30 pupils or ‘Scouts’).
* Then, ask them to work in pairs to work out that if there are [30] Scouts, and each Scout gets two cheesy puffs, what would the final number called out be [60]. Ask them to prove it by having each pupil taking turn to skip count from 2 to the final number. (To make it more exciting, find a small soft ball that pupils can gently throw to the next person for them to call out the next number, and so on.)
* Time permitting, repeat the above activity with the five pegs per Scout (i.e. skip counting from 5 to 150), and finally the ten twigs per Scout (i.e. skip counting from 10 to 300).

*Second suggested initial teaching input (10 mins)*

* Ask pupils what skip counting reminds them of. (‘Multiplication table facts’)
* Return to the page, *“Albert dropped to the ground. Handing him the last two cheesy puffs, Agnes counted again.”* Remind pupils that Agnes gives out 2 cheesy puffs to each of the 10 scouts. Count by twos up to 20 with the class. Explain that there are 10 scouts with 2 cheesy puffs each: that is the same as: 10 groups of 2, or 10 x 2 = 20. Demonstrate 10 x 2 = 20 as repeated addition statement (2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 = 20). Explain that if pupils know that 10 x 2 = 20 then they know the turnaround fact 2 x 10 = 20. (Remind them that this is called the ‘commutative property’.)
* Return to the page, *“Agnes counted by fives as she handed out the pegs.”* Remind pupils that Agnes has 5 pegs for each of the 10 scouts. Count by fives up to 50. Explain that 10 scouts with five pegs each is the same as 10 groups of 5 or 10 x 5 = 50. Demonstrate 10 x 5 as repeated addition statement (5 + 5 + 5 + 5 + 5 + 5 + 5 + 5 + 5 + 5 = 50). Explain that if students know that 10 x 5 = 50 they know the turnaround fact 5 x 10 = 50. (Remind them that this is called the ‘commutative property’.)
* Return to the page, *“Agnes counted again by tens. This time all the scouts joined in.”* Remind pupils that Agnes asks each of the 10 scouts to collect 10 twigs. Count by tens up to 100. Explain that 10 scouts with each collecting 10 twigs is the same as 10 groups of 10 or 10 x 10 = 100. Demonstrate 10 x 10 = 100 as repeated addition statement (10 + 10 + 10 + 10 + 10 + 10 + 10 + 10 + 10 + 10 = 100).
* To make this part of the lesson more accessible to those pupils who need support, they could count in 2s and 5s using concrete resources e.g. counters or Unifix cubes (and Dienes blocks when counting in 10s), for example.

*Second suggested activity (15 mins)*

Display the following word problems on the screen and ask pupils to represent each problem as repeated addition and then as multiplication; as well as to provide the correct answer in their book. To save time, teachers may also want to present the questions below on a sheet of paper, so pupils could simply provide their answers on the paper and stick it in their book:

* **Two Squeaky Scouts are given six sweets each. How many sweets are they given altogether? [Example: ‘6+6 = 2x6 = 12’. Delete this before showing it to pupils on the screen.]**
* **Five Squeaky Scouts are asked to collect seven stones each. How many stones will they be collecting altogether?**
* **Ten Squeaky Scouts are given three books each. How many books are they given altogether?**
* **Five Squeaky Scouts are asked to collect nine leaves each. How many leaves will they be collecting altogether?**
* **Two Squeaky Scouts are given four apples each. How many apples are they given altogether?**
* **Ten Squeaky Scouts are asked to collect eight snails each. How many snails will they be collecting altogether?**

As an extension, pupils could be asked to pose their own word problems like the above examples. Ask them to use multiplication table facts from the 2x, 5x and 10x tables.

*Suggested plenary activity (5 mins)*

During the plenary, display the following reasoning question on the screen and ask pupils to discuss it with their partner:

**Is it correct to represent the following word problem with 5+5: *‘There are five schools. In each school, there are two teachers. How many teachers are there altogether?’* Explain your answer.**

[Incorrect as the repeated addition should have been 2+2+2+2+2 as there are five lots of two.]

**Lesson 2**

*Mental starter (5 mins)*

As a class, practise recalling the 2x table facts by first allowing time for pupils to work in pairs to work out the 2x table facts on their mini whiteboards. (Please feel free to varying the teaching approach here to include other strategies as appropriate e.g. the use of a counting bead or a counting stick, etc.) Later, teacher to ask quick fire questions about the table facts (e.g. ‘What is 2 times 8?’).

*First suggested initial teaching input (10 mins)*

Ask pupils to remind you what they have learned yesterday in their maths lesson.

Then, teacher to display the following number sentence on the screen: “10 x 5”, and ask pupils to represent this multiplication sentence as repeated addition on their mini whiteboard. Then, give pupils enough time to discuss with their talking partner what could be a word problem for that number sentence. Later, invite pupils to share the word problems that they come up. Emphasise that there is no one correct word problem to represent 10 x 5, and that there are many different possible word problems to represent that number sentence. Also emphasise the fact that in the context of ‘groups of objects’-type word problems, it is very important that pupils remember to include the word ‘each’ to indicate how many objects are there in *each* group.

Then, display the following reasoning questions in turn on the screen and ask pupils to discuss with their partner:

**Is *'If Jim has 5 sweets and his mum gives him 2 more sweets. How many sweets are there altogether?'* a word problem for 5 x 2? Explain your answer.**

[No as the given word problem is about addition (“more of the same objects”) and not about “groups of objects”. Invite pupils to give you an appropriate word problem to represent 5 x 2.]

