



Mental Maths Challenge v2.1

User Guide

We would like to thank all the pupils and staff of Robert Wilkinson Primary School in York who have contributed greatly to the creation of this new version of Mental Maths Challenge and in particular Mr Clint Lees who has tirelessly communicated to us his and their suggestions and feedback.

What is Mental Maths Challenge?

Mental Maths Challenge is a natural complement to **BondBuilder** & **TableTrainer**.

Recalling number facts is only part of the story. Very often, these facts need to be adapted or made to contribute to a strategy involving ideas about number relationships that enable us to work things out in our heads.



Practice Mode and Challenge Mode

BondBuilder & **TableTrainer** has a standard 20 cards in each set, but the strategies used in mental calculation do not demand an instant recalled answer. Mental calculations require time to think to work out a strategy, and even though these can be enacted very rapidly, it is reasonable that it will take a bit longer to produce an answer to **15% of 60** than to recall the answer to **6+3**.

Mental Maths Challenge provides two distinct kinds of engagement – **Practice Mode** and **Challenge Mode**.

In **Practice** mode, all the cards are presented in a pre-defined order of increasing difficulty with no timer recording the time taken. Once the student feels confident that s/he understands the strategy and can enact it accurately, s/he can press the *Take the Test* button.

In **Challenge** mode, a subset of the cards is randomly selected for answering. The challenge is to complete the test in less than a minute. Because the subset is a random selection, teachers may feel it appropriate to expect students to complete the test on more than one occasion to ensure they can answer all possible examples from the set.

How does it work?

Students enter their name/class on the menu at the start of a session and their achievements are recorded on the results page for optional printing at the end of that session. (If you're using an IWB and don't want to key in a name, just ignore the command – it only occurs once).

To start a challenge a student clicks on the relevant image on the menu: Copper, Bronze, Silver, Gold or Platinum.

They then select the challenge that they are currently working on, eg Bronze Challenge 2. The data used in each set can be seen in the appendix to this guide.

Before clicking the **Go** button the student may want to position the mouse over the hint (“?”) button. This will display a description of the challenge with a worked example. When ready to start, pressing the **Go** button will display the first ‘card’. Either in Test mode or Practice mode, the **Go** button can be pressed at any time to restart the activity.

The task then is to

1. Recognise the nature of the strategy, as described in the help window.
2. Perform the mental calculations required to come up with an answer.
3. Pick up the card, by positioning the mouse over it and holding down the left mouse button, and drag it to the number disk which corresponds to the calculated answer.
4. Drop the card onto this disk by releasing the mouse button.

If the student is successful a 'ding' will sound and the card will spin and then disappear. If unsuccessful, a 'bloop' will be heard and the card will jump back to the centre for another try. Any cards that get incorrectly placed will re-presented.

Here is a description of each challenge along with a worked example which can be viewed in the software by moving the mouse over the help (“?”) button.

Recording results

Each session's results are documented on the Menu's Results Page. This page can then be printed as a hard copy of a pupil's achievement.

Additionally the User Guide contains in the appendix a set of class record sheets and the template for pupil booklets to be printed.

In this way each pupil can keep track of their progress and each teacher can monitor the whole class as they progress through the system.

Copper Challenge tasks

| | Description | These worked examples are to give a guide to a suggested mental procedure, and <u>not</u> intended for students to write down: |
|-----------------|------------------------|--|
| Copper 1 | Easy Doubles | Doubling 2 and 3 digit numbers is best done by partitioning. e.g. double 17 is (double 10) + (double 7) = 20+14 = 34; double 230 is (double 200) + (double 30); |
| Copper 2 | Looking for 10s | To move students on from doing a lot of counting, we encourage them to look for a pair of numbers whose total they know . When this is a 10, adding the rest does not necessitate any counting e.g. 3+6+7.....3+7=10, so it's 10 and 6! |
| Copper 3 | Easy Halves | Look for significant digits in the number e.g. <i>the 8 in 80, halve it and make the adjustment to the SIZE of the number.</i> |
| Copper 4 | Harder Halves | Partition the number and add the halves of each part e.g. half of 68 is (half of 60) + (half of 8) = 30+4 =34; <i>half of 640 is 300+20;</i> |
| Copper 5 | Change from £1 | Two main strategies for £1 – 75p a) <i>Take away in stages e.g. £1 - 70p =30p, then - 5p = 25p</i> b) <i>Add on from the amount, e.g. 75p +5p =80p, then +20p = £1, So 25p</i> |
| Copper 6 | Bonds of 1000 | Several possible strategies for 1000 - 650 a) <i>1000 – 600 = 400, then 400 – 50 = 350</i> b) <i>650 +50 is 700, then +300, is 350</i> c) <i>Recall that 65 and 35 is 100</i> |
| Copper 7 | | A MIXTURE of sets 1 to 6 |

Bronze Challenge tasks

| Challenge | Description | These worked examples are to give a guide to a suggested mental procedure, and <u>not</u> intended for students to write down: |
|------------------|------------------------------------|--|
| Bronze 1 | Harder doubles | Partition the number and double each bit <i>e.g. double 32 is (double 30) + (double 2) = 60 + 4 = 64; double 420 is (double 400 and d20);</i> |
| Bronze 2 | Odd halves | All these involve halving an odd number so that the answer always has $\frac{1}{2}$. Ideally, students need to learn and just <u>recall</u> the halves of 1,3,5,7,9. They can then apply this knowledge when faced with ANY odd number. <i>e.g. half of 17 is (half of 10) + (half of 7)= 5+3½=8½ half of 43 is (h of 40) + (h of 3);</i> |
| Bronze 3 | Bridging multiples of 10 | Treat the next 10 as a stopping off point. Add on to the next ten and then add the rest. <i>e.g. 18 +5....18 +2 = 20, then +3 is 23; 25+7... 25 +5 +2 = 32;</i> |
| Bronze 4 | Small differences | In subtractions, when the numbers are either side of a “Tens boundary”, it is easier to ADD ON rather than take away. <i>e.g. 53-48....48 +2 =50, then +3 = 53 (a total of 5 has been added); 236-229... 236 +1 +6...= 7</i> |
| Bronze 5 | Adding near multiples of 10 | Two main methods: 57+8 a) Transform this into 55 + 10 by subtracting 2 from the 57 and adding it to 8; b) Change the 8 to 10 and do 57 + 10 , then compensate by subtracting 2 <i>247+19 is either 246+20, or 247 +20 -1</i> |
| Bronze 6 | Fractions of money | These are all unitary fractions, (<i>the numerators are always 1</i>). Therefore, the number has only to be divided by the denominator. <i>e.g. 1/5 of £10 is simply 10÷5 = £2 1/8 of £1.60 can be thought of as 160p ÷8 =20p</i> |
| Bronze 7 | Change from £1 | Two main methods: £1 – 68p a) Partition the 68p into 60p and 8p and subtract each bit separately.... <i>100p – 60p (40p), - 8p = 32p;</i> b) Add on from 68p... <i>2p (70p), then 30p=32p</i> |
| Bronze 8 | | A MIXTURE of sets 1 to 7 |

