

Mental Addition and Subtraction

Background

These resources were first used as warm up activities in a pre-GCSE maths (Level 1 and Level 2 numeracy) course. Although members of the group were competent at most Entry Level 3 curriculum elements, many had never been taught mental strategies.

These mental strategies and skills are from Entry Levels 2 and 3 but are well worth teaching, or recapping and revising, at higher levels.

Teaching ideas

Print pages 4, 6, 8 on coloured paper, laminate (we used different colours for addition and subtraction cards) and cut out.

For Levels 1 and 2 cards be used to introduce the topic of mental addition and subtraction with no input from the teacher. The activity can then be used to promote class discussion about different strategies – at this level many students are genuinely interested in the technical terms for these strategies: counting on (including shopkeeper's method) or counting back; reordering, partitioning (e.g. into tens and units, or bridging through ten); compensating; doubles and near doubles; number bonds or complementary numbers, etc. For more details on these see recommend links and information sources on page 2.

For Entry Levels cards can be used for consolidation after specific strategies have been taught, as a warm-up activity, or for revision. For Entry 1 and 2 encourage the use of numbered or blank number lines, and 100 squares (page 9). Many students like to have a small individual number square – blanks are provided on pages 10 and 11 for lamination.

Digit cards (p8)

- Students work in pairs. Each pair has two sets of digit cards (i.e. 20 cards) spread out, face down, on the table between them. One student picks two cards (to make a 2 digit number) then another two (to make another 2 digit number). Second student has to add them up – first student checks on calculator. Continue until all cards have been used up. As an extra challenge students can then try to add up all ten two-digit numbers they have made. Students then swap role and repeat. (Entry 1 students can work with a single set of digits if needed, adding tow single digits together).
- As above but subtract the smaller two digit number from the larger.
- As examples above but give students three sets of cards and make 3 digit numbers.

Mental addition and subtraction cards (p4 and p6)

Paired work

Students work in pairs (or threes). One upturned pile between them. Mix the cards or work through addition and subtraction separately.

- Take turns taking one card from pile and asking each other the question.
- As above but the questioner works out the answer with a calculator (even if they can do it quicker mentally). Who gets it first?
- Turn over a card, both students work out answer – then discuss how they did it.

Group work

Teacher can simply use page 5 or 7 as a prompt sheet. Ask questions to class – students write answer on individual whiteboards and hold up. Discuss how they got their answers. Is there more than one efficient mental strategy?

These maths cards are linked to an interactive scheme of work for Level 1 and Level 2 adult numeracy. Related resources and further lesson plans can be found at <http://members.aol.com/skillsworkshop/mscheme.htm>

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Links and other useful sources of information

Five different number lines: available on our site at
<http://members.aol.com/twittwoo/mathpdfs/nlines1.pdf>

Teaching Mental Calculation Strategies (2001), ISBN 1 85838 367 6. QCA. £3.
Can be ordered via QCA website at <http://www.qca.org.uk/>

Online adult numeracy curriculum – mental addition strategies at
http://www.dfes.gov.uk/curriculum_numeracy/tree/number/wholenum/guidance/4/

Online adult numeracy curriculum – mental subtraction strategies at
http://www.dfes.gov.uk/curriculum_numeracy/tree/number/wholenum/guidance/5/

Or see page 25 of the printed curriculum, available free from the Basic Skills Agency at
<http://www.basic-skills.co.uk/>

BBC Skillswise at <http://www.bbc.co.uk/skillswise/>
has loads of useful fact sheets, a quiz, worksheets and interactive games at
<http://www.bbc.co.uk/skillswise/numbers/wholenumbers/addsubtract/mental/index.shtml>

Use the following sites with care: they are designed for children but may appeal to some Entry Level 1 and 2 learners.

Excellent demonstration of bridging (through 10, 20, 50, decimals) from Toftwood School
Using a 'bridging rocket' (does look child-like but really demonstrates how bridging works)
<http://atschool.eduweb.co.uk/toftwood/bridging.html>

Excellent demonstration, a number line to subtract large (4 digit) numbers using partitioning
(does not look child-like) from Southbury School at
<http://www.southbury.enfield.sch.uk/mw/add & sub/sub large nos.swf>

Doubling using partitioning – very clever demonstration from Toftwood School at
<http://atschool.eduweb.co.uk/toftwood/woodcards.html>

Standards Site (National Numeracy Strategy) has some excellent interactive numeracy
applications (need Flash) at
<http://www.standards.dfes.gov.uk/numeracy/publications/>

These are ideal for use with an interactive whiteboard or for individual work on PCs with
internet access. Most interactive activities are also available as downloadable programs for
Windows and Macs. Many come with tutorials and teaching ideas.

They include:

An interactive 100 square at
http://www.standards.dfes.gov.uk/numeracy/publications/itps/number_grid/

Addition and subtraction facts (to 20)
http://www.standards.dfes.gov.uk/numeracy/publications/itps/number_facts/NumberFacts_1_2.swf

Counting on or back in tens or ones (up to 100) on a string of beads
http://www.standards.dfes.gov.uk/numeracy/publications/itps/count_on_and_back/countingon_flash.swf

Curriculum links

Note

Mental maths strategies are covered by Entry Level curriculum elements, but do not assume that students working at higher levels will be familiar with these techniques. Many adults have not been taught mental maths strategies, only rapid recall of facts such as tables and number bonds.

Adult should be shown (and practise) a range of strategies but encouraged to use those that work best for them.