**Is *'There are 2 piles of sweets, and there are 5 sweets in each pile. How many sweets are there altogether?'* a word problem for 2 x 5 or 5 x 2? Explain your answer.**

[Either is fine: commutative property]

***Is ‘'There are 10 schools, and there are 5 teachers. How many teachers are there altogether?'* a word problem for 10 x 5? Explain your answer.**

[No as the given word problem does not indicate that EACH school has 5 teachers. It just says “there are 5 teachers”.]

*First suggested activity (15 mins)*

* Pupils to pose (and solve) their own five word problems in their book. (While floating, teacher to check if the pupils are on the right track and to address any misconception there and then.) Pupils should be encouraged to use numbers from the 2, 5, and 10 multiplication tables to help them pose their word problems.

*Second suggested initial teaching input (10 mins)*

* On the screen, display the following word problem: *‘There are 2 piles of sweets, and there are 5 sweets in each pile. How many sweets are there altogether?’.*
* Ask pupils to work in pairs to discuss and show how this word problem could be shown *visually*. Discuss what the term ‘visually’ means.
* Invite pupils to share their visual representation of the given word problem.
* Highlight that while some pupils drew a pictorial representation of the problem (e.g. a drawing of two piles of five sweets), others used other objects to represent the problem (e.g. two groups of five circles; bar modelling, etc.). Emphasise that there is no one correct way to visualise the given word problem, but also discuss why the latter could be more useful (e.g. much quicker than having to spend so much time having to draw to likeness).
* Then, display the following reasoning questions in turn on the screen and ask pupils to discuss with their partner:

**Is an image of 2 groups of 7 sweets the pictorial representation of 2 x 5? Explain your answer.**

[No as there should be only 5 sweets in each of the two groups, not 7.]

**Is an image of 5 groups of 2 sweets the pictorial representation of 2 x 5 or 5 x 2? Explain your answer.**

[Either is fine: commutative property]

*Second suggested activity (15 mins)*

* In their book, pupils to come up with visual representation of the word problems that they have come up with in the first half of the lesson. (While floating, teacher to check if the pupils are on the right track and to address any misconception there and then.)

*Suggested plenary activity (5 mins)*

Invite one volunteer to read out their one word problem for the rest of the class to solve on their mini whiteboard.

On the screen, display 5 groups of 7 stars, and later 2 groups of 8 triangles for pupils to translate them to multiplication sentences and find the answers.

**Lesson 3**

*Mental starter (5 mins)*

As a class, practise recalling the 5x table facts by first allowing time for pupils to work in pairs to work out the 5x table facts on their mini whiteboards. (Please feel free to varying the teaching approach here to include other strategies as appropriate e.g. the use of a counting bead or a counting stick, etc.) Later, teacher to ask quick fire questions about the table facts.

*Suggested initial teaching input (15 mins)*

* Ask pupils to remind you what they have learned yesterday in their maths lesson.
* Then, sign in to TumbleMath.com, then go to the following page to access the ‘Count on Pablo’ story: <https://www.tumblemath.com/H5Player.aspx/?ProductID=377&book=%2FH5Books%2FTM%2Fbooks%2FCount%20on%20Pablo%2FCount%20on%20Pablo.json&page=0> Once on the page, click on the ‘Read online’ icon below the book cover. On the next page, click on ‘Start playing’ to start the story. (Ensure the volume of your projector / PC is on.) **The story takes around 10 minutes.**
* Before reading, teacher to introduce the story by telling pupils that a young boy named Pablo is helping his *abuela* (or grandmother in Spanish) to get ready for selling vegetables at the farmers’ market. Let’s find out how Pablo uses his maths skill to help his grandmother get everything ready.
* During the story, ask pupils to count with Pablo as he is counting different vegetables.
* After the story, invite a number of pupils to take turn to retell the story. Ensure that they cover key pieces of mathematical information e.g. Pablo counting onions in 2s; peppers in 5s and tomatoes by 10s.
* Remind to pupils that what Pablo did is called ‘skip counting’ – similar to what the scout leader did in the ‘Where’s Albert?’ story that the class read on Monday. Again, remind them that this is linked to repeated addition, which itself is linked to multiplication.

*First suggested activity (10 mins)*

* Return to the page, “*“Could you count the onions?” Abuela asked. “I’ll count them by twos.”* Remind pupils that Pablo is counting onions by 2s. Count by twos up to 40 with the class. Ask pupils if they know a special name of these numbers. Explain that they are called *multiples of 2*. (Write this on the screen)
* Ask pupils to discuss in pairs what they think this statement means. (Specifically what does ‘a multiple’ mean?) Then, establish that ‘a multiple’ is what we get after multiplying a whole number (or an 'integer') with another integer. Later, demonstrate that when 2 times 4, we get 8. Therefore, 8 is a multiple of 2 (and 4).
* Then, on the screen, display the following statement: “8 is a multiple of 5”. Ask pupils to discuss in pairs whether they agree or disagree with this statement and why. Later, try to demonstrate that there is no whole number / integer that when it is multiplied by 5 will get 8. Therefore, 8 is not a multiple of 5.
* On screen, display the following set of numbers: 24, 35, 42, 46, 50, 95, 102, 105, 120 and 125. Draw three intersecting sets labelled ‘multiples of 2’, ‘multiples of 5’ and ‘multiples of 10’. Then:
* Ask pupils: *Is 10 a multiple of 2? How do you know?* Then,drag it into the circle labelled ’multiples of 2’.
* Ask children: *Is 35 a multiple of 2? How do you know? A multiple of 5? A multiple of 10?* Drag it into the set labelled ’multiples of 5’.
* Repeat with 24, 42 and 95.
* *Is 50 a multiple of 2? 5? 10? So where shall we put that number?* Discuss how you can put it in the overlapping parts of the three sets so it can be in all three sets at once.
* Repeat with the other numbers.

