

REASONING

7ER17MS

Marking the test

and understanding performance



150292



Llywodraeth Cymru
Welsh Government

Marking the reasoning test

This document comprises:

- the markscheme for the National Numeracy Test (Reasoning) for Year 7 together with marking guidance
- additional information to support teachers' understanding of their learners' responses, providing a platform for growth.

For learners using the modified large print or Braille test materials, some questions have been adapted or replaced. When marking a modified large print or Braille test, please use this markscheme alongside the adapted markscheme which is included in the *Notes for teachers* that accompany the modified tests.

All items within this test require numerical reasoning and therefore most are open, allowing the learner to select what they consider to be an appropriate strategy. This means that there may be a range of ways of arriving at a solution.

As a consequence, marking the reasoning tests may not be as straightforward as simply checking whether or not the final answer is correct since the methods used are also of importance.

Understanding the markscheme

To ensure the accessibility of the markscheme, the focus is primarily on key pointers that indicate the learner's understanding. For example, the markscheme may state 'Shows the value **12**' or 'Links **36** to **9**'.

These values generally credit intermediate stages, showing partial understanding.

Alongside this, commentary is provided as appropriate, to enable markers and teachers to understand their learners' responses and also to support marking.

Common errors are also flagged up, as well as explanations as to why certain responses are awarded partial credit.

Exemplars

To help schools not only with marking but also in interpreting their learners' responses, a range of exemplars is provided for each item, as appropriate.

These exemplars are actual responses from learners (taken from a trial of the reasoning tests) so include spelling mistakes and numerical inaccuracies. They have been typed to ensure anonymity.

Assessing and building on test performance

Marking the test gives teachers an overall score for each learner.

However, this score in isolation is unlikely to provide a great deal of information relating to the strengths of individual learners, or evidence of those areas of numerical understanding and reasoning skills that require improvement.

Equally, comparing learners' scores may mask significant differences in their performance. For example, two learners may both score 12. However, within that overall score Learner A may show a clear ability to communicate effectively but need support to review their work, while Learner B may show the exact opposite.

For this reason, the markscheme and the accompanying materials are designed to provide teachers with a deeper assessment of both individual and class performance.

Diagnostic tool

To assist in interpreting and building on test performance, a diagnostic tool is provided.

This can be accessed via gov.wales/learning

At its simplest level, the diagnostic tool provides markers with a check on the total score for that particular learner.

However, completing the full set of data on each learner gives the teacher an overview of class performance, identifying group or individual strengths and problem areas and hence indicating further teaching needs.

Building on the test: classroom activities

Having assessed learners' ability to apply numerical reasoning and identified areas for both individual and class development, teachers may then wish to build on the test experience and materials through accessing gov.wales/learning

This site provides sample test items and associated markschemes, but also includes additional materials with suggestions for linked classroom activities to extend the learning.

In addition, further activities supporting the learning and teaching of numerical reasoning can be found on gov.wales/learning

Markscheme

General marking rules

It is essential that you apply this markscheme, the marking guidance and the general marking rules given below to your own marking, in order for the standardised scores to be valid.

- The marking guidance shown within the markscheme should be applied to find the relevant score for each question. No half marks are awarded.
- At the end of each double-page spread of marking, record the total number of marks in the 'total' box in the bottom right-hand corner. Check that the mark recorded does not exceed the maximum number of marks available.
- Once the marking has been completed, add up the total number of marks awarded. This is the total score and should be recorded on the cover of the test booklet and input onto the relevant mark sheet on the school's management information system, together with the details and date of the test taken.
- Markers should record their initials on the cover of the test booklet to assist quality assurance.

This data should then be submitted as part of the Welsh National Tests Data Collection (WNTDC). Further details are available from the *National Reading and Numeracy Tests – Test administration handbook 2017* on the Learning Wales website and in *Welsh National Tests Data Collection and reporting arrangements 2016/17* available on the Welsh Government website.

Marking guidance

It is important that the tests are marked accurately. The questions and answers below help to develop a common understanding of how to mark fairly and consistently.

Must learners use the answer boxes?

Provided there is no ambiguity, learners can respond anywhere on the page. If there is more than one answer, the one in the answer box must be marked, even if incorrect. However, if the incorrect answer is clearly because of a transcription error (e.g. 65 has been copied as 56), mark the answer shown in the working.

Does it matter if the learner writes the answer differently from that shown in the markscheme?

Numerically equivalent answers (e.g. eight for 8, or two-quarters or 0.5 for half) should be marked as correct unless the markscheme states otherwise.

How should I mark answers involving money?

Money can be shown in pounds or pence, but a missing zero, e.g. £4.7, should be marked as incorrect unless the markscheme states otherwise.

How should I mark answers involving time?