Silver Challenge tasks

| Challenge | Description | These worked examples are to give a guide to a suggested mental procedure, and <u>not</u> intended for students to write down. |
|-----------|------------------------------------|---|
| Silver 1 | Even Harder doubles | Partition the number, double each bit and then add them. double 83 e.g. (double 80) + (double 3) = 160+6 = 166; double 145.... (d100) + (d45) or (d140) + (d5) |
| Silver 2 | Mixed doubles, halves | This is just a return to the Harder Halves from Copper mixed with the level above. Students need to become able to switch their thinking between the two operations. |
| Silver 3 | × 20 | Basically this is just a doubling of a x10 operation. e.g. 34x20 is ... 34 ×2 (68)... ×10 = 680 |
| Silver 4 | Tables with multiples of 10 | This set simply extends the idea above. e.g. 4 x 70 is thought of as 4 x 7 x 10 = 28 x 10; 50 x 6 as 5 x 6 x 10; |
| Silver 5 | × 4 | ×4 is the same as ×2 ×2, in other words, doubling twice . e.g. 35x4...(double 35) = 70, then double 70 = 140; 4x82.....(double 82) x2 = double 164 = 328 |
| Silver 6 | ÷ 10 with integers and 1dp | Although many people have learned to “move the decimal point 1 place to the right”, we teach students to shift the digits around a fixed decimal point. e.g. 34.1 ÷ 10, the 3 (30) becomes 3, the 4 becomes 4 tenths and the 1 becomes 1 hundredth....3.41 – each digit has been moved 1 place to the right. |
| Silver 7 | Fractions of numbers | When the fraction is unitary (1/3, ¼, 1/7 etc), it is a simple matter of dividing by the denominator. When the fraction is not unitary, we need to divide by the denominator and then, multiply by the numerator. So, with ¾ we first find ¼ and multiply by 3 to find 3 of them. e.g. 5/8 of 32.....32 ÷8 is 4, then 4 ×5 = 20; |
| Silver 8 | Partitioning | Multiplying by a teens number involves partitioning it into tens and units. e.g. 13 ×7 = (10+3) ×7 or..... (10×7) + (7×3) = 70 + 21 = 91 This is a general rule for all numbers, but when the number is EVEN, (e.g. 14 x6) it might be quicker to do double(7x6). |

| | | |
|------------------|---|---|
| <p>Silver 9</p> | <p>Rounding money (+ and -)</p> | <p>These addition problems involve rounding up to the next £. When those rounded up amounts are added, the “extra” pence must be subtracted. If two 99p amounts are to be added that means -2p, but if two 98p amounts are added that means -4p. <i>e.g. £2.98 + £1.98.... (£3 + £2) – 4p = £4.96</i> The subtraction problems can be tackled like the simpler examples in Copper 5 (Change from £1) either by adding on to the next £, (“<i>shopkeeper’s change</i>”). <i>e.g. £5 - £3.99.....1p (to make £4), then £1 = £1.01</i> or subtracting the rounded up amount then adding on the amount that was rounded up, <i>e.g. £10 - £6.98...£10 - £7 = £3, then £3 + 2p = £3.02</i></p> |
| <p>Silver 10</p> | <p>Adding near multiples of 10</p> | <p>This simply extends the examples in Bronze 5. <i>e.g. 165+27....</i> Transform this into 162+30 by transferring 3 from the 165 onto the 27, <u>or</u> <i>add 3 to make 30, and do 165+30, then subtract 3.</i></p> |
| <p>Silver 11</p> | | <p>A MIXTURE of sets 1 to 10</p> |

Gold Challenge tasks

| Challenge | Description | These worked examples are to give a guide to a suggested mental procedure, and <u>not</u> intended for students to write down: |
|-----------|------------------------|--|
| Gold 1 | Applying Doubles | Each of these examples has an EVEN 2-digit number to be multiplied. You <i>halve</i> that number then <i>double</i> the product, <i>e.g. 8x14 is double (8x7) and 14x6 is double (7x6);</i> |
| Gold 2 | Halving ODD numbers | To calculate a half of an ODD number, you can halve the number before it and then just add $\frac{1}{2}$. <i>e.g. half of 7 is the number that is halfway between the halves of 6 and 8 (between 3 and 4).</i> This can be modelled on a number line or with quantities. The aim would be to learn most of the halves in this set, off by heart, so no calculation is needed. |
| Gold 3 | Equivalent Measures | Knowledge that 1m = 100cm, whereas, 1 litre = 1000g and 1kg = 1000g is necessary here. So, it is an application of simple fractions of either 100 or 1000. |
| Gold 4 | Using Negative numbers | The context of temperature is a familiar one for using negative numbers – especially in the winter! Using a thermometer scale allows modelling of the operation as a journey on a number line that goes below zero, or starts below zero and rises above it. In both cases, zero is the landmark that acts as a “staging post”. <i>e.g. 2° falls 5°... can be thought of as “falls 2° to 0°, then a further 3° to -3°”;</i> The pure number examples might benefit from a conversion to the temperature context, <i>e.g. 1 – 3.....start at 1° and fall 3° = -2</i> <i>-2 + 5.....start at -2° and rise 5° = +3</i> <i>-3 – 2.... start at -3° and fall 2° = -5</i> |
| Gold 5 | ÷ 4 | Dividing by 4 and finding $\frac{1}{4}$ are the same idea and both can be enacted by recalling the 4 times table, but when numbers are beyond 40 or not multiples of 4, a good strategy is to halve, and halve again. <i>e.g. 50÷4 is.....25....12½ ; ¼ of 320 is...160...80;</i> |
| Gold 6 | Rounding money (x) | Prices are often shown as 1p or 2p below a £, so it is quicker to round the amount up then subtract the pence according to how many items there are. <i>e.g. £1.98 x 4....£2x4 = £8, then subtract 2p x 4 (8p) from £8 = £7.92;</i> |

