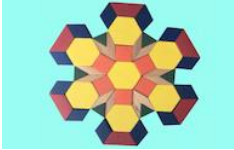


Reasoning in EYFS

Activity	Mathematical thinking and reasoning	Resources (representations and manipulatives)	The mathematical journey	Variation and Development
Exploring characteristics of shapes using both everyday and mathematical language to describe shapes, talk about positions and solve problems	Adult makes a simple construction with a few blocks or pieces of Lego, and challenges the child to copy it with the same pieces or from a selection. Use more different pieces to increase the challenge. Describing Look very closely: how is your model different from mine? Which block do you need to put to the right of / above / below / behind this red one? Your blocks are all pointing the same way - can you see these ones are crossways? Reasoning How do you think you need to change yours to make it look the same as mine? How do you need to turn that brick to make it look the same? Opening Out Take a photo of a secretly made model and see if the child can copy that, using the same pieces. What do you think is at the back, underneath the red brick? I've made a little model which I've got hidden under the table - I'll see if I can tell you how to make it. First, take a blue brick, then put a yellow one on top... Can you make a secret model with five bricks and describe it for me to make?	    	Properties of shapes: - selecting appropriate blocks to match others, correctly identifying properties such as flat, curved etc. - using informal shape language - <i>sharp, slopey, pointy, like a brick, arch, box, roof</i> etc. - using mathematical shape language - <i>corner, side, edge, flat, curved, rectangular, cylinder</i> etc. Properties of shapes: - selecting appropriate blocks to match others, correctly identifying properties such as flat, curved etc. - using informal shape language - <i>sharp, slopey, pointy, like a brick, arch, box, roof</i> etc. - using mathematical shape language - <i>corner, side, edge, flat, curved, rectangular, cylinder</i> etc. - copying arrangements and relative positions of bricks - rotating pieces to match - using positional language - <i>on top of, next to, underneath, in front of, behind, between, left, right</i> etc. - constructing a 3D model from a 2D picture; identifying hidden pieces which are not visible in the picture; drawing a model with key features Measures:	Make more complex models, with more pieces and varied shapes. Use more challenging language like <i>between, in front of, behind, overlapping, at right angles</i>. Show a model quickly and hide it again: can the child look closely then draw it from memory? Make some pictures with 2D shapes, and draw outlines for children to fit shapes into.

Reasoning in EYFS

	Recording Let's take a photo of your best one and see if you can make it again tomorrow. Can you do a drawing of your model?		identifying <i>longer</i> and <i>shorter</i> pieces to match those in the model	
Use everyday language to talk about size, to compare quantities and objects and to solve problems	The Activity The child lies down and the adult 'measures' the child, by putting a marker by head and feet, then stretching a piece of tape as long as the child. They find out how many pens will match this, carefully placed end to end, making sure they are straight, with no gaps or overlaps. Repeat with other things of uniform length, some long, some short (such as rolled up sheets of newspaper, spoons, buttons, Lego or Duplo bricks) to make several 'trails' of equal length and compare the results. Describing What do you notice about using the pens and the paper rolls? How many pens does it take to match the tape? You are 20 pens tall! How many paper rolls tall are you? You are 3 and a bit rolls long/not quite 3 rolls long. Reasoning I wonder what will happen if we measure with Lego bricks? Why do you think there will be more? There are some gaps between the dinosaurs - do you think that matters? Does it matter if they are all not the same length?	  Building blocks, interlocking bricks, Lego or other construction material, 2D shapes and picture	Counting and cardinality: - counting objects using the number sequence, tagging each item and saying the total - comparing quantities and numbers, more / less / fewer / not as many - ordering several numbers most / biggest number / smallest number - estimating numbers Matching numerals and amounts: - writing and reading numerals Measures: - using language: tall, height, long, short, longer, length - predicting and explaining that the shorter things are the more you will need and vice versa: 'The buttons are really small so we will need lots' - generalising: 'If you get really long things you don't need as many'	Predict and compare the number of things needed to measure an adult. Cut a piece of string the length of the child - or use strips of newspaper joined together with sellotape - and try to find things the same length, commenting whether they are shorter or longer. Tape pieces of newspaper together, draw round the child with a marker pen and cut out the silhouette, then mark the length in a straight line, so the child can see that their height is the distance between the top of their head and the bottom of their feet lying down or standing up. Cut pieces of string (or paper strips) the same length as the child's reach (finger tip to finger tip with arms outstretched) and compare - are they the same? Compare this to head circumference. Find strips to match other body parts such as length of feet or waist.

