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WHY WE NEED COMPUTATION SKILLS

Although the calculator is a valuable and welcome tool to aid accuracy and speed of mathematical calculations, basic computation knowledge and skills remain important for estimation and more complex mathematics. They are also useful as a manual 'back-up system'.

Teaching basic facts and computation skills will not compromise a modern mathematics program; they will enhance it.

WHY WE NEED TO ASSESS COMPUTATION SKILLS

Good analysis is critical to effective teaching. To help those who struggle to understand the skills of computation you must isolate the problem before you can intervene.

WHO CAN ADMINISTER COMPASS™

They are comprehensive yet easy-to-use assessments that can be administered by specialists, general classroom teachers and, with support, para-professional teaching staff.

WHO CAN BE ASSESSED WITH COMPASS™

General class and special needs students from middle primary school (elementary) to adult learners - in an individual or group setting.

WHAT ARE THEY DESIGNED TO DO

The assessments are designed to test knowledge and skills of the four computation areas: addition, subtraction, multiplication and division. The skills are progressively more difficult.

To evaluate levels of competency, items are matched to the NZ primary school curriculum strands. If a student is able to successfully complete 100% of all items in a reasonable time they can be regarded as competent at an adult level.   However, it should be understood that the COMPASS™ assessments are not designed to simply give a raw score. They are behavioural assessments that, with careful analysis, can pinpoint accurately where teaching should begin. Suggested reasons for error are provided to assist interpretation of a student's results.

HOW IS IT STRUCTURED

For each of the four computation areas there are three sets of assessments (making twelve in total). Each assessment item is a single teaching step ahead of the preceding one.

ABOUT THE WRITERS

Catherine and Chris Parkin are specialist practitioners/writers. Both have had more than thirty years in education - from classroom teaching to advising and specialist learning assessment and tuition. They develop assessment and teaching resources and provide training courses based on their extensive hands-on experience, observation and analysis of students young and old.

CUSTOMER CARE

Triune is dedicated to creating high quality resources. Customers are encouraged to phone or email any questions they may have on the effective use of these resources.

COMMON ERRORS - SUBTRACTION

Inverts digits instead of renaming
The student inverts the digits and works from the bottom.

$$
\begin{array}{r}
8\,3 \\
-\;2\,4 \\
\hline
6\,1
\end{array}
$$

inverted the 3 and the 4

Not renaming when there is more than one zero
Multiples of ten, one hundred, or one thousand
(where the number has more than one zero)
often present renaming difficulties.

$$
\begin{array}{r}
7\,0\,0\,0 \\
-\;1\,2\,0 \\
\hline
7\,1\,2\,0
\end{array}
$$

inverted the digits 0 & 2 then 0 & 1

COMMON ERRORS - MULTIPLICATION

Problems of regrouping
Multiplication is being carried out correctly,
but the regrouped digit is not being taken
through to the next step.

$$
\begin{array}{r}
{}^{3}\;\;\;\; \\
2\,1\,7 \\
\times\;\;5 \\
\hline
1\,0\,5\,5
\end{array}
$$

the 3 was not added to the product of 1x5

No zero as a placeholder in 3-step multiplication
This is commonly missed in the second step

$$
\begin{array}{r}
2\,4 \\
\times\;3\,2 \\
\hline
4\,8 \\
7\,2
\end{array}
$$

2nd step shows 72 instead of 720

Incorrect addition in 3-step multiplication

$$
\begin{array}{r}
2\,4 \\
\times\;3\,2 \\
\hline
4\,8 \\
7\,2\,0 \\
\hline
7\,7\,8
\end{array}
$$

added 4 + 2 = 7 instead of 6

COMMON ERRORS - DIVISION

No zero as placeholder in quotient

$$
\begin{array}{r}
2\,8\;\;\; \\
4\,)\overline{8\,3\,2}
\end{array}
$$

quotient 28 instead of 208

No remainders recorded
Some students do not know how to work out
a remainder and will record only the whole number.