*Second suggested activity (20 mins)*

* As a class, play the ‘2x, 5x and 10x Tables Bingo’ game where pupils to fill their own 2x5 grid with ten numbers that are multiples of 2, 5 and 10, and the biggest number could only be 120 (10 x 12). Ask pupils to check all of their ten numbers that they are indeed multiples of 2, 5 and 10 – ask pupils how they could check that their numbers are appropriate. Then, teacher to call out random multiples of 2, 5 and 10 until a winner is found (i.e. the person who is the first to have all the numbers as called out by the teacher on their bingo card).
* Play one more round of the game.
* Once pupils are familiar with the rules, ask them to play with people at their table – where each team member would take turn being the person calling out the numbers.

*Suggested plenary activity (10 mins)*

Display the following reasoning questions in turn on the screen and ask pupils to discuss with their partner:

**Someone said 12 is a multiple of 2. Is that person correct? Explain your answer.**

[Correct as when 2 is multiplied by a whole number or an ‘integer’ (i.e. 6), it gets 12.]

**Someone said 19 is not a multiple of 2. Is that person correct? Explain your answer.**

[Correct as there is no whole number / integer that can multiply 2 to get 19.]

**Someone said 40 is a multiple of both 5 and 10. Is that person correct? Explain your answer.**

[Correct as either 5 or 10 can be multiplied by a whole number / an integer to get 40.]

**Someone said 22 is not a multiple of 5. Is that person correct? Explain your answer.**

[Correct as there is no whole number / integer that can multiply 5 to get 22.]

**Lesson 4**

*Mental starter (5 mins)*

As a class, practise recalling the 10x table facts by first allowing time for pupils to work in pairs to work out the 10x table facts on their mini whiteboards. (Please feel free to varying the teaching approach here to include other strategies as appropriate e.g. the use of a counting bead or a counting stick, etc.) Later, teacher to ask quick fire questions about the table facts. *Ask pupils if they notice any relationship between the 5x and 10x table facts. (Here, it could be useful to have the 5x and 10x table facts displayed alongside each other. This could be done so on the screen or a working wall so pupils would find it easier to establish the relationship between these two multiplication tables.)*

*Activity (55 mins)*

Explain to the class that earlier this week they have heard two maths stories about multiplication (as repeated addition), and that they are now going to have a go at creating their own mini story picture book about the said topic ontheir own. (In the context of this research project, please avoid having pupils work in pairs or small groups on this task. Each pupil is to work on their own maths story picture book. Feel free to provide support as you see appropriate to those pupils who need help.)

Give each pupil a printed copy of the Mathematical Story Picture Book template (downloadable from <https://www.mathsthroughstories.org/research-project-resources.html>) and explain to them how to use the template and highlight that their maths story this week should be framed as a fairy tale, a myth or a legend. (The genre for Week 2 will be an adventure, and Week 3 will be a horror story or a thriller.)

Pupils should be encouraged to use multiplication facts from the 2, 5 and 10 multiplication tables for their story this week.

Hopefully, the guideline on the template is already self-explanatory, but do feel free to model the beginning of a story as a whole class first. Refer to the two maths stories read earlier this week as inspiration for story ideas. As the template indicates, each story needs to be a 6-7 pages long only.

Pupils should be informed of the expectation that by the end of the lesson, each of them should have a clear idea of what their maths story is going to be about and what to go on each page illustration.

Your teaching in today’s lesson and tomorrow will be through you actively engaging in mathematical dialogue with each pupil to help scaffold their mathematical story thinking (e.g. “Think of an everyday situation or problem that could be solved through your characters’ knowledge of multiplication (as repeated addition).”, “How are you going to *visually* represent this multiplication fact in your page illustration?”, etc.).

**Lesson 5**

*Activity (60 mins)*

*For those pupils who have already finishing drafting their story yesterday,* they can now transfer their draft work (on the template) onto clean sheets of A4 paper as a finished product. Only allow them to do the colouring once all the writing and drawing have been completed.

*For those pupils who still need a bit of time to finish off their draft work today,* allow them up to 10-15 minutes only as the focus today should be on them turning their draft work to become the finished product by the end of the lesson.

Please ensure that they put their names on the front cover of their maths story picture book.

If time allows, invite 1-2 pupils to share their maths story with the rest of the class at the end of the lesson.