Reasoning in EYFS

	Opening Out Which did we use most of? Which needed the smallest number? You are three and a bit rolls long - what do you think we could use to measure the extra bit - little Lego bricks? How many pens tall do you think your grown-up will be? What other things are about the same height as you? Which are shorter or taller? How tall are you with the measuring tape - what numbers can you see? Are you more or less than a metre tall? How many footsteps tall are you? (Make sure you walk heel to toe and in a straight line!) Recording Let's take a photo of the 'trails' we've made. Let's write the numbers of papers and pens, and centimetres tall you are. How can we make the calculator show these numbers?			How many of your own feet tall are you? (With several children, focus on comparing the numbers and lengths of things used to measure, but not children's heights, as no-one likes being the shortest!) Measure heights with a measuring tape and discuss the fact that there are 100 centimetres in a metre, and whether the child is more or less than a metre.
Use everyday language to talk about time, to compare quantities and to solve problems	The Activity Set a timer for a minute (or half a minute) and count how many actions the child can do in that time, such as star jumps, hops, or writing their name. Describing Encourage children to discuss the numbers of actions they did within the time frame using comparison words (e.g. more, fewer). How many star jumps did you do? How many hops? Which did you do more of?	 Rolled up sheets of newspapers (secured with a piece of sellotape), pens, Lego bricks, spoons, buttons, coins or anything of roughly uniform length.	Counting and cardinality: - counting actions - using the number sequence, tagging each item and saying the total - comparing quantities and numbers, more / less / fewer / not as many - ordering several numbers most / biggest number / smallest number - estimating numbers Matching numerals and amounts:	There are a huge variety of activities which children might suggest, some very brief, like clapping (or blinking!) and some taking longer, like twirling round (or winking!). Outdoor activities might include running/hopping the length of a path, or throwing and catching a ball. Indoor activities might include

Reasoning in EYFS

You did more jumps - does that mean you are getting faster or slower?

Reasoning

What do you think you can do more of in a minute, star jumps or twirls? Why do you think that is?

Try again - can you do more this time?

What makes you think you are getting faster? Or slower?

How many times do you think you can do 'heads, shoulder, knees and toes'? How many claps or stamps do you think you can do in half a minute?

Opening Out

Can you think of some other actions you can do in a minute? Writing your name?

Singing happy birthday all the way through?

Can you put your coat and shoes on in a minute?

Stand up with your eyes shut: sit down when you think a minute is over. How close were you? Did you think a minute was a shorter or longer time than it really is?

Recording

Shall we write down how many jumps you do each time, so we can keep track. What do these show?

- writing and reading numerals

Measures:

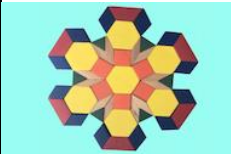
- using language: quickly / fast / faster / slower; takes a long / short time
- predicting and explaining that the shorter time things take the more you can do in a minute (and vice versa): 'Clapping is really quick so you can do lots'
- generalising: 'if it takes a long time you get a small number'

saying a rhyme or singing songs.

Longer activities, such as running round a circuit, can be timed to the nearest minute and the number discussed. Does a smaller number of minutes mean that you are getting slower or faster - and why? Timings for daily activities such as getting dressed or tidying away toys can be recorded and compared.

You should brush your teeth for two minutes (twice a day) - can you guess when two minutes is up?