$$
\begin{array}{r}
6\;\; \\
4\,)\overline{2\,6}
\end{array}
$$

remainder 2 not recorded

MULTIPLICATION
TARGETED SKILLS
with suggested reasons for error

lack of concept and/or lack of basic facts could be reasons for error in all items

1. **multiply a 1 digit factor by zero**
   a) does not know rule for multiplying by zero

2. **multiply a 2 digit factor by one**
   a) does not know rule for multiplying by one

3. **multiply a 1 digit factor by another 1 digit factor**
   A) misreading operation sign

4. **multiply a multiple of one hundred by a 1 digit factor**
   a) lacks knowledge of how to multiply by zero
   b) lacks knowledge of how to multiply by hundreds

5. **multiply a multiple of ten by a 1 digit factor**
   a) lacks knowledge of how to multiply by ten
   b) lacks knowledge of the function of zero (or ignores it)

6. **multiply a 3 digit factor by a 1 digit factor**
   a) lacks knowledge of using all the columns (multiplies the digit in ones column and then just drops
   the remaining two digits into the answer space)   b) placing 3 digits of answer into 2 places

7. **multiply a 2 digit factor by a 1 digit factor to give a 2 digit product - with regrouping**
   a) lacks knowledge of how to regroup   b) transposing digits of regrouped number

8. **multiply a 3 digit factor by a 1 digit factor - with regrouping**
   a) inconsistent regrouping   b) omitting to add regrouped tens into next step of calculation

9. **multiply a 2 digit factor by a 1 digit factor to give a 3 digit product - with regrouping**
   a) transposing digits of regrouped number
   b) omitting to add regrouped tens into next step of calculation

10. **multiply a 2 digit factor by a 2 digit multiple of ten - with regrouping**
    a) lacks knowledge of how to multiply by ten

11. **multiply a 2 digit factor by a 2 digit factor (using the 3-step method) - with regrouping**
    a) lacks knowledge of 3 step method   b) addition error

12. **multiply three 1 digit factors**
    a) not knowing to multiply all three numbers   b) lacks knowledge of commutative rule

13. **multiply a 4 digit factor by 2 digit factor - with regrouping**
    a) not adding regrouped digits into next step of calculation
    b) lacks knowledge of 3 step method of multiplication
    c) unable to sustain concentration on longer calculations   d) addition error

14. **multiply a 3 digit, 2 decimal place factor by a 1 digit factor -**
    with a 2 decimal place product
    a) lacks knowledge of where decimal point is placed   b) lacks understanding of decimal system

15. **multiply two 1 decimal place factors - with a 2 decimal place product**
    a) lacks knowledge of where decimal point is placed

15

TERMINOLOGY

SUBTRACTION

Minuend, Subtrahend & Difference
The number you are subtracting from is the **minuend**.
The number your are subtracting is the **subtrahend**.
The number that is left is the **difference**.   in 6 - 4 = 2 the **minuend** is 6**, subtrahend** 4 and the **difference** is 2

Renaming
If within a number, the subtrahend is larger than the minuend, (i.e. the top number is smaller) then renaming must be carried out.

 ³¹⁵
 4̶5̶.   5 - 7 cannot be done, so the 45 is renamed as 30+15. A ten is moved to the ones column making it 15
 - 1 7   leaving 3(tens) in the tens column. The computation of 15 - 7 can now be carried out.

MULTIPLICATION

Factor & Product
The numbers you multiply together are **factors.**   **2** x **3**   The 1st factor is the **multiplicand.** The 2nd is the **multiplier**
The result of multiplying factors is the **product.**   2 x 3 = **6**   **6** is the product

Commutative rule
When there are several numbers to be multiplied the order in which they are multiplied does not affect the answer.   6 x 4 x 8 is the same as 8 x 6 x 4 or 4 x 8 x 6.