**Please do not mark or write any comment directly on the story picture books that your pupils created just yet as the research team will need to scan them first. Please keep them safe for collection by the research team as part of their post-test visit after the half-term.**

**WEEK 2 (MON 03/02/20 – FRI 07/02/20)**

**TARGET MULTIPLICATIVE FACTS:** REVISION OF THE 3, 4, 6 AND 8 MULTIPLICATION TABLES

**TARGET APPLICATIONS:** MULTIPLICATION AS ARRAYS (AREA OF RECTANGULAR SHAPES)

**Statutory requirements:** Pupils should be taught to find the area of rectilinear shapes by counting squares

**For any references highlighted in green, refer to the corresponding PowerPoint**

**For any references highlighted in pink, refer to the corresponding worksheet**

**See the Resources webpage for more information**

<https://www.mathsthroughstories.org/research-project-resources.html>

**Lesson 6**

*Mental starter (5 mins)*

As a class, practise recalling the 3x table facts by first allowing time for pupils to work in pairs to work out the 3x table facts on their mini whiteboards. (Please feel free to varying the teaching approach here to include other strategies as appropriate e.g. the use of a counting bead or a counting stick, etc.) Later, teacher to ask quick fire questions about the table facts.

*Suggested initial teaching input (20 mins)*

* Sign in to TumbleMath.com, then go to the following page to access the ‘Bigger, Better, Best!’ story: <https://www.tumblemath.com/Result.aspx?m=Title&key=%20%20%20Bigger,%20Better,%20Best!>
* Once on the page, click on the ‘Read online’ icon below the book cover. On the next page, click on ‘Start playing’ to start the story. (Ensure the volume of your projector / PC is on.) **The story takes around 10 minutes.**
* Before reading, teacher to introduce the story by telling pupils that this story is about siblings named Jeff and Jenny who always fight on who has bigger and better things, and what they do to work out who has bigger things.
* After the story, invite a number of pupils to take turn to retell the story. Ensure that they cover key pieces of mathematical information (e.g. Jeff’s window is 3 sheets of paper high and 4 sheets across; Jenny’s window is 2 sheets of paper high and 6 sheets across, etc.).
* Drawing from the story, ask pupils to discuss with their talking partner: 1) how they would define / explain what *area* is (e.g. “Area is the amount of space covered by a figure.”); and 2) how it is different from *perimeter* (if they have already learned about perimeter).
* On the screen, show an image of a rectangle made up of an array of 6 x 3 unit squares. Ask pupils to work with their talking partner to identify the length and width of the rectangle (i.e. the length is 6 unit squares and the width is 3 unit squares) – remind them length is the longer side, and width is the shorter side. Then, ask them to work out the area of the said rectangle (i.e. by simply counting the number of squares = 18 square units).
* Take time to explain that each square is called a *‘unit square’* (i.e. “a square with sides measuring 1 unit”), while *‘square units’* is a unit of measurement.

*First suggested activity (15 mins)*

* Pupils to work in groups of three, and each group is to be given a set of small post-it notes; sheets of A4 paper, and sheets of broadsheet newspaper (as well as some blue tack).
* They are to measure surface areas of five different rectangular objects of their choice found within the classroom (e.g. a book cover, a desk surface, a door, etc.).
* Each group is to discuss which of the three units of measurement they should use to measure the different objects, and why. Then, they are to record their findings in their book. (Again, remind them length is the longer side, and width is the shorter side.)

*Second suggested activity (15 mins)*

On the screen, display details of the following task:

On grid paper, create the following rectangles with the following dimensions and find the area of each of them:

* + **A 3 x 5 unit square rectangle**
  + **A 3 x 8 unit square rectangle**
  + **A 6 x 4 unit square rectangle**
  + **A 4 x 8 unit square rectangle**
  + **A 8 x 5 unit square rectangle**
  + **A 8 x 7 unit square rectangle**

(Feel free to create some ready-drawn rectangles for SEND children.)

As an extension, pupils can use a ruler to draw rectangles of different sizes (of their choosing) in their book and to ask their neighbouring peer to work out the area of these rectangles. For dimensions, pupils should be encouraged to use numbers from the 3, 4, 6 and 8 multiplication tables – regardless of their ability levels.

*Suggested plenary activity (5 mins)*

Display the following reasoning questions in turn on the screen and ask pupils to discuss with their partner:

*Show a rectangle of 6 x 8 unit squares. Below the rectangle, insert the following statement:* ***“Someone said that the area of this rectangle is 42 square units. True or false? Explain your answer.”***

*[False as the correct area is 48 square units.]*

*Show a rectangle of 3 x 8 unit squares and another of 4 x 6 unit squares. Below the rectangles, insert the following statement:* **“The 3 x 8 array has a larger area than the 4 x 6 array. True or false? Explain your answer.”**

[False as 3 x 8 equals 24, and 6 x 4 also equals 24.]

**Lesson 7**

*Mental starter (5 mins)*

As a class, practise recalling the 6x table facts by first allowing time for pupils to work in pairs to work out the 6x table facts on their mini whiteboards. (Please feel free to varying the teaching approach here to include other strategies as appropriate e.g. the use of a counting bead or a counting stick, etc.) Later, teacher to ask quick fire questions about the table facts. *Ask pupils if they notice any relationship between the 3x and 6x table facts. (Here, it could be useful to have the 3x and 6x table facts displayed alongside each other. This could be done so on the screen or a working wall so pupils would find it easier to establish the relationship between these two multiplication tables.)*