| | | |
|-----------------------|---|---|
| <p>Gold 7</p> | <p>Partitioning (2)</p> | <p>This harder level of Partitioning involves multiplying a single digit by 2-digit numbers that are not decade numbers. Most of the examples are odd numbers so the option to halve or quarter the number does not present itself. Instead, we recommend this approach, <i>e.g. 27×3....is $(20 \times 3) + (7 \times 3)$, which can be modelled using the grid method (a rectangle 27 by 3 in which a line partitions the longer side into 20 and 7). The two rectangles this line creates have areas of 60 and 21.</i> <i>63×7....$(6 \times 7) \times 10$ add (3×7);</i></p> |
| <p>Gold 8</p> | <p>$\times 5$</p> | <p>Multiplying by 5 is equivalent to multiplying by 10 and halving the answer. <i>e.g. 61×5....half of (61×10).....Halving 610 can be partitioned into 600 and 10....$300 + 5$;</i> <i>5×0.9.... $9 (0.9 \times 10) \div 2 = 4.5$;</i></p> |
| <p>Gold 9</p> | <p>Find the Average (mean)</p> | <p>Finding the mean (average) involves first finding the total and then dividing by the number of numbers. <i>e.g. $4, 2, 3, 7$....total is 16....$\div 4 = 4$;</i></p> |
| <p>Gold 10</p> | <p>Same Difference or Compensating</p> | <p>All these examples involve pairs of numbers where the number being subtracted (subtrahend) has a larger unit digit than the first number (minuend). The often favoured strategy is to round up the subtrahend to the next decade and then compensate by adding that extra rounding. <i>e.g. $76 - 19$....$76 - 20 + 1$;</i> An alternative is to add whatever is needed to round up the minuend, to the other number as well. Doing this creates a new pair of numbers with the same difference. An alternative is to round up the subtrahend to a nice decade number. But whatever is done to this number must also be done to the minuend as well. Doing this creates a new pair of numbers with the same difference. <i>$76 - 19$....=$77 - 20$ (1 has been added to <u>both</u> numbers) which is much easier!</i> <i>$94 - 46$....=$98 - 50$ (4 has been added to <u>both</u> numbers)</i> <i>$145 - 28 = 147 - 30$ (2 has been added to <u>both</u> numbers)</i> The Number Gym has a <i>Same Difference</i> modelling activity.</p> |
| <p>Gold 11</p> | | <p>A MIXTURE of challenges 1 to 10</p> |

Platinum Challenge tasks

| Challenge | Description | These worked examples are to give a guide to a suggested mental procedure, and <u>not</u> intended for students to write down: |
|------------|--------------------------|--|
| Platinum 1 | Doubling decimals | <p>The strategy we recommend here involves treating the number as if it were not a decimal (<i>by removing the decimal point</i>), but re-instating it by approximating the rough size of the answer.</p> <p><i>e.g. double 0.7.....the digits will be 14, and since 0.7 is a bit less than 1, the answer will be less than 2, so that is why the answer is 1.4 and not 14 or 0.14;</i></p> <p><i>double 1.6....the digits will be 32, and since 1.6 is approximately 1½, the answer needs to be about 3, therefore, 3.2;</i></p> <p><i>double 1.07....214.....and must be 2.14 because the other option of 21.4 is clearly not a doubling of 1...;</i></p> |
| Platinum 2 | $\div 5$ | <p>Dividing by 5 is equivalent to dividing by 10, then doubling, because dividing by a smaller number gives a larger answer. $1/5$ is an equivalent operation to dividing by 5.</p> <p><i>e.g. 72 $\div 5$.... = 7.2 x2 = 14.4;</i></p> |
| Platinum 3 | Percentages (1) | <p>Four easier percentages are introduced here:</p> <p>50% - just halve the amount.</p> <p>25% - halve the half!</p> <p>10% - divide by 10, by shifting each digit 1 place to the right;</p> <p><i>e.g. 10% of £2.60... = £0.26 or 26p;</i></p> <p>1% - divide by 100, by shifting each digit 2 places to the right.</p> <p><i>e.g. 1% of £13... = £0.13 or 13p;</i></p> |
| Platinum 4 | Dreadful doubles | <p>This final set of doubles presents some awkward looking numbers. The aim is to partition them, double each bit and add these.</p> <p><i>e.g. double 163..(double 100)+(double 60)+(double 3)</i></p> <p><i>double 176...(double 170) + (double 6) = 340+12;</i></p> |
| Platinum 5 | More Percentages | <p>These percentages extend the ability to calculate 10%. 5%....by then halving it. 20%...by doubling it. 30%...by trebling it.</p> <p><i>e.g. 5% of £30....10% is £3, halve it = £1.50;</i> <i>20% of £80....10% is £8, double it = £16;</i></p> <p><i>Note that 20% is also 1/5, so an alternative is to $\div 5$</i> <i>30% of £12...10% is £1.20,... x3....£3.60;</i></p> |