In the real world, specific times are shown in a multiplicity of ways so accept, for example, 02:30, 2.30, half past 2, etc. Do not accept 2.3 as this is ambiguous. The same principle should be used for marking time intervals, e.g. for two and a half hours accept 2.5 but not 2.5pm.

What if the method is wrong but the answer is correct?

Unless the markscheme states otherwise, correct responses should be marked as correct even if the working is incorrect as learners may have started again without showing their revised approach.

What if the learner has shown understanding but has misread information in the question?

It is important that learners select the appropriate information and review their work. However, for most questions, method marks can still be obtained.

What should I do about crossed-out work?

Working which has been crossed out and not replaced can be marked if it is still legible.

What is the difference between a numerical error and a conceptual error?

A numerical error is one in which a slip is made, e.g. within 86×67 the learner works out $6 \times 7 = 54$ within an otherwise correct response. A conceptual error is a more serious misunderstanding for which no method marks are available, e.g. if 86×60 is recorded as 516 rather than 5160

What if learners use a method that is not shown within the markscheme?

The markscheme shows the most common methods. However, there can be a wide range of approaches to a question and any correct method, however idiosyncratic, is acceptable.

In all questions, the correct answer should be given full marks, whatever the method used, unless the markscheme states otherwise.

Most questions give partial credit for responses that show a correct method but the answer is incorrect or incomplete: a correct method is one that would lead to a correct answer if there were no numerical errors.

7ER17 Reasoning test: Markscheme

Q	Marks	Answer
1i	2m	34.2
	Or 1m	Answer 34 with no correct working Or Shows 19 × 1.8 or $(6 + 6.5 + 6.5) \times 1.8$


Accept 34 provided 34.2 or other correct working is also shown

Condone brackets omitted, e.g. accept $6 + 6.5 + 6.5 \times 1.8$

1ii	2m	Dylan, by 6 points
	Or 1m	Answer 55 , by 6 points Or Shows 49 and 55 Or Shows one correct and one incorrect total then follows through correctly to show their correct winner, with their correct number of points, e.g. <ul style="list-style-type: none"> T 57 (error) D 55 T wins by 2 points

Total scores for Tom and Dylan

Question 1i: Exemplars




$$\begin{aligned}
 &6.5 + 6.0 + 5.5 + 6.5 + 7.0 = 31.5 \\
 &31.5 - 5.5 = 26.0 \\
 &26 - 7 = 19 \\
 &19 \times 1.8 =
 \end{aligned}$$

Total score = 34.2

Correct; **2 marks**

- This learner works inefficiently, adding all five marks then subtracting the two that are not needed. Seeking ways to work efficiently is part of becoming numerate.




$$6.5 + 6.0 + 6.5 \times 1.8$$

Total score = 24.2

$(6.5 + 6.0 + 6.5) \times 1.8$; **1 mark**



Omission of brackets is condoned. However, this learner needs support to understand order of operations: because multiplication takes precedence over addition only part of the calculation, 6.5, has been multiplied by 1.8




$ \begin{array}{r} 6.5 \\ 5.5 \\ \hline 6.5 \\ 18.5 \end{array} $	$ \begin{array}{r} 18.5 \\ \times 1.8 \\ \hline 33.3 \end{array} $
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Total score =

Incorrect; **0 marks**

- The set of marks selected is incorrect. Checking is an integral part of becoming numerate.


Question 1ii: Exemplars



<u>Tom</u> 24.5×2.0 $= 49$	<u>Dylan</u> 22.0×2.5 $= 55$
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Dylan by 6 points

Correct; **2 marks**




Tom $24.5 \times 2.0 = 49$
 Dylan $22.0 \times 2.5 = 55$
 $55 - 49 = 6$

55 by 6 points

Answer 55 by 6 points; **1 mark**

- The answer shows poor numerical communication which is why the markscheme allows just 1 mark.



$ \begin{array}{r} 24.5 \\ 24.5 \\ \hline 48.10 \end{array} $	$ \begin{array}{r} 22.0 \\ 22.0 \\ \hline 11.0 \\ 55.0 \end{array} $	$ \begin{array}{r} 55.0 \\ 48.10 \\ \hline 6.90 \end{array} $
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Dylan by 6.90 points

55 with correct follow-through; **1 mark**

- 48.10 shows a common misconception in how to add decimals, but 55.0 is correct and the subtraction follows through correctly.



Tom = 49.0
 Dylan = 31.5

Tom by 17.5 points

49 with correct follow-through; **1 mark**

- Note that if Tom's score is greater than Dylan's, the answer must show Tom with the learner's correct difference.



Tom by 6 points

Incorrect; **0 marks**

- Tom is incorrect and there is no working to support 6 points. No marks can be given.