*Suggested initial teaching input (15 mins)*

* Ask pupils to remind you what they have learned last week in their maths lessons.
* Then, sign in to TumbleMath.com, then go to the following page to access the ‘Sam’s Sneaker Squares’ story: <https://www.tumblemath.com/Result.aspx?m=Title&key=%20%20%20Sam%e2%80%99s%20Sneaker%20Squares>
* Once on the page, click on the ‘Read online’ icon below the book cover. On the next page, click on ‘Start playing’ to start the story. (Ensure the volume of your projector / PC is on.) **The story takes around 10 minutes.**
* Before reading, teacher to introduce the story by telling pupils that this is a story about a young boy named Sam who needs to find a way to compare the size of different lawns so he would know how much work involves in mowing them and how much money to charge for his work.
* After the story, invite a number of pupils to take turn to retell the story. Ensure that they cover key pieces of mathematical information (e.g. Mrs. Green’s lawn is 20 steps long and 10 steps wide; and Mr. Hill’s lawn is 160 sneaker squares bigger than Mrs. Green).
* On the screen, show a rectangle that is 12-square long and 8-square wide. Ask pupils to brainstorm with their partners to come up with a way to work out the surface area of the shape without having to count every single unit square as this would be time-consuming. (Hints could include getting pupils to see that they are essentially looking at *an* *array* of squares.)
* From there, introduce pupils to the formula to find surface area of a rectangle (i.e. *length x width*).
* Proceed to prove that the area of the 12 x 8 rectangle is 96 square which is the total number of all the unit squares if one was to count all the unit squares.

*First suggested activity (15 mins)*

* Pupils to work in groups of three, and each group is to use Sam’s strategy to find areas of the school’s gym and playground.
* Then, they are to record their findings (i.e. both the dimensions and the areas) in their book. (Again, remind them that length is the longer side, and width is the shorter side.)

*Second suggested activity (20 mins)*

On the screen, display details of the following task:

On a sheet on blank paper, use a ruler to create the following rectangles with the following dimensions and find the area of each of them using the formula. Remember to also write the dimensions along the length and width of each rectangle.

* + a 3cm x 9cm rectangle
  + a 3cm x 11cm rectangle
  + a 4cm x 3cm rectangle
  + a 4cm x 8cm rectangle
  + a 6cm x 9cm rectangle
  + a 8cm x 5cm rectangle

Please ensure that the pupils use blank paper as opposed to grid/graph paper as the former would mean pupils are less tempted to relying on counting the squares on grid paper to work out the surface areas. (Also either introduce or remind pupils that their answers must be accompanied by *cm2*)

Pupils are then encouraged to use a ruler to create 1-2 rectangles of their own chosen dimensions on a sheet of blank A4 paper (i.e. not in their book as the pages sometime contain grids and hence unit squares), and to work out the surface areas. (For dimensions, pupils should be encouraged to use numbers from the 3, 4, 6 and 8 multiplication tables – regardless of their ability levels.) Remind pupils that their answers must be accompanied by *cm2* if the dimensions are in cm.

*Suggested plenary activity (5 mins)*

Invite a few pupils to share their rectangles with the rest of the class and ask the rest of the class to work out the rectangles’ areas on their mini whiteboard.

**Lesson 8**

*Mental starter (5 mins)*

As a class, practise recalling the 4x table facts by first allowing time for pupils to work in pairs to work out the 4x table facts on their mini whiteboards. (Please feel free to varying the teaching approach here to include other strategies as appropriate e.g. the use of a counting bead or a counting stick, etc.) Later, teacher to ask quick fire questions about the table facts.

*First suggested initial teaching input (15 mins)*

* Ask pupils to remind you what they have learned last week in their maths lessons.
* Then, sign in to TumbleMath.com, then go to the following page to access the ‘Bigger, Better, Best!’ story: <https://www.tumblemath.com/Result.aspx?m=Title&key=%20%20%20Bigger,%20Better,%20Best!>
* Once on the page, click on the ‘Read online’ icon below the book cover. On the next page, click on ‘Start playing’ to start the story. (Ensure the volume of your projector / PC is on.)
* Return to the page, ““Wait,” said Jill. “What about that little part in front of the closet?”” and invite pupils to retell that part of the story. (Try to get them to establish that the shape of Jeff’s bedroom is essentially a combination of two rectangles (or what is called a ‘composite’ shape) where the bigger rectangular is 6 sheets of newspaper long and 4 sheets wide and the smaller rectangular part is 3 sheets long and 2 sheets wide.
* Ask pupils to apply the formula that they have learned yesterday to work out the combined area (or floorspace) of Jeff’s bedroom.
* Then, show on the screen a composite shape made up of two different rectangles (e.g. a ‘T’ shape). For this example, unit squares should still be visible. Proceed to demonstrate how to work out the total area of the shape (i.e. by working out the area of the two separate rectangles before adding them up).
* Repeat with another example but *without* the unit squares being made visible (i.e. pupils should just see the outline of the shapes with width and length information (in cm) displayed next to the shape so that pupils are encouraged to use their multiplication facts to work out the areas instead of relying on counting the unit squares.

*First suggested activity (15 mins)*

Consolidate pupils’ mastery of working out surface areas of composite rectangular shapes by using the formula through working on the practice questions on the worksheet which is downloadable from the link below. Teacher to model solving the first problem so everyone is clear of what they are expected to do.