| | | |
|-------------|-----------------------------|--|
| Platinum 6 | Division with decimals | <p>It is important with these to be alert to the nature of the numbers. e.g. when you divide by 0.5 this is equivalent to saying “how many halves in”. So we should expect the answer to be 10 times larger than if we were dividing by 5. Similarly, dividing by 0.7 will give an answer that is 10 times larger than dividing by 7.</p> <p><i>e.g. $42 \div 0.6 \dots 42 \div 6 = 7$, so the answer must be 10 times bigger than that....70</i></p> <p><i>$4.9 \div 7 \dots$ we know that $49 \div 7 = 7 \dots$ but 4.9 is 10 times smaller so the answer must be 10 times smaller.....0.7</i></p> |
| Platinum 7 | What’s the change from....? | <p>There are two things to consider here, the direction that the change is occurring – if it is going UP, this is a rise and will therefore be a plus amount, and a negative value if it is a decrease in temperature, <u>regardless of where the original temperature is.</u></p> <p>The other thing is the size of the rise or fall.</p> <p><i>e.g. 3° to $-7^\circ \dots$ is a fall of 10°, so.....-10° ;</i></p> <p><i>-3 to $-1 \dots$ is a rise of 2, so$+2$;</i></p> <p><i>-2 to $-5 \dots$ is a fall of 3, so -3.</i></p> |
| Platinum 8 | Still more Percentages | <p>15% involves first calculating 10%, halving it to get 5%, then adding the two amounts.</p> <p><i>e.g. 15% of £160....$\pounds 16 + \pounds 8 = \pounds 24$</i></p> <p>75% is 3/4, so first find 1/4 then x3 to get 3 quarters.</p> <p><i>e.g. 75% of £36....$\pounds 9 \times 3 = \pounds 27$</i></p> <p>60% is 50% + 10%, so first find 1/2, then 1/10 and add them.</p> <p><i>e.g. 60% of £4....$\pounds 2 + 40p = \pounds 2.40$</i></p> <p>Another strategy for 60% is find 10% and x6</p> <p><i>e.g. 60% of £4.... $40p \times 6 = \pounds 2.40$</i></p> |
| Platinum 9 | Rounding to approximate | <p>This is the only set of cards where there is <u>no expectation that the correct answer will be calculated.</u> Instead, an approximate answer is required. This will involve rounding the numbers to gain an idea of the approximate size of the answer.</p> <p>Where two possible answers are presented, a secondary check is needed. This involves recognising that the unit digit of a product can be known by noticing the unit digits of the factors. e.g. <i>ANY number ending in a 3 multiplied by ANY number ending in a 7 must have a product ending in 1, because $3 \times 7 = 21$.</i></p> <p><i>e.g. $51 \times 98 \dots$ rounding this to 50×100, an approximate answer will be about 5000. But $1 \times 8 = 8$, so of the two “likely” answers (4998 and 4922) only 4998 can be considered the correct one.</i></p> |
| Platinum 10 | Percentage discounts | <p>Having learned how to calculate 50%, 25%, 10% and 20% in previous levels, the challenge now is to subtract these amounts from the “price” to discover the discounted price.</p> <p><i>e.g. £120, 10% off.... the calculation will be $\pounds 120 - \pounds 12 = \pounds 108$;</i></p> <p><i>but, £6.80, 50% off ... is simply “half price”...£3.40;</i></p> <p><i>£5.50, 20% offis $\pounds 5.50 - (2 \times 55p) = \pounds 5.50 - \pounds 1.10$;</i></p> |
| Platinum 11 | | MIXTURE of challenges 1 to10 |

Finally, we hope that this software offer some assistance in the challenging task of teaching mathematics. Do please let us know if you've found these resources useful or have some suggestions for their improvement. Please send your feedback to feedback@numbergym.co.uk

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Appendix – The Data Sets and record sheets

Copper Challenges 1 to 6 (7 is a mixture of 1 to 6)

| 1 | 2 | 3 | 4 | 5 | 6 |
|--------------|-----------------------------|--------------|---------------|----------------|------------------|
| Easy doubles | Looking for multiples of 10 | Easy halves | Harder halves | Change from £1 | Bonds of 1000 |
| double 5 | $8 + 2 + 6$ | half of 4 | half of 48 | £1 - 10p | 1000 - 50 |
| double 6 | $8 + 6 + 2$ | half of 6 | half of 26 | £1 - 20p | 1000 - 150 |
| double 7 | $7 + 3 + 6$ | half of 8 | half of 68 | £1 - 30p | 1000 - 250 |
| double 8 | $3 + 6 + 7$ | half of 10 | half of 82 | £1 - 40p | 1000 - 350 |
| double 9 | $4 + 6 + 4$ | half of 12 | half of 84 | £1 - 50p | 1000 - 450 |
| double 20 | $7 + 4 + 3$ | half of 14 | half of 108 | £1 - 60p | 1000 - 550 |
| double 21 | $4 + 8 + 6$ | half of 16 | half of 120 | £1 - 70p | 1000 - 650 |
| double 24 | $2 + 5 + 8$ | half of 18 | half of 240 | £1 - 80p | 1000 - 750 |
| double 40 | $9 + 4 + 1$ | half of 20 | half of 280 | £1 - 90p | 1000 - 850 |
| double 30 | $6 + 4 + 3$ | half of 22 | half of 420 | £1 - 95p | 1000 - 950 |
| double 100 | $2 + 8 + 6$ | half of 40 | half of 500 | £1 - 85p | $900 + ? = 1000$ |
| double 400 | $8 + 5 + 5$ | half of 44 | half of 640 | £1 - 75p | $800 + ? = 1000$ |
| double 1000 | $8 + 1 + 9$ | half of 60 | half of 1200 | £1 - 65p | $700 + ? = 1000$ |
| double 300 | $3 + 6 + 4$ | half of 80 | half of 1600 | £1 - 55p | $600 + ? = 1000$ |
| double 2000 | $20 + 60 + 40$ | half of 100 | half of 2400 | £1 - 45p | $500 + ? = 1000$ |
| double 200 | $30 + 60 + 70$ | half of 200 | half of 180 | £1 - 35p | $400 + ? = 1000$ |
| double 50 | $50 + 90 + 50$ | half of 400 | half of 30 | £1 - 25p | $300 + ? = 1000$ |
| double 15 | $70 + 70 + 30$ | half of 1000 | half of 32 | £1 - 15p | $200 + ? = 1000$ |
| double 500 | $40 + 80 + 60$ | half of 50 | half of 34 | £1 - 5p | $100 + ? = 1000$ |
| double 3000 | $50 + 20 + 80$ | half of 30 | half of 50 | £1 - 99p | $50 + ? = 1000$ |