Q	Marks	Answer
1iii	3m	Selects 2.0 (accept 2) as giving the highest score, and links 40.0 (accept 40) to that dive
	Or 2m	Shows or implies the best dive is of difficulty 2.0 (accept 2) Or Links at least three dive difficulties to their correct total scores (see alongside)
	Or 1m	Links two dive difficulties to their correct total scores

For 3 marks, do not accept 2.0 without it linked to 40.0 or 40

Dive difficulty	Total score
1.8	39.6
1.9	39.9
2.0	40.0 or 40
2.1	39.9
2.2	39.6
2.3	39.1
2.4	38.4
2.5	37.5

Question 1iii: Exemplars



He should choose Dive difficulty 2.0 because it gives him the highest possible score from the table

2.0 highest score and links 40; **3 marks**

- Without the annotated graph, this learner would have scored 2 marks. However, 40 linked to 2.0 is shown on the graph.



2.0 gives the highest score of 40.0 but he should do a dive of 2.1 or even 2.2 as those scores are close and he might surprise everyone!

2.0 highest score and links 40.0; **3 marks**

- The comments regarding dives of 2.1 and 2.2 do not contradict that 2.0 gives the highest score of 40.0 so can be ignored.



He should pick 2.0 as it gives him a score of 40 while the others are 37.5 to 39.9

1.8= 39.4	1.9= 39.9
2.0= 40	2.1= 39.9
2.2= 39.6	2.3= 39.1
2.4= 38.4	2.5= 37.5

2.0 highest score and links 40; **3 marks**

- The error for the total score for 1.8 can be ignored.



39.6
39.9
40
39.9
39.6
39.1
38.4
37.5

Links at least three correctly; **2 marks**

- The dive difficulties are not listed but are implicit as the total scores are ordered for 1.8 to 2.5 inclusive. However, no decision has been taken as to which is the best.



He should choose dive difficulty 1.8 because $22 \times 1.8 = 39.6$ compared to dive difficulty 2.5 because $2.5 \times 15 = 37.5$. So the 1.8 he can get a higher score.

Links two correctly; **1 mark**



It is a common error to consider only the lowest and highest dive difficulties. It may be counter-intuitive that the maximum is not at one of the extremes of the graph, but any such assumption should be checked.



2.1 Difficulty because he would get a total score of 40 which is the highest there.

Incorrect; **0 marks**

- The dive difficulty, 2.1, is incorrect. Why it is linked to 40 is unknown. No marks can be given.

Q	Marks	Answer								
2	2m	<p>Justifies why 60r is not enough through one of the following:</p> <table><tr><th>Conversion</th><th>Decision</th></tr><tr><td>$6f = 72r$ (enables comparison with 60r)</td><td>No</td></tr><tr><td>$60r = 5f$ (enables comparison with 6f)</td><td>No</td></tr><tr><td>$6f = 24n$ $60r = 20n$ (enables comparison of n's)</td><td>No</td></tr></table>	Conversion	Decision	$6f = 72r$ (enables comparison with 60r)	No	$60r = 5f$ (enables comparison with 6f)	No	$6f = 24n$ $60r = 20n$ (enables comparison of n's)	No
Conversion	Decision									
$6f = 72r$ (enables comparison with 60r)	No									
$60r = 5f$ (enables comparison with 6f)	No									
$6f = 24n$ $60r = 20n$ (enables comparison of n's)	No									
	Or 1m	<p>The only error is that the decision is incorrect or omitted</p> <p>Or</p> <p>Shows any correct equivalence of f and r, e.g.</p> <ul style="list-style-type: none">• $(1)f = 12r$ <p>Or</p> <p>Shows a complete, correct method with not more than one conversion error, and a correct decision for their values, e.g.</p> <ul style="list-style-type: none">• $6f = 18n$ (conversion error) $18n = 54r$ (correct follow-through) so she has enough								

There must be a correct decision, e.g. for 2 marks do not accept

- 6f = 72r

Question 2: Exemplars



$6 \times 4 = 24$
 $24 \times 3 = 72$ but she only has 60

Correct; **2 marks**

- Although units are omitted, as the amounts being compared are both in r there is no ambiguity and 2 marks can be given.



She has 60 r and that is the same as $60 \div 3 = 20$ n and 20 n is the same as $20 \div 4 = 5$ f but she needs 6 f so the answer is that she does not have enough money to buy the hat she will need to play the game some more or buy something that is cheaper.

Correct; **2 marks**

- This learner changes 60r to 5f and shows a correct decision so scores 2 marks. However, writing a 'mini-essay' is time-consuming. Support is needed to show how to present a mathematical argument concisely.