<https://www.math-salamanders.com/image-files/math-worksheets-4th-grade-area-perimeter-4.gif>

*Second suggested initial teaching input (10 mins)*

Teacher to model to the class how to pose word problems involving finding surface areas of both rectangular shapes (e.g. “If a rectangular living room is 3-metre wide and 4-metre long, how big is the floor space?”) and composite shapes made of rectangles (e.g. “The shape of a garden is a combination of two rectangles. One rectangle is 2-metre wide and 6-metre long, and the other rectangle is 4-metre wide and 5-metre long. How big is the garden’s total area?”).

*Second suggested activity (15 mins)*

* Pupils to pose (and solve) their own five word problems in their book using the formula (i.e. multiplication).
* For dimensions, pupils should be encouraged to use numbers from the 3, 4, 6 and 8 multiplication tables – regardless of their ability levels.
* The units could be in either feet, cm or m.

**Lesson 9**

*Mental starter (5 mins)*

As a class, practise recalling the 8x table facts by first allowing time for pupils to work in pairs to work out the 8x table facts on their mini whiteboards. (Please feel free to varying the teaching approach here to include other strategies as appropriate e.g. the use of a counting bead or a counting stick, etc.) Later, teacher to ask quick fire questions about the table facts. *Ask pupils if they notice any relationship between the 4x and 8x table facts. (Here, it could be useful to have the 4x and 8x table facts displayed alongside each other. This could be done so on the screen or a working wall so pupils would find it easier to establish the relationship between these two multiplication tables.)*

*Activity (55 mins)*

Explain to the class that earlier this week they have heard two maths stories about multiplication (as arrays), and that they are now going to have a go at creating their own mini story picture book about the said topic ontheir own. (In the context of this research project, please avoid having pupils work in pairs or small groups on this task. Each pupil is to work on their own maths story picture book. Feel free to provide support as you see appropriate to those pupils who need help.)

Give each pupil a printed copy of the Mathematical Story Picture Book template (downloadable from <https://www.mathsthroughstories.org/research-project-resources.html>) and explain to them how to use the template and highlight that their maths story this week should be framed as an adventure. (The genre for Week 3 will be a horror story or a thriller.)

Pupils should be encouraged to use multiplication facts from the 3, 4, 6 and 8 multiplication tables for their story this week.

Hopefully, the guideline on the template is already self-explanatory, but do feel free to model the beginning of a story as a whole class first. Refer to the two maths stories read earlier this week as inspiration for story ideas. As the template indicates, each story needs to be a 6-7 pages long only.

Pupils should be informed of the expectation that by the end of the lesson, each of them should have a clear idea of what their maths story is going to be about and what to go on each page illustration.

Your teaching in today’s lesson and tomorrow will be through you actively engaging in mathematical dialogue with each pupil to help scaffold their mathematical story thinking (e.g. “Think of an everyday situation or problem that could be solved through your characters’ knowledge of multiplication (as repeated addition).”, “How are you going to *visually* represent this multiplication fact in your page illustration?”, etc.).

**Lesson 10**

*Activity (60 mins)*

*For those pupils who have already finishing drafting their story yesterday,* they can now transfer their draft work (on the template) onto clean sheets of A4 paper as a finished product. Only allow them to do the colouring once all the writing and drawing have been completed.

*For those pupils who still need a bit of time to finish off their draft work today,* allow them up to 10-15 minutes only as the focus today should be on them turning their draft work to become the finished product by the end of the lesson.

Please ensure that they put their names on the front cover of their maths story picture book.

If time allows, invite 1-2 pupils to share their maths story with the rest of the class at the end of the lesson.

**Please do not mark or write any comment directly on the story picture books that your pupils created just yet as the research team will need to scan them first. Please keep them safe for collection by the research team as part of their post-test visit after the half-term.**

**WEEK 3 (MON 10/02/20 – FRI 14/02/20)**

**TARGET MULTIPLICATIVE FACTS:** THE 7, 9, 11 AND 12 MULTIPLICATION TABLES

**TARGET APPLICATION:** MULTIPLICATION AS SCALING

**Statutory requirements:** Pupils should be taught to solve problems involving multiplying and [...] integer scaling problems […]

**For any references highlighted in green, refer to the corresponding PowerPoint**

**For any references highlighted in pink, refer to the corresponding worksheet**

**See the Resources webpage for more information**

<https://www.mathsthroughstories.org/research-project-resources.html>

**Lesson 11**

*Mental starter (5 mins)*

As a class, working out the 7x table facts by first allowing time for pupils to work in pairs to work out the 7x table facts on their mini whiteboards. (Please feel free to varying the teaching approach here to include other strategies as appropriate e.g. the use of a counting bead or a counting stick, etc.) Later, teacher to ask quick fire questions about the table facts.

*Suggested initial teaching input (20 mins)*

* Sign in to TumbleMath.com, then go to the following page to access the ‘Beanstalk: The Measure of a Giant’ story: <https://www.tumblemath.com/Result.aspx?m=Title&key=beanstalk>
* Once on the page, click on the ‘Read online’ icon below the book cover. On the next page, click play the video. (Ensure the volume of your projector / PC is on.) **The story takes around 13 minutes.**
* Before reading, teacher to introduce the story by telling pupils that this is a story about a young boy named Jack who climbs up a magical beanstalk to find a giant named Ray living above the clouds.
* After the story, invite a number of pupils to take turn to retell the story. Ensure that they cover key pieces of mathematical information (e.g. the giant is 5 times as tall as Jack).
* Return to the page, “Jack found his checkerboard, measured it, and multiplied by five.” Ask pupils why Jack is making a checkerboard that is five times larger than it normally is. (“Because Ray the Giant is five times larger than Jack.”). Establish that this is called *scaling*.
* Ask pupils to discuss with their talking partner to come up with a definition of scaling. (Establish that when you scale something, you change the amount or size of something, and that you can either scale up or scale down things. Concerning scaling things up, establish that pupils’ knowledge of multiplication can be handy like it is to Jack.)