Bronze Challenges 1 to 7 (8 is a mixture of 1 to 7)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|----------------|---------------------------|--------------------------|-------------------|------------------------------|--------------------|----------------|
| Harder doubles | Odd halves with fractions | Bridging multiples of 10 | Small differences | Transforming or compensating | Fractions of money | Change from £1 |
| double 14 | half of 1 | 15 + 8 | 31 - 28 | 27 + 9 | 1/4 of £8 | £1 - 92p |
| double 12 | half of 3 | 16 + 7 | 32 - 29 | 28 + 8 | 1/4 of 80p | £1 - 89p |
| double 13 | half of 5 | 15 + 7 | 31 - 26 | 26 + 8 | 1/4 of £6 | £1 - 88p |
| double 31 | half of 7 | 17 + 6 | 32 - 27 | 25 + 9 | 1/4 of 60p | £1 - 83p |
| double 16 | half of 9 | 17 + 8 | 33 - 28 | 34 + 9 | 1/3 of £3 | £1 - 79p |
| double 17 | half of 11 | 18 + 5 | 43 - 38 | 33 + 18 | 1/3 of £15 | £1 - 74p |
| double 18 | half of 13 | 16 + 6 | 51 - 47 | 32 + 19 | 1/3 of £12 | £1 - 71p |
| double 19 | half of 15 | 18 + 7 | 53 - 48 | 47 + 9 | 1/3 of £30 | £1 - 68p |
| double 23 | half of 17 | 19 + 5 | 62 - 57 | 65 + 8 | 1/3 of £1.50 | £1 - 66p |
| double 24 | half of 19 | 25 + 7 | 64 - 57 | 78 + 19 | 1/5 of £10 | £1 - 59p |
| double 32 | half of 21 | 27 + 6 | 74 - 69 | 135 + 9 | 1/5 of £1 | £1 - 52p |
| double 150 | half of 23 | 28 + 4 | 83 - 77 | 164 + 8 | 1/5 of £20 | £1 - 46p |
| double 52 | half of 25 | 29 + 6 | 91 - 86 | 146 + 9 | 1/6 of £12 | £1 - 37p |
| double 230 | half of 41 | 48 + 5 | 101 - 98 | 247 + 19 | 1/6 of 60p | £1 - 33p |
| double 120 | half of 43 | 97 + 4 | 102 - 95 | 459 + 9 | 1/8 of £16 | £1 - 29p |
| double 210 | half of 63 | 38 + 7 | 183 - 179 | 157 + 18 | 1/8 of £1.60 | £1 - 26p |
| double 420 | half of 83 | 127 + 5 | 251 - 248 | 58 + 9 | 1/8 of £24 | £1 - 18p |
| double 250 | half of 101 | 138 + 6 | 1002 - 997 | 83 + 19 | 1/8 of £2.40 | £1 - 13p |
| double 123 | half of 89 | 77 + 5 | 2001 - 1997 | 123 + 9 | 1/10 of £10 | £1 - 11p |
| double 345 | half of 99 | 97 + 6 | 2009 - 1998 | 57 + 8 | 1/10 of £1 | £1 - 9p |



Silver Challenges 1 to 10 (11 is a mixture of 1 to 10)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|------------------------|-----------------------------|------------------------|---|----------------------------|---------------------------------|-------------------------|--------------|-------------------|------------------------------------|
| Even Harder Doubles | Mixed doubles, halves | x20 is x2, then x10 | Mixed tables with multiples of 10 | x4 is doubling twice | ÷10 with integers and 1dp | Fractions of numbers | Partitioning | Rounding Money | Compensating or Transforming |
| double 65 | half of 64 | 22 x 20 | 40 x 4 | 15 x 4 | 300 ÷ 10 | 2/3 of 12 | 12 x 5 | 99p + 99p | 29 + 29 |
| double 64 | double 125 | 24 x 20 | 30 x 7 | 51 x 4 | 30 ÷ 10 | 2/3 of 15 | 12 x 6 | £1.99 + 99p | 47 + 19 |
| double 74 | double 84 | 28 x 20 | 40 x 6 | 44 x 4 | 120 ÷ 10 | 1/3 of 15 | 12 x 7 | £1.99 + £1.99 | 74 + 29 |
| double 72 | double 240 | 31 x 20 | 4 x 70 | 24 x 4 | 12 ÷ 10 | 2/3 of 18 | 12 x 8 | £2.99 + £1.99 | 67 + 28 |
| double 83 | double 145 | 33 x 20 | 40 x 8 | 4 x 13 | 102 ÷ 10 | 3/4 of 36 | 13 x 5 | £1.49 + £2.49 | 66 + 29 |
| double 82 | half of 26 | 34 x 20 | 4 x 90 | 4 x 21 | 230 ÷ 10 | 2/3 of 300 | 13 x 7 | £1.99 + £3.99 | 63 + 28 |
| double 92 | half of 36 | 35 x 20 | 50 x 4 | 4 x 32 | 23 ÷ 10 | 3/4 of 20 | 13 x 6 | £3.99 + £2.99 | 124 + 29 |
| double 94 | half of 140 | 42 x 20 | 50 x 6 | 4 x 45 | 2.3 ÷ 10 | 3/5 of 20 | 13 x 8 | £5.99 + £5.99 | 157 + 29 |
| double 135 | half of 180 | 44 x 20 | 5 x 70 | 4 x 16 | 33.1 ÷ 10 | 2/5 of 40 | 14 x 5 | £2.98 + £1.98 | 148 + 39 |
| double 145 | half of 120 | 20 x 30 | 50 x 8 | 4 x 60 | 49.9 ÷ 10 | 2/7 of 21 | 14 x 6 | £10.90 + £3.90 | 165 + 27 |
| double 260 | double 220 | 20 x 54 | 5 x 90 | 4 x 71 | 5 ÷ 10 | 3/7 of 70 | 15 x 5 | £5 - 99p | 143 + 37 |
| double 360 | double 58 | 20 x 62 | 60 x 4 | 4 x 82 | 50.5 ÷ 10 | 3/8 of 24 | 15 x 9 | £5 - £2.99 | 136 + 29 |
| double 350 | double 56 | 20 x 70 | 6 x 50 | 4 x 90 | 650 ÷ 10 | 5/8 of 72 | 16 x 9 | £5 - £1.98 | 227 + 38 |
| double 450 | double 53 | 20 x 80 | 60 x 6 | 4 x 18 | 66.6 ÷ 10 | 4/9 of 36 | 16 x 3 | £5 - £3.99 | 438 + 90 |
| double 2500 | half of 5000 | 20 x 90 | 6 x 70 | 31 x 4 | 780 ÷ 10 | 2/9 of 18 | 17 x 3 | £5 - £4.99 | 317 + 90 |
| double 4500 | half of 9000 | 20 x 41 | 60 x 8 | 43 x 4 | 70.3 ÷ 10 | 3/4 of 60 | 17 x 7 | £5 - £4.98 | 266 + 90 |
| double 3500 | half of 7000 | 20 x 18 | 6 x 90 | 61 x 4 | 860 ÷ 10 | 7/8 of 32 | 17 x 6 | £10 - £2.99 | 284 + 80 |
| double 134 | half of 3000 | 20 x 19 | 7 x 40 | 26 x 4 | 84.8 ÷ 10 | 7/8 of 56 | 17 x 5 | £10 - £4.99 | 325 + 190 |
| double 125 | half of 900 | 20 x 55 | 70 x 3 | 35 x 4 | 910 ÷ 10 | 3/10 of 90 | 17 x 3 | £10 - £8.99 | 467 + 190 |
| double 430 | half of 700 | 20 x 45 | 8 x 70 | 45 x 4 | 93.6 ÷ 10 | 7/10 of 30 | 17 x 8 | £10 - £9.98 | 376 + 190 |