Reasoning in EYFS

Using everyday language to compare objects and to solve problems	The Activity Each player needs the same small collection of blocks and small world toys. One player (the Builder) creates an arrangement with their toys. The Builder tells a second player (the Maker) how to make their arrangement exactly the same. Swap roles. Once this idea is understood, introduce a 'barrier' such as an upstanding book, to hide what the Builder is making from the Maker. The Maker has to create the same arrangement without seeing it (you could offer a glimpse to begin with), which encourages use of precise vocabulary. Describing What do you notice about these two collections? Are you sure you both have <i>exactly</i> the same collection to start? How do you know? What is the <i>same</i>? What is <i>different</i>? Reasoning How did you decide to place that (piece) there? What did you hear Ivy say to make you place that there?... that way around? What words helped you know where to put it? Are the two <i>exactly</i> the same? Are you sure? How do you know? What if... we turn that one around? Or move it next to the cow? Which positions are the most tricky to describe? What makes an arrangement easier or harder? Opening Out What if ... we try this with Pattern Blocks? ... mosaic tiles? ... big blocks/boxes	   Digital timer on a phone, or a wind-up kitchen timer which 'pings'. Egg-timers may be less effective as they do not make a noise when the time is up. A number track or ruler of some kind is useful to refer to, for children to see how to write the numbers. Make a 'tocker' with a coffee jar lid, a lump of playdough or blutak, and a piece of card stuck on to provide a pointed 'handle', on which you can draw a face and hat. Pull the point so it	Shape, space and position: - recognise similarity and difference in shapes and objects - visualise what objects will look like in different positions and orientations - begin to imagine what objects will look like from someone else's viewpoint (perspective-taking) - understand and use shape, position and direction words, such as: <i>on top, underneath, behind, turn it over, the other way around, next to, in front, beside, across</i> Measures: - begin to use and understand time vocabulary relating to sequencing and order, such as: <i>first, next, then, after</i> Number: - using counting to check that each player has the same number of pieces in order to play and when the arrangement is complete.	Once the rules of the game are understood, this can be played with as many different resources as you can imagine, large and outdoors as well as smaller and indoors. Ask the children what they would like to play it with. Can they 'make it the same' without giving the Maker an initial glimpse and without them looking until the Builder is satisfied the whole arrangement is complete? Try playing with structured resources such as Numicon, pegboards and pegs, as well as unstructured natural materials such as a collection of twigs, leaves and pebbles. Try a variation where the Builder places one item at a time for the Maker to follow-their-lead. Try starting with both arrangements built. The Builder becomes The Changer and describes how they have changed their arrangement to The Maker for them to follow.
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Reasoning in EYFS

	outside? What if ... we try playing this with one Builder and a group of friends as Makers? What if ... we try this without using a specific word (e.g. 'behind') Recording Take photographs of the arrangements to discuss and try and re-make. Provide children with clipboards to draw their arrangement of toys. You might even try drawing the arrangements from a different viewpoint (e.g. what the cow can see).	is flat on the table and then release it: the lid should 'tock' several times to and fro before coming to rest. Use this time period to see how many things you can do. Or make tockers with different lids or amounts of playdough and set them off at the same time to see how long they keep tocking.		
Using everyday language to talk about position, direction and time	The Activity Children make their own way round the routes on offer. Children waiting for a turn can write their name or put their name card on a board to mark their position in the queue. They can use a digital timer to measure 10 minute turns and watch the digits count down. Describing Tell me about your route. What did you go between? Behind? Where will you go next? How many people are waiting in front of you? What number are you in in the queue? What numbers can you see on the timer? What does that 5 mean, do you think? Reasoning Why will you need to go that way? Is there another way of getting there? Do you think you will have to wait a long or a short time? How long? Why do you think that? What number do you think will come next? What do you notice about the numbers?	An outdoor area with interesting paths and landmarks. A whiteboard and pens, or sticky name cards, for the waiting list. Digital timers, which can be set to ring after a specific number of minutes. These provoke more discussion of decreasing numbers than sand timers.	Shape and space: - using positional language e.g. 'behind', 'between', or directions like 'left' and 'right' - describing shape properties of a route e.g. 'straight', 'corner', 'bend' Numbers: - remembering the word sequence and saying one number for each object e.g. when counting people waiting - cardinality i.e. that the last number gives the total e.g. number of wheels - using the language of 'more' and 'less' or 'fewer' to compare e.g. number of minutes - using ordinal language - 'first', 'second' or 'number 3' in the queue Measures: - language to compare duration ('a longer/shorter time') and speed ('slower/faster')	Trikes and bikes can be numbered and parked in matching bays. Children can decide which one they are queuing for. You could introduce the idea of a map by creating a simple map, marking 'landmarks' in the area. Children could use laminated maps in their outdoor play. Ask children to draw a picture of their journey so someone else could follow their route.