*First suggested activity (15 mins)*

* Pupils to work in groups of three to use a ruler to measure dimensions of five everyday objects found in the classroom in feet (to the nearest feet), and to figure out how big the dimensions would be if the giant is 7 times bigger than they are. (These everyday objects could include a desk, a chair, a book shelf, a flip chart, a computer, etc.)
* Pupils to then independently record both sets of measurement in a comparison table (‘Normal dimensions’ and ‘Scaled-up dimensions’) in their book.

*Second suggested activity (15 mins)*

On the screen, display the following word problems below for pupils to solve in their book. To save time, teachers may also want to present the questions below on a sheet of paper, so pupils could simply provide their answers on the paper and stick it in their book:

* The length of a normal checkerboard is 2 feet. The giant’s checkerboard is 11 times as long as the normal one. How long is the giant’s checkerboard?
* A normal sunflower is about 3 feet tall. A sunflower in the giant world is 7 times taller than a normal one. How tall is the giant sunflower?
* Jack normally eats 6 biscuits a week, and Ray the Giant eats 12 times as many biscuits as Jack. How many biscuits does Ray the Giant have?
* Ray the Giant takes only 5 minutes to run around Jack’s town. It takes Jack 9 times longer than it takes Ryan to do so. How long does it take Jack?
* The length of Jack’s trouser is 4 feet long. If the giant’s trouser is 12 times as long as Jack’s trouser, what is the length of the giant’s trouser?
* Jack’s bedroom is around 8 feet wide. If Ray the Giant’s bedroom is 12 times as wide as Jack’s bedroom, how wide is the giant’s bedroom? How wider is the giant’s bedroom than Jack’s?
* Jack has 5 eggs every morning. Ray the Giant has 35 eggs every morning. Ray thinks he has 6 times more eggs Jack. True or false? Explain your answer.

*Suggested plenary activity (5 mins)*

Go through the last two problems together as a class to ensure everyone understands the questions and know how to solve them.

**Lesson 12**

*Mental starter (5 mins)*

As a class, working out the 9x table facts by first allowing time for pupils to work in pairs to work out the 9x table facts on their mini whiteboards. (Please feel free to varying the teaching approach here to include other strategies as appropriate e.g. the use of a counting bead or a counting stick, etc.) Later, teacher to ask quick fire questions about the table facts.

*First suggested initial teaching input (15 mins)*

Ask pupils to remind you what they have learned yesterday in their maths lesson.

Then, on the screen, display the word problem below and ask pupils to work in pairs on their mini whiteboard to solve it and explain their answer:

“Sam takes 9 minutes to finish eating his breakfast. Tim takes 3 times as long as Sam. How long does Tim take?”

Once satisfied with their answer, establish that the above problem can also be represented as a multiplication sentence or a number sentence (i.e. 9 x 3).

Then, ask pupils to work in pairs to try to come up with a drawing or an image to visually represent that word problem. Later, invite a few pupils to share their drawings / images with the rest of the class. Comment on their ideas on what you like about them.

Establish that there is no one correct way to visually represent scaling word problems, but one simple way to do so is to use bar modelling. Introduce to pupils the bar model below and ask pupils to discuss in pairs what they think the bar model below represents and how it is related to the above word problem.

|  |  |
| --- | --- |
| **9** |  |

|  |  |  |
| --- | --- | --- |
|  |  |  |

Once pupils understand the concept behind how to use bar modelling to represent and to help solve scaling word problems, display the problem below on the screen and ask pupils to use bar modelling to solve the problem on their mini whiteboard:

“Clare’s hair is 7 inches long. Jennifer’s hair is 4 times as long as Clare. How long is Jennifer’s hair?”

*First suggested activity (15 mins)*

Ask pupils to refer back to the seven word problems from yesterday. For each of those questions, ask them to draw a bar model and to write a multiplication to represent and to help solve the problem.

*Second suggested initial teaching input (10 mins)*

* Show pupils the bar model below and ask them to work in pairs on their mini whiteboard to come up with a scaled-up word problem and a multiplication sentence to represent the bar model.
* Invite a few volunteers to read out the word problem that they come up with.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **11** |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

*Second suggested activity (10 mins)*

* Each pupil to pose five scaling word problems in their book and to represent each of them with a bar model and a multiplication number sentence.
* Pupils are encouraged to use numbers from the 7, 9, 11 and 12 multiplication tables in their word problems.
* (While floating, teacher to check if the pupils are on the right track and to address any misconception there and then.)

*Suggested plenary activity (5 mins)*

Invite a few pupils to read out their questions and for the rest of the class to solve them on their mini whiteboard.

**Lesson 13**

*Mental starter (5 mins)*

As a class, working out the 11x table facts by first allowing time for pupils to work in pairs to work out the 11x table facts on their mini whiteboards. (Please feel free to varying the teaching approach here to include other strategies as appropriate e.g. the use of a counting bead or a counting stick, etc.) Later, teacher to ask quick fire questions about the table facts.