Gold Challenges 1 to 10 (11 is a mixture of 1 to 10)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|------------------|---------------------|---------------------|------------------|-------------|----------------|--------------|-------------------|----------------|---------------------------------|
| Applying Doubles | Halving odd numbers | Equivalent Measures | Negative Numbers | ÷4 and 1/4 | Rounding money | Partitioning | x5 is half of x10 | Averages | Same Difference or Compensating |
| 20 x 8 | half of 1 | 250g = ? | 0° falls 5° | 1/4 of 80 | 99p x 2 | 26 x 3 | 12 x 5 | 4, 2, 3 | 23 - 9 |
| 18 x 3 | half of 3 | 50cm = ? | 2° falls 6° | 120 ÷ 4 | 99p x 3 | 26 x 4 | 15 x 5 | 2, 6, 4 | 33 - 19 |
| 5 x 18 | half of 5 | ½ litre = ? | -1° falls 5° | 1/4 of 60 | 99p x 4 | 26 x 5 | 18 x 5 | 4, 7, 4 | 36 - 19 |
| 18 x 7 | half of 7 | ¼ litre = ? | -7° falls 2° | 240 ÷ 4 | 99p x 5 | 23 x 5 | 42 x 5 | 6, 1, 2 | 37 - 18 |
| 4 x 16 | half of 9 | ½ metre = ? | -2° falls 7° | 1/4 of 640 | 99p x 10 | 23 x 7 | 17 x 5 | 40, 10, 10 | 58 - 29 |
| 2 x 16 | half of 11 | 500g = ? | -3° falls 4° | 52 ÷ 4 | 98p x 5 | 27 x 3 | 2.4 x 5 | 5, 3, 7 | 25 - 9 |
| 14 x 7 | half of 13 | 500ml = ? | 0° rises 2° | 1/4 of 460 | £1.99 x 2 | 32 x 3 | 25 x 5 | 30, 40, 20 | 36 - 9 |
| 14 x 5 | half of 15 | 2000ml = ? | -1° rises 4° | 1/4 of 6 | £1.99 x 3 | 33 x 7 | 36 x 5 | 4, 2, 3, 7 | 54 - 9 |
| 14 x 3 | half of 17 | 1000m = ? | -2° rises 1° | 30 ÷ 4 | £1.99 x 5 | 24 x 7 | 38 x 5 | 3, 6, 1, 2 | 64 - 18 |
| 3 x 16 | half of 19 | 2000g = ? | -3° rises 2° | 1/4 of 106 | £1.99 x 10 | 27 x 4 | 4.1 x 5 | 60, 20, 30, 10 | 76 - 19 |
| 6 x 14 | half of 21 | 1½ km = ? | -3° rises 4° | 50 ÷ 4 | £1.98 x 2 | 43 x 7 | 49 x 5 | 17, 3, 4 | 82 - 29 |
| 16 x 7 | half of 25 | ¾ metre = ? | -7° rises 2° | 1/4 of 300 | £1.98 x 4 | 47 x 3 | 52 x 5 | 14, 6, 4 | 94 - 38 |
| 8 x 14 | half of 23 | 1½ litres = ? | -6° rises 4° | 70 ÷ 4 | £1.98 x 5 | 53 x 9 | 5 x 61 | 7, 11, 3 | 73 - 27 |
| 16 x 3 | half of 33 | 10 mm = ? | -6° rises 9° | 1/4 of 320 | £1.98 x 10 | 59 x 3 | 5 x 63 | 7, 7, 13 | 84 - 48 |
| 5 x 16 | half of 35 | 15 mm = ? | 1 - 3 | 90 ÷ 4 | £2.99 x 2 | 63 x 7 | 5 x 76 | 10, 0, 2, 4 | 94 - 46 |
| 16 x 6 | half of 105 | 150 cm = ? | 3 - 5 | 1/4 of 1000 | £2.99 x 5 | 67 x 3 | 5 x 83 | 15, 21 | 145 - 28 |
| 18 x 4 | half of 107 | 75 cm = ? | -4 + 2 | 128 ÷ 4 | £9.99 x 5 | 27 x 7 | 5 x 91 | 3, 9, 9 | 166 - 37 |
| 6 x 18 | half of 121 | 3½ km = ? | -2 + 3 | 1/4 of 10 | £9.99 x 4 | 26 x 6 | 5 x 0.9 | 3, 3, 9 | 247 - 29 |
| 12 x 8 | half of 57 | 2.5 cm = ? | -5 - 2 | 64 ÷ 4 | £9.99 x 3 | 55 x 3 | 5 x 10.5 | 6, 12, 0 | 375 - 48 |
| 12 x 6 | half of 69 | 1½ litres = ? | -3 - 5 | 248 ÷ 4 | £9.99 x 2 | 87 x 5 | 5 x 29 | 1, 5, 2, 4 | 153 - 36 |