Reasoning in EYFS

	Why do you think the numbers are going backwards? Opening Out There are a lot of people today - should we allow 5 minutes or 10 minutes for each turn? Shall we time how long your friend takes to go round the circuit? How shall we do that? Recording How could we record how long people took to do a circuit? Let's take a look at the recording board. Tell us what has been going on.		explaining that a smaller number of minutes is a shorter time	
Comparing and talking about weight	The Activity Children choose items to put into the cartons and discuss why some items pull the carton down further than others. They can then predict for new items. Describing What do you see? What are you noticing? What happened with the orange? Did it go down a lot further or a little further compared with the ...? Reasoning What do you think is happening this time? I wonder why we are getting different things happening? Why do you think that? What about you, Jordan? Opening Out I wonder what will happen with the sponge and the pebble? And the banana? What do you think? How sure are you?	 Cartons for fruit juice, milk or soup, string, hole punch, long thin elastic bands and tape. A collection of fruit, vegetables, toys and everyday objects of different mass, some lighter (e.g. sponge, pumice stone, shells, plastic toys, pine cones) and some heavier (e.g. pebbles, a bunch of keys, oranges). Paper on the wall or a	Measures: - using language - lower than, higher than, half-way, not/nearly as far as, further than, heavier/lighter than, a little/a lot heavier, nearly as heavy as, heaviest/lightest, exactly the same weight as, equal to - comparing weights of two objects - ordering weights of several objects - explaining - "The orange is heavier because it went down further" and "The one that did not go down as far is lighter"	Fill the carton using different things: some larger and lighter (e.g. a sponge), and some smaller and heavier (e.g. a stone). Go 'big' and outdoors: suspend a hanging basket from a bracket with a bungee spring. See what happens with traditional spring scales or digital luggage scales.

Reasoning in EYFS

	Why do you think our prediction was wrong? What about you? Recording Can you make a mark where you think the bottom of the carton will stretch to? What do the marks tell us? What happened? Maybe use a different colour for your guess and what really happened. Which is your guess and which is Amir's?	board, different coloured pens.		
Doubling numbers Counting and adding	The Activity Tell a story of someone having trouble looking after two dogs who will not do what they are told. Then they get given two more dogs to look after - now they have four and they have 'double trouble'! What about if they have three dogs - how many would be double trouble? Ask the children to model doubling numbers up to five on their fingers and to select images to match the story numbers, e.g. dominoes and dot patterns. Describing What do you notice about the numbers and their patterns? What happens if you match the doubles numbers to a number line? Reasoning What do you have to do when you double? How do you know a number is a double? Opening Out Encourage children to make 'double' numbers in two column arrays, with objects, counters and pegboards.	 Toy animals for the 'double trouble' story. 'Doubles' images: dice, dominoes, Numicon, multilink in two-column arrays, egg boxes. Counters and pegboards to	Same and different: - describing 'doubles' patterns e.g. "There are five here and five here" - discussing what is the same and different about domino and array patterns Counting and cardinality: - counting to check the same number has been added when doubling Matching numerals and amounts: - matching numerals to patterns, or patterns to a number line Adding: - adding on the same number again to double 'counting all' to find the total 'counting on' from the first number to find the total - predicting how many there will be before doubling a number	Doubling and halving: invite children to double and halve numbers, using objects arranged in two-column arrays e.g. with pegboards and multilink. What happens when you halve a number? You could use other story contexts: a sheepdog with troublesome sheep, or a cat looking after kittens or... Older children can play a game in pairs with dice: one gets the number of objects, the other doubles it. They can check by matching and counting. Repeat with a range of apparatus.