*Suggested initial teaching input (15 mins)*

* Ask pupils to remind you what they have learned yesterday in their maths lesson.
* Sign in to TumbleMath.com, then go to the following page to access the ‘Cut Down to Size at High Noon’ story: <https://www.tumblemath.com/Result.aspx?m=Title&key=%20%20Cut%20Down%20to%20Size%20at%20High%20Noon>
* Once on the page, click on the ‘Read online’ icon below the book cover. On the next page, click play the video. (Ensure the volume of your projector / PC is on.) **The story takes around 10 minutes.**
* Before reading, teacher to introduce the story by telling pupils that this is a story about two special barbers who are very good at using their knowledge of scaling to design some very special hairstyles!
* After the story, invite a number of pupils to take turn to retell the story.

*Suggested activity (30 mins)*

Tell pupils that their task today is to help Buzzsaw design hairstyles in the form of enlarged composite rectangular shapes. (Ask pupils to think back to the previous week and ask them to remind you what we mean by *composite* shapes.)

Stick a sheet of enlarged A3 grid / graph paper (<https://i.pinimg.com/736x/dd/d6/94/ddd6944d5648797a000595c24c973096--graph-paper-template-printable-graph-paper.jpg)> on a flip chart, and draw a small ‘T’ shape like the one shown below on it:

|  |  |  |
| --- | --- | --- |
|  |  |  |
|  |  |  |
|  |  |  |

Then, ask pupils to work in pairs on their mini whiteboard to work out the dimensions of the shape if it is to by enlarged 9 times the size. Then, ask for a pair of pupils to come out and show their enlarged ‘T’ shape on another sheet of enlarged A3 grid / graph paper.

In their book (or on sheets of grid / graph paper), pupils to independently design and enlarge ten composite rectangular shapes (e.g. ‘T’ and ‘H’ shapes) based on given scales e.g. 1 unit square : 7 unit squares / 1 unit square : 9 unit squares. Once done, they can colour the shapes. (While floating, teacher to check if the pupils are on the right track and to address any misconception there and then.)

*Suggested plenary activity (10 mins)*

Display the following reasoning questions on the screen and ask pupils to work in pairs on their mini whiteboard to solve the problem. After 5 minutes, invite a few volunteers to share their answers with the rest of the class.

*Question 1:*

The postcards in the art gallery measure 11cm by 12cm.

The first postcard is of a painting which is 7 times the length and width of the postcard.

The second postcard is of a painting which is 9 times bigger.

Write the measurements of each painting.

*Question 2:*

Mr Jones’ rectangular garden measures 11m by 12m. His neighbour's garden measures 77m by 96m. The neighbour says “My garden is 7 times the width and length of your garden.” True or false? Explain your answer.”

**Lesson 14**

*Mental starter (5 mins)*

As a class, working out the 12x table facts by first allowing time for pupils to work in pairs to work out the 12x table facts on their mini whiteboards. (Please feel free to varying the teaching approach here to include other strategies as appropriate e.g. the use of a counting bead or a counting stick, etc.) Later, teacher to ask quick fire questions about the table facts.

*Activity (55 mins)*

Explain to the class that earlier this week they have heard two maths stories about multiplication (as arrays), and that they are now going to have a go at creating their own mini story picture book about the said topic ontheir own. (In the context of this research project, please avoid having pupils work in pairs or small groups on this task. Each pupil is to work on their own maths story picture book. Feel free to provide support as you see appropriate to those pupils who need help.)

Give each pupil a printed copy of the Mathematical Story Picture Book template (downloadable from <https://www.mathsthroughstories.org/research-project-resources.html>) and explain to them how to use the template and highlight that their maths story this week should be framed as a horror story or a thriller.

Pupils should be encouraged to use multiplication facts from the 7, 9, 11 and 12 multiplication tables for their story this week.

Hopefully, the guideline on the template is already self-explanatory, but do feel free to model the beginning of a story as a whole class first. Refer to the two maths stories read earlier this week as inspiration for story ideas. As the template indicates, each story needs to be a 6-7 pages long only.

Pupils should be informed of the expectation that by the end of the lesson, each of them should have a clear idea of what their maths story is going to be about and what to go on each page illustration.

Your teaching in today’s lesson and tomorrow will be through you actively engaging in mathematical dialogue with each pupil to help scaffold their mathematical story thinking (e.g. “Think of an everyday situation or problem that could be solved through your characters’ knowledge of multiplication (as repeated addition).”, “How are you going to *visually* represent this multiplication fact in your page illustration?”, etc.).

**Lesson 15**

*Activity (60 mins)*

*For those pupils who have already finishing drafting their story yesterday,* they can now transfer their draft work (on the template) onto clean sheets of A4 paper as a finished product. Only allow them to do the colouring once all the writing and drawing have been completed.

*For those pupils who still need a bit of time to finish off their draft work today,* allow them up to 10-15 minutes only as the focus today should be on them turning their draft work to become the finished product by the end of the lesson.

Please ensure that they put their names on the front cover of their maths story picture book.

If time allows, invite 1-2 pupils to share their maths story with the rest of the class at the end of the lesson.

**Please do not mark or write any comment directly on the story picture books that your pupils created just yet as the research team will need to scan them first. Please keep them safe for collection by the research team as part of their post-test visit after the half-term.**