3-step method of multiplication
Used when factors have 2 or more digits.

$$
\begin{array}{r}
24 \\
\times 36 \\
\hline
144 \\
+ \ 720 \\
\hline
864
\end{array}
$$

Step 1 is multiplying 24 by the ones (6)
Step 2 is multiplying 24 by the tens (30)
Step 3 is adding the totals of Steps 1 & 2

Placement of the decimal point
Count the digits to the **right** of any decimal points in the question. Place the decimal point in the answer to the **left** of the same number of digits. In 3.2 x 6.8 there are two digits to the right of the decimal points, so there will be 2 digits to the right of the decimal point in the answer.   3.**2** x 6.**8** = 21.**76**

DIVISION

Dividend, Divisor & Quotient
The number that is being divided is the **dividend**.   In **6** ÷ 3 = 2   6 is the dividend
The number that you are dividing by is the **divisor** .   In 6 ÷ **3** = 2   3 is the divisor
The answer to a division calculation is the **quotient**.   In 6 ÷ 3 = **2**   2 is the quotient

Remainder
What is left over when a number is not able to be divided exactly.   50 ÷ 8 = 6 with **2** left over. **2** is the **remainder**.

Placement of the decimal point
The decimal point in the quotient is placed directly above the decimal point in the dividend.

Rounding decimals to two places
If the quotient has 3 decimal places or more, look only at the 3rd decimal place. If this is 5 or more, then the 2nd decimal place increases by 1. If this is less than 5, then the 2nd decimal place stays the same. Then drop the 3rd decimal place (and any others that are beyond the 3rd place).

Rounding 6.34**7**   Because the **7** is *'5 or more than 5'*, the 2nd place **4** is rounded to **5** making it 6.3**5**

Rounding 6.34**2**   Because the **2** is *'less than 5'*, the 2nd place **4** doesn't change making it 6.3**4**

1.
```
   2
  +4
   6
```

2.
```
   8
  +7
  15
```

3.
```
  32
 + 4
  36
```

4.
```
  45
 + _
   0
```

6.
```
  53
 + 35
  88
```

7.
```
 500
 + 70
 570
```

8.
```
  38
 + 3_
  _2
```

10.
```
  366
 + 276
  642
```

11.
```
  2236
  3599
 + 4821
 10656
```

12.
```
   4_
   __
   _5
   85
   62
  + 39
   342
```

14.
```
  7357
  3265
   685
   262
 + 3139
 14708
```

15.
```
  27.4
 + 57.76
  85.16
```

SUBTRACTION
SET 3 ANSWERS
DO NOT COPY

1.
```
    9
  - 3
    6
```

2.
```
    7
  - 7
    0
```

3.
```
   74
  - 2
   72
```

4.
```
   76
```

6.
```
   786
  - 253
   533
```

7.
```
   93
  - 45
   48
```

8.
```
   84
```

10.
```
   539
  - 276
   263
```

11.
```
   460
  - 37
   423
```

12.
```
   900
```

14.
```
   8040
  - 469
   7571
```

15.
```
   24.5
  - 4.86
   19.64
```

compass

COMPUTATION ASSESSMENT

TRiUNE INITIATIVES 2003

Tick items correct.
Comment on specific difficulties/needs.
Level - refers to NZ curriculum strands.

RECORD SHEET
TARGETED SKILLS

name

age / class (if appropriate)

ADDITION

date	level ITEM	one			two							three				
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	SET 1															
	SET 2															
	SET 3															

Comment

SUBTRACTION

date	level ITEM	one			two							three				
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	SET 1															
	SET 2															
	SET 3															

Comment

MULTIPLICATION

date	level ITEM	two									three					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	SET 1															
	SET 2															
	SET 3															

Comment

DIVISION

date	level ITEM	two			three								
		1	2	3	4	5	6	7	8	9	10	11	12
	SET 1												
	SET 2												
	SET 3												

Comment