Reasoning in EYFS

	Identify the double numbers with dice, dominoes, egg boxes, multilink etc. Make up other patterns with double numbers. Compare patterns for the same number e.g. double 5 domino and 10 as an array. Recording Photograph, stick, stamp or draw patterns for 'doubles'. Match doubles patterns to a number line.	make up doubles patterns. Stamps or sticky circles to record patterns. Large number lines to attach patterns to.	Multiplying: ▪ talking about six being 'two threes' rather than 'three and three' ▪ talking about 'doubling three' to get six	
Adding and subtracting Solving problems	The Activity Put toys one at a time into the box, so children cannot see them inside, counting all together. Ask: "Can you show on your fingers how many are hidden?" Display a large numeral. Add one to the box, without showing the objects inside, and ask children to show on their fingers, "How many are there now?". Then show how many are inside the box and count to check. Describing How many were there at the start? How many are there now? Reasoning How do you know? How did you work it out? Opening Out What if we add two more? What if we take one out? Two out? Imagine there are 10 in there and I take out 6 - how would you know how many were left?	 Box or tin with lid, a pot to upturn or a screen, cloth, cave... Toys, pennies, children, dinosaurs... Large numerals to display.	Counting and cardinality: ▪ saying numbers in the right order ▪ saying one number for each object ▪ saying how many there are by showing 'finger numbers', by counting fingers, and instantly (without counting) Matching numerals and amounts: ▪ selecting numerals to match the starting and finishing numbers Adding: ▪ predicting adding one to a number (or two) ▪ modelling on fingers ▪ counting all e.g. putting up four, then two more, then counting from one through to six ▪ counting on, starting from the first number - "Four, five, six" ▪ visualising or counting mentally, e.g. nodding at hidden objects or saying "I went four, five, six"	Increase numbers to start, to add and take away: ▪ Repeatedly add one to the previous number. ▪ Repeatedly subtract one from the previous number. ▪ Vary the starting number, but just add one each time (or two). ▪ Keep one starting number and subtract varying amounts to build number fact knowledge. ▪ Repeatedly add two or subtract two from a starting number.

Reasoning in EYFS

	Recording Can you show how many there were? Can you show how many there are now? Can you show how many there were and what happened?		- using number facts - "Because there were three and you put one more", "I know two and two is four" Subtracting: - predicting taking one from a number (or two) - modelling on fingers - counting all, then how many are left - putting up six, putting down two, counting the four still up - visualising or counting backwards mentally - "I went six, five, four so there are four"	Children can choose how many to add or take away. Vary the context: use pennies in a pot, children behind a screen, dinosaurs in a cave. Model with fingers, Numicon, large number line, 'staircase' of cubes or other resources.
Comparing capacities Counting	The Activity We want to take some bottles of lemonade (homemade!) to the park for our outing. Which bottles will hold the most? Describing What do you notice about the bottles? How are they different? What happens if you pour this one into this other one? Reasoning How can we find out which hold the most? How do you know which one holds more? Opening Out How many cups will they each fill up? Can we put them in order from the smallest to the biggest/from which holds the most to the least? Recording Can we put labels on the bottles to help us remember how much is in them?	 A varied collection of bottles, containers and flasks for lemonade and cups. Funnels, jugs and a tray. A collection of transparent containers - some short and fat, some tall and thin. Food colouring.	Same and different: - discussing how some containers are different shapes or have a greater capacity than others, progressing from just 'bigger' to 'shorter', 'fatter', 'taller', 'thinner' and 'holds more than' Counting and cardinality: - counting how many cups are filled Matching numerals and amounts: - making labels to show how many cups each bottle holds Properties of shapes: - describing shapes e.g. 'round', 'bendy', 'straight' or 'square' Size and measures: - explaining how they know that containers hold more - "This is smaller because when you pour from the	How much lemonade do we have to make so that everyone gets one cup? Two cups? Plan for a smaller group of children, or some toys having a party. Pour one cupful of coloured water into each of some tall, thin and short fat transparent containers. Discuss what happens to the water level in each and why.