Platinum Challenges 1 to 10 (11 is a mixture of 1 to 10)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|--------------------------|--------------------------|------------------------|-------------------------|-------------------------|-------------------------------|------------------------------------|------------------------|--|-----------------------------|
| Doubling decimals | ÷5 is ÷10 doubled | Percentages (1) | Dreadful Doubles | Percentage s (2) | Division with decimals | What's the change from....? | Percentages (3) | Rounding to approximate an answer | Percentage discounts |
| double 0.5 | 60 ÷ 5 | 50% of £2.60 | double 19 | 5% of £4 | 8 ÷ 0.2 | 2° to 6° | 15% of £4 | 0.9 x 21 | £6, 50% off |
| double 0.25 | 1/5 of 90 | 50% of £3.80 | double 37 | 5% of £10 | 80 ÷ 0.2 | 6° to 2° | 15% of £12 | 1.9 x 21 | £5, 50% off |
| double 0.7 | 210 ÷ 5 | 50% of £28 | double 78 | 5% of £30 | 88 ÷ 0.2 | 3° to -4° | 15% of £160 | 9 x 29 | £9, 50% off |
| double 0.9 | 1/5 of 11 | 50% of £130 | double 780 | 5% of £160 | 35 ÷ 0.5 | 4° to -7° | 15% of £60 | 99 x 102 | £25, 50% off |
| double 1.5 | 72 ÷ 5 | 50% of £150 | double 67 | 5% of £20 | 350 ÷ 0.5 | -3° to 4° | 15% of £120 | 47 x 11 | £6.80, 50% off |
| double 1.6 | 1/5 of 105 | 25% of £60 | double 167 | 20% of £60 | 3.5 ÷ 5 | -2° to 7° | 75% of £20 | 1.9 x 3.9 | £10, 25% off |
| double 1.7 | 36 ÷ 5 | 25% of £400 | double 68 | 20% of £400 | 3.5 ÷ 0.5 | -7° to 6° | 75% of £60 | 1.9 x 39 | £60, 25% off |
| double 1.8 | 1/5 of 225 | 25% of £1000 | double 76 | 20% of £1000 | 4 ÷ 8 | -3° to -1° | 75% of £400 | 19 x 39 | £200, 25% off |
| double 2.5 | 660 ÷ 5 | 25% of £18 | double 77 | 20% of £35 | 40 ÷ 0.8 | -7° to -4° | 75% of £1000 | 19 x 390 | £8, 25% off |
| double 2.6 | 1/5 of 77 | 25% of £1.80 | double 86 | 20% of £250 | 0.4 ÷ 0.8 | -9° to -4° | 75% of £36 | 1.9 x 399 | £16, 25% off |
| double 4.7 | 68 ÷ 5 | 10% of £2.60 | double 88 | 40% of £30 | 42 ÷ 0.6 | -3° to -5° | 60% of £300 | 5.1 x 8.8 | £10, 10% off |
| double 10.3 | 1/5 of 14 | 10% of £24 | double 96 | 40% of £60 | 4.2 ÷ 6 | -5° to -8° | 60% of £4 | 51 x 98 | £120, 10% off |
| double 10.8 | 74 ÷ 5 | 10% of £100 | double 163 | 40% of £9 | 420 ÷ 0.6 | 3° to -2° | 60% of £8 | 5.1 x 98 | £150, 10% off |
| double 13.5 | 1/5 of 17 | 10% of £108 | double 274 | 40% of £10 | 2.1 ÷ 0.7 | -1° to -5° | 60% of £10 | 29 x 61 | £240, 10% off |
| double 0.05 | 820 ÷ 5 | 10% of £12.50 | double 184 | 40% of £5 | 2.1 ÷ 7 | 12 to 0 | 60% of £20 | 2.9 x 610 | £50, 10% off |
| double 0.06 | 1/5 of 19 | 1% of £2 | double 176 | 30% of £30 | 210 ÷ 0.7 | 7 to -2 | 90% of £300 | 2.9 x 10.1 | £20, 20% off |
| double 0.09 | 63 ÷ 5 | 1% of £20 | double 365 | 30% of £60 | 49 ÷ 0.7 | 4 to -1 | 90% of £4 | 19 x 6.1 | £250, 20% off |
| double 1.04 | 1/5 of 16 | 1% of £13 | double 870 | 30% of £9 | 4.9 ÷ 0.7 | -3 to 7 | 90% of £8 | 41 x 6.4 | £60, 20% off |
| double 1.06 | 145 ÷ 5 | 1% of £80 | double 1720 | 30% of £10 | 4.9 ÷ 7 | -5 to -2 | 90% of £10 | 29 x 29 | £15, 20% off |
| double 5.18 | 1/5 of 28 | 1% of £350 | double 1608 | 30% of £5 | 490 ÷ 0.7 | -2 to -5 | 90% of £20 | 4.1 x 67 | £5.50, 20% off |