N1/E1.4 Add single-digit numbers with totals up to 10, including zero (a) understand the operation of addition and related vocabulary, e.g. add, sum of, total, plus, etc. (b) know all pairs of numbers with a total of 10 (c) understand that addition is commutative (the concept not the terminology).

N1/E1.5 Subtract single-digit numbers from numbers up to 10 (a) understand the operation of subtraction and related vocabulary, e.g. difference, take away, less than, etc. (b) know subtraction facts for pairs of numbers with totals to 10, e.g. $10 - 6 = 4$ (c) know how to add back to check, e.g. $10 - 6 = 4$, $6 + 4 = 10$ (d) understand that subtraction is not commutative and that (using positive whole numbers) you can only subtract a number from itself or from a larger one (e) understand that subtracting zero leaves a number unchanged.

N1/E2.3 Add and subtract two-digit whole numbers.

N1/E2.4 recall addition and subtraction facts to 10 (a) understand that there are different strategies to help with mental addition and subtraction (b) understand that subtraction is the inverse of addition (c) understand how to align numbers for column addition.

N1/E3.2 Add and subtract three-digit whole numbers.

N1/E3.3 recall addition and subtraction facts to 20 (a) understand that there are different strategies for adding and subtracting (b) understand how to align numbers for column addition (c) understand that there are different methods of checking answers, e.g. adding in a different order, using inverses, using a calculator.

Mental Addition Cards

29 + 33	35 + 37	11 + 12
51 + 49	7 + 5 + 3	67 + 32
30 + 45	17 + 23	39 + 46
22 + 23	99 + 98	1 + 16 + 24
87 + 9	67 + 45	78 + 15
76 + 19	41 + 39	48 + 17

Possible addition strategies (not an exhaustive list)

<p>29 + 33 compensating 30+33-1 partitioning 29+30+3 bridging 29+30+1+2</p> <p>62</p>	<p>35 + 37 partitioning 30+30+5+7 bridging 35+30+5+2 near doubles 35+35+2</p> <p>72</p>	<p>11 + 12 partitioning 11+10+2</p> <p>23</p>
<p>51 + 49 near doubles near multiples of ten complementary</p> <p>100</p>	<p>7 + 5 + 3 reordering 7+3+5</p> <p>15</p>	<p>67 + 32 partitioning 67+30+2</p> <p>99</p>
<p>30 + 45 partitioning 30+40+5 counting on in 10s 45+10+10+10</p> <p>75</p>	<p>17 + 23 complementary pairs partitioning 17+3+20</p> <p>40</p>	<p>39 + 46 compensating 40+46-1 bridging 39+40+1+5 partitioning 39+40+6</p> <p>85</p>
<p>22 + 23 partitioning 22+20+3 near doubles 22+22+1</p> <p>45</p>	<p>99 + 98 near doubles 99+99-1 compensating 99+100-2</p> <p>197</p>	<p>1 + 16 + 24 reordering 24+16+1</p> <p>41</p>
<p>87 + 9 compensating 87+10-1</p> <p>96</p>	<p>67 + 45 partitioning 60+40+7+5</p> <p>112</p>	<p>78 + 15 partitioning 78+10+5</p> <p>93</p>
<p>76 + 19 compensating 76+20-1</p> <p>95</p>	<p>41 + 39 partitioning 41+9+30 near doubles 40+40</p> <p>80</p>	<p>48 + 17 bridging 48+10+2+5 compensating 50+17-2</p> <p>65</p>

Teacher's answer or prompt sheet.

Mental Subtraction Cards

91 - 56	163 - 76	147 - 21
74 - 19	100 - 77	92 - 15 - 12
23 - 9	56 - 28	37 - 19
72 - 49	95 - 37	163 - 76
90 - 15	82 - 40	78 - 15
167 - 82	119 - 39	78 - 12 - 4

Possible subtraction strategies (not an exhaustive list)

91 - 56 compensating 90-56+1 partitioning (bridging) 91-50-1-5 35	163 - 76 partitioning (bridging) 163-70-3-3 163-3-60-10-3 87	147 - 21 compensating partitioning 147-20-1 126
74 - 19 compensating 74-20+1 partitioning 55	100 - 77 partitioning 100-70-7 number facts to 100 counting on shopkeepers 23	92 - 15 - 12 reordering 92-12-15 partitioning 92-10-10-2-5 65
23 - 9 bridging 23-3-6 compensating 23-10+1 14	56 - 28 doubles (28+28=56) compensating 56-30+2 28	37 - 19 near doubles (19+19=38) compensating 37-20+1 18
72 - 49 compensating 72-50+1 23	95 - 37 partitioning 95-30-5-2 58	163 - 76 partitioning 163-70-6 or 163-60-10-6 87
90 - 15 partitioning 90-10-5 75	82 - 40 count back in tens 42	78 - 15 partitioning 78-10-5 63
167 - 82 near doubles 82+3 85	119 - 39 partitioning 119-19-20 compensating 119-20+1 80	78 - 12 - 4 recombining 78-16 62

Teacher's answer or prompt sheet.

Digit Cards

0	1	2	3
4	5	6	7
8	9	0	1
2	3	4	5
6	7	8	9

100 Square

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Tips: mental addition and subtraction with a number square.

Add 10 Move down one line.
Subtract 10 Move up one line.
Add 20 Move down two lines.
Subtract 20 Move up two lines.
Add 9 Move down one line then
 back one square.

Subtract 9 Move up one line then
 forwards one square.
Add 32 Move down three lines
 then forward two squares
Subtract 43 Move up four lines then
 back three squares.
 Etc. etc.

Individual 100 squares

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
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