Reasoning in EYFS

			bigger one it overflows", "This is smaller because when you pour it into the bigger one the water only comes up to there" or "This is bigger because you get six cups and that one only fills four cups" Conservation: explaining that the water levels are different in different containers because...	
Sorting and describing, using mathematical properties such as size, shape, weight, capacity and pattern Counting and comparing numbers	The Activity You could provoke the children by saying something like, "These have all got muddled up" as you present them with an assortment of small items. Describing Tell me about your box and the ... you are putting away. How many will fit? Will they all fit? Reasoning Looking at all the boxes we've got here, who has the most ... in their box? How do you know? Could we fit more/fewer in ...'s box? Opening Out Which boxes/trays would be best for keeping which things in? Are some things better to be kept in something other than a box or tray? If so, what? Recording Do you want to make a new label for the box showing how many are inside?	 Any objects and resources that need to be 'put away'. A range of containers, for example, trays, boxes, baskets etc.	Properties of shapes: - choosing particular trays/boxes for particular objects having analysed the properties of the shapes involved Same and different: - grouping according to a rule, e.g. "These are good for our artwork when we need to stick bits onto card" Counting and cardinality: - noticing that amounts increase as more are gathered together - counting and cardinality - progressing from knowing some number words to saying one number for each object, then knowing the number of the whole group - relative number size - comparing numbers - part-whole numbers - noticing numbers within numbers, for subgroups within collections	Many settings use songs associated with different parts of the day. Using such songs can help children focus on packing things away.

Reasoning in EYFS

Solving problems Story Time	The Activity Pirate Panda has taken all the treasure, 20 golden coins. Cat, Dog and Rabbit jump about excitedly. "Can we have some too?" "No! No! No!" says Pirate Panda. Can the children suggest what Panda ought to do? Describing Is it fair? Have they all got the same amount? Is it fair now? Reasoning Why is this fair/not fair? How do you know? Opening Out What if we give them another one each? Sheep comes along - what should we do now? Bear comes too, so what could we do about the remainder? What else could we do? Recording Could you draw a picture to show Panda what to do in order to be fair?	Puppets or toy animals Things to share e.g. gold coins, treasure Large numerals and dot cards Trays, plate	Counting: - cardinality - the last number gives how many there are - counting for a purpose - to see if everyone has the same number Number symbols: - matching numerals to amounts, or recording amounts informally Comparing: - saying who has more or not as many - saying which numbers are more or less than others Adding and subtracting: - saying how many there will be if we give them one more each - saying how many there will be if we take one away Dividing: - sharing practically, using one-to-one and many-to-one - understanding how 'dealing' results in equal shares and the same number each Problem solving: - starting again and redistributing - using adding and subtracting to make it fair - creating fractions to solve a remainder problem - finding alternative solutions - checking to make sure they all have the same	Start the story with Panda sharing unfairly, provoking the children to comment. The numbers chosen determine the level of challenge: 20 shared between four toys encourages counting up to 5 for younger children. Simplify the problem by having two and then three characters, but use larger numbers of characters for expert counters. Deliberately choosing numbers which create remainders, like 4 or 5 shared between three, offers opportunities for alternative solutions such as fractions, subtracting some or adding some more. Problems such as 7 shared between four offer more challenging multistep solutions. Toys and objects could fit with a current interest, such as a teddy bear party. Use a real context such as sharing fruit. This would encourage discussion of fractions, especially if there was a 'bigger half'! Other contexts include sharing bulbs between containers or sharing resources for artwork. Use Numicon or ten frames to check that everyone has the
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Reasoning in EYFS

				same amount, or arrange coins on trays or plates. Large numeral cards will emphasise whether everyone has the same number and encourage discussion about comparing numbers if the sharing is unfair. These could be supported by dot patterns on card, Numicon or other representations of amounts.
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