| COPPER | | BRONZE | | SILVER | | GOLD | | PLATINUM | |
|--------|---|--------|--|--------|---|------|--|----------|---|
| 1 | Easy Doubles (double 9.....20.....400) | 1 | Harder Doubles (double 19.....420) | 1 | Even Harder Doubles (double 83.....420) | 1 | Applying Doubles (18×4 is double 9×4) | 1 | Doubling decimals (double 1.6.....1.07) |
| 2 | Looking for 10s (8+5+2; 80+70+30) | 2 | Odd halves with fractions half of 7....27) | 2 | Mixed Doubles and Halves | 2 | Halving ODD numbers (half of 15...107) | 2 | ÷5 and 1/5 is double ÷10 (68÷5.....1/5 of 19) |
| 3 | Easy Halves (half of 8....30....120) | 3 | Bridging multiples of 10 (17+5; 28+4; 139+7) | 3 | Combining tables with x10 (70×6) | 3 | Equivalent Measures (750g...50mm½ of 1kg ...¼ of 1litre.) | 3 | Percentages (1) (10%...50%...25%.) |
| 4 | Harder Halves (half of 42....1600) | 4 | Small differences (61-57; 103-96; 1020-995) | 4 | ×20 is ×2 then ×10 (20× 30...×54) | 4 | Negative numbers (-3° rises 2°2° falls 3°) | 4 | Dreadful doubles (double 368) |
| 5 | Change from £1 multiples of 5p (£1-30p; £1-45p) | 5 | Adding near multiples of 10 (1) (27+9; 35+19;) | 5 | ×4 is doubling, twice (4× 13....×32) | 5 | ÷4 and ¼ is halving, twice (¼ of 10...128÷4) | 5 | Percentages (2) (5%...20%....60%.... of money) |
| 6 | Bonds of 1000 (1000-800, 1000 -250) | 6 | Fractions of money (1/4 of £8) | 6 | ÷10 (123÷10...14÷10) | 6 | Rounding money (x) (£1.99p×3) | 6 | Division with decimals (40÷0.8...) |
| 7 | COPPER MIXTURE | 7 | Change from £1 (£1-17p; £1-69p) | 7 | Fractions of numbers (2/5 of 20) | 7 | Partitioning (2) (23×7) ×5 is half of ×10 | 7 | What's the change from...? (-3° to 2° ...7 to -2) |
| | | 8 | BRONZE MIXTURE | 8 | Partitioning (1) (13×8) | 8 | ×5 is half of x10 (5× 38....0.9) | 8 | Percentages (3) (15%...75%.) |
| | | | | 9 | Rounding money (+/-) (£2.99+£1.99; £5-£3.99) | 9 | Find the Average (of 5, 1, 7, 3; 20, 50, 20;) | 9 | Rounding to Estimate (29×61...) |
| | | | | 10 | Adding near multiples of 10 (2) (123+38; 536+190) | 10 | Same Difference or Compensating (23-9; 83-38; 165-48) | 10 | Percentage discounts (5%...10% ...25% off) |
| | | | | 11 | SILVER MIXTURE | 11 | GOLD MIXTURE | 11 | PLATINUM MIXTURE |

| COPPER | | Best test time | Date completed |
|---------------|---|----------------|----------------|
| 1 | Easy Doubles <i>(double 9....20....400)</i> | | |
| 2 | Looking for 10s <i>(8+5+2; 80+70+30)</i> | | |
| 3 | Easy Halves <i>(half of 8....30....120)</i> | | |
| 4 | Harder Halves <i>(half of 42....1600)</i> | | |
| 5 | Change from £1 multiples of 5p <i>(£1-30p; £1-45p)</i> | | |
| 6 | Bonds of 1000 <i>(1000-800, 1000 -250)</i> | | |
| 7 | COPPER MIXTURE | | |

| BRONZE | | Best test time | Date completed |
|---------------|---|----------------|----------------|
| 1 | Harder Doubles <i>(double 19....420)</i> | | |
| 2 | Odd halves with fractions <i>half of 7....27)</i> | | |
| 3 | Bridging multiples of 10 <i>(17+5; 28+4; 139+7)</i> | | |
| 4 | Small differences <i>(61-57; 103-96; 1020-995)</i> | | |
| 5 | Adding near multiples of 10 (1) <i>(27+9; 35+19;)</i> | | |
| 6 | Fractions of numbers (unitary) <i>(1/3 of £15; 1/8 f £24)</i> | | |
| 7 | Change from £1 <i>(£1-17p; £1-69p)</i> | | |
| 8 | BRONZE MIXTURE | | |

| SILVER | | Best test time | Date completed |
|---------------|--|----------------|----------------|
| 1 | Even Harder Doubles <i>(double 83....420)</i> | | |
| 2 | Mixed Doubles and Halves | | |
| 3 | Combining tables with x10 <i>(70×6)</i> | | |
| 4 | ×20 is ×2 then ×10 <i>(20× 30...×54)</i> | | |
| 5 | ×4 is doubling, twice <i>(4× 13....×32)</i> | | |
| 6 | ÷10 <i>(123÷10...14÷10)</i> | | |
| 7 | Fractions of numbers <i>(2/5 of 20; 7/8 of 32)</i> | | |
| 8 | Partitioning (1) <i>(13×8)</i> | | |
| 9 | Rounding money (+/-) <i>(£2.99+£1.99; £5-£3.99)</i> | | |
| 10 | Adding near multiples of 10 (2) <i>(123+38; 536+190)</i> | | |
| 11 | SILVER MIXTURE | | |

| GOLD | | Best test time | Date completed |
|-------------|---|----------------|----------------|
| 1 | Applying Doubles <i>(18×4 is double 9×4)</i> | | |
| 2 | Halving ODD numbers <i>(half of 15...107)</i> | | |
| 3 | Equivalent Measures <i>(750g...50mm½ of 1kg ...¼ of 1litre.)</i> | | |
| 4 | Negative numbers <i>(-3° rises 2°2° falls 3°)</i> | | |
| 5 | ÷4 and ¼ is halving, twice <i>(¼ of 10...128÷4)</i> | | |
| 6 | Rounding money (x) <i>(£1.99p×3)</i> | | |
| 7 | Partitioning (2) <i>(23×7) ×5 is half of ×10</i> | | |
| 8 | ×5 is half of x10 <i>(5× 38....0.9)</i> | | |
| 9 | Find the Average <i>(of 5, 1, 7, 3; 20, 50, 20;)</i> | | |
| 10 | Same Difference or Compensating <i>(23-9; 83-38; 165-48)</i> | | |
| 11 | GOLD MIXTURE | | |



Mental Maths Challenge – Record sheet for

| PLATINUM | | Best test time | Date completed |
|-----------------|---|----------------|----------------|
| 1 | Doubling decimals <i>(double 1.6..... 1.07)</i> | | |
| 2 | ÷5 and 1/5 is double ÷10 <i>(68÷5..... 1/5 of 19)</i> | | |
| 3 | Percentages (1) <i>(10%...50%...25%.)</i> | | |
| 4 | Dreadful doubles <i>(double 368)</i> | | |
| 5 | Percentages (2) <i>(5%, 20%, 60% of money)</i> | | |
| 6 | Division with decimals <i>(40÷0.8...)</i> | | |
| 7 | What's the change from ... <i>(-3° to 2°...7 to -2)</i> | | |
| 8 | Percentages (3) <i>(15%...75%.)</i> | | |
| 9 | Rounding to Estimate <i>(29x61...)</i> | | |
| 10 | Percentage discounts <i>(5%...10% ...25% off)</i> | | |
| 11 | PLATINUM MIXTURE | | |