














Slide 1	 <p>Advanced Mathematics Support Programme®</p> <p>Managed by ME Mathematics Education Innovation</p>	<p>Sum Tricks Teacher Notes</p>
Slide 2	 <p>10 number sum</p> <ul style="list-style-type: none"> Choose two numbers (i.e 16 and 23) Write them down Add them together (39) Continue to add the previous two numbers together (can you remember what sequence this reminds you of?) Do this so you have 10 terms <p>(example = 16,23,39,62,101,163,264,427,691,1108)</p>	<p>Represent number 1 and number 2 as x and y. When you start adding, the 7th term is $5x + 8y$ and the sum of the 10 terms is $55x + 88y$, so multiply the 7th term by 11 and you get the answer to the sum!!</p>
Slide 3	 <ul style="list-style-type: none"> Add your 10 numbers. Don't show your answer! Give your teacher your sequence. They can work out the answer straight away. <p>HOW?????</p>	
Slide 4	 <p>The ?? trick</p> <ul style="list-style-type: none"> Choose a digit between 1 and 9 (for example 5) Write down the digit 3 times to turn it in to a 3 digit number. (if you wrote down 5 you should now have 555). Add your multiply your digit by 3. Divide your two numbers. (for example $555 \div 15$) Write your answer down. Compare your answer to your neighbour. Prove your result. 	<p>You will always get 37, as if you start with the digit a, you end up with $111a/3a = 37$</p>
Slide 5	 <p>But how?</p> <ul style="list-style-type: none"> Does the digit you choose ever affect the answer? Can you prove how it works? Do you get a similar result for a 4 digit number ($aaaa \div 4a$)? Or 5 digit? Will it work for any number? 	<p>It only works for numbers that only have 3 (or powers of 3) as a factor – so the next number it works for is 111,111,111 and then 1.... (27 1s).</p>
Slide 6	 <p>Integers</p> <ul style="list-style-type: none"> What length numbers give integer solutions? What is the simple sum you can do for each length to see if you can get an integer solution? 	<p>You want students to realise that each sum reduces to 11111..... Divided by the length of the number (for example $11111 \div 5$)</p>

<p>Slide 7</p>	 <p>Try to decide whether these will have integer solutions/ Don't use a calculator – you don't need to work out the solution, just decide whether the solution will be an integer or not.</p> <table border="1" data-bbox="215 168 566 369"> <thead> <tr> <th>Number</th> <th>Integer solution? (Guess Yes/No)</th> <th>Actual solution</th> </tr> </thead> <tbody> <tr><td>111</td><td></td><td></td></tr> <tr><td>1,111</td><td></td><td></td></tr> <tr><td>11,111</td><td></td><td></td></tr> <tr><td>111,111</td><td></td><td></td></tr> <tr><td>1,111,111</td><td></td><td></td></tr> <tr><td>11,111,111</td><td></td><td></td></tr> <tr><td>111,111,111</td><td></td><td></td></tr> <tr><td>1,111,111,111</td><td></td><td></td></tr> <tr><td>11,111,111,111</td><td></td><td></td></tr> <tr><td>111,111,111,111</td><td></td><td></td></tr> <tr><td>1,111,111,111,111</td><td></td><td></td></tr> <tr><td>11,111,111,111,111</td><td></td><td></td></tr> <tr><td>111,111,111,111,111</td><td></td><td></td></tr> </tbody> </table>	Number	Integer solution? (Guess Yes/No)	Actual solution	111			1,111			11,111			111,111			1,111,111			11,111,111			111,111,111			1,111,111,111			11,111,111,111			111,111,111,111			1,111,111,111,111			11,111,111,111,111			111,111,111,111,111			<p>111 = 1+1+1 = 3 which means 111 is divisible by 3. 1,111 won't be divisible by 4 as it is an odd number 11,111 clearly isn't a multiple of 5 111,111 is an odd number so isn't a multiple of 6 1,111,111 – there are a few divisible by 7 tricks however students probably won't know them so the best thing would be to ask them to use a suitable division method 11,111,111 can't be divisible by 8 as it's an odd number 111,111,111 is divisible by 9 as 1+1+1+1+1+1+1+1+1 = 9 Students can continue this thinking to see what numbers would generate an integer solution, for example any with an even number of 1s won't be divisible by the sum. There is a nice divisible by 7 test here which would be good to explore with students if time allows https://www.transum.org/Maths/Activity/Divide/</p>
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<p>Slide 8</p>	 <p>ANSWERS AFTER THIS SLIDE</p>																																											
<p>Slide 9</p>	 <ul style="list-style-type: none"> ▪ Start with two numbers, x and y ▪ Add the two previous terms ▪ The sequence is as follows ▪ x,y,x+y,x+2y,2x+3y,3x+5y,5x+8y,8x+13y,13x+21y,21x+34y ▪ The sequence sums to 55x+88y ▪ This is 11 times the 7th term 	<p>Students should identify the coefficients as the Fibonacci sequence</p>																																										
<p>Slide 10</p>	 <ul style="list-style-type: none"> ▪ Take digit a ▪ Your new number aaa is 111a ▪ a+a+a = 3a ▪ $111a \div 3a = \frac{111a}{3a} = \frac{111}{3} = 37$ 																																											
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<p>Slide 12</p>	 <p>About the AMSP</p> <ul style="list-style-type: none"> ▪ A government-funded initiative, managed by MEL, providing national support for teachers and students in all state-funded schools and colleges in England. ▪ It aims to increase participation in AS/A level Mathematics and Further Mathematics, and Core Maths, and improve the teaching of these qualifications. ▪ Additional support is given to those in priority areas to boost social mobility so that, whatever their gender, background or location, students can choose their best maths pathway post-16, and have access to high quality maths teaching. 	<p>Slide 13</p>	 <p>Contact the AMSP</p> <ul style="list-style-type: none"> ☎ 01225 716 492 @ admin@amsp.org.uk 📍 amsp.org.uk 🐦 Advanced_Maths 																																									