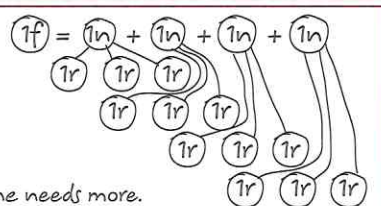


She is short of 4n

Correct; **2 marks**

- The numerical communication is poor, but this learner is comparing 24n (6f) to 20n (60r).



$1f = 1n + 1n + 1n + 1n$

 She needs more.

$1f = 12r$; **1 mark**

- $1f = 12r$ is shown, albeit informally, but this is insufficient to show why 'she needs more'.



$60r = 20n$
 $20n = 10f$ which is more than 6f so yes

One conversion error, correct decision; **1 mark**

- This learner is converting 60r to get an answer in f. The first step, $60r = 20n$, is correct but the second step should be $20n = 5f$. However, the decision follows through correctly so 1 mark can be given.



$1f = 4n$ so $6f = 10n$
 $1n = 3r$ so $10n = 13r$
 She has loads of money she could get more hats about 4?

Two conversion errors; **0 marks**

- This learner is converting 6f to get an answer in r. Both conversions are incorrect showing that support is needed to understand multiplicative relationships.

Q	Marks	Answer
3	3m	Shows or implies any of the following, with no additional incorrect statements or working: <ul style="list-style-type: none"> – 10 young people can't ride – 65 minutes needed but 60 available – 13 rides (accept $12\frac{1}{2}$) needed but time for only 12 rides
	Or 2m	Shows or implies any of the following (ignore errors elsewhere): <ul style="list-style-type: none"> – 10 young people can't ride – 65 minutes needed (accept $62\frac{1}{2}$) – 13 rides (accept $12\frac{1}{2}$) needed <p>Or</p> <p>The only error is that time available is 55 minutes not 60, i.e. shows or implies the following, with no additional incorrect statements or working:</p> <ul style="list-style-type: none"> – 30 young people can't ride
	Or 1m	Shows or implies any of the following (ignore errors elsewhere): <ul style="list-style-type: none"> – 12 rides per hour – 200 people take 50 minutes – 50 people take 15 minutes – 30 young people can't ride

◀ The learner may refer to rides filled which is why $12\frac{1}{2}$ is accepted for 13

Question 3: Exemplars



250 people want to go up
Ride opens 2pm, last time 2:55
12 rides
Only 240 people can go on the ride
because $12 \times 20 = 240$ so No

10 can't ride, no errors; **3 marks**

- 250 and 240 clearly imply that 10 young people can't ride.



$250 \div 20 = 12 \text{ r } 10$ So 13 times to
 $13 \times 5 = 65$ have them all go on
2:00 2:05 2:10 2:15 2:20 2:25 2:30
1 2 3 4 5 6 7
2:35 2:40 2:45 2:50 2:55 3:00
8 9 10 11 12 13 No not
enough time.

13 rides but time for 12, no errors; **3 marks**

- '13 times' implies 13 rides and 2:55 linked to 12 is sufficient to imply there is time for only 12 rides. However, this learner needs support to understand the importance of explaining their conclusions.



$60 \div 5 = 12$ Rides
min min
 $250 \div 20 = 12.5$ rides
 $250 - 5 = 245$ people
only 245 people will be able to go on
the ride, five cannot go on before
they leave. They will not have time
as five cannot go on the ride. In an
hour there are only 12 rides.

12.5 rides needed; **2 marks**

- This learner shows both 12 and 12.5 but misinterprets 12.5 and states that 245 people can ride. Only 2 marks can be given.



10 can't ride because they would
finish at 3:10 which is too late.

10 can't ride; **2 marks**

- The numerical communication is poor as we have no evidence as to why '10 can't ride'. Nonetheless, without the incorrect statement about finishing at 3:10 this learner would have scored 3 marks.



$55 \div 5 = 11$
 $11 \times 20 = 220$. Only 20 can go on
not worth them hanging around
they should go on other rides.

30 can't ride, no further errors; **2 marks**



'Only 20 can go on' implies that 30 can't since there are 50 young people altogether. It is a common error to not realise that because there is a ride at 2pm there are 12 available rides not 11



$200 \div 20 = 10$
 $10 \times 5 = 50$
So they finish at 2.30
so plenty of time for the 50
young people to ride.

200 people take 50 minutes; **1 mark**



$200 + 50 = 250$
20 per ride
 $250 \div 20 = 50$
50 rides for everyone = 50 mins

Incorrect; **0 marks**

- Here '50 mins' links to 250 people not 200 so is incorrect. No marks can be given.

Q	Marks	Answer												
4i	2m	30												
	Or 1m	<p>Shows or implies that the numbers are 5 and 6, in either order</p> <p>Or</p> <p>Shows at least two of the rows below, linking pairs of numbers with their product</p> <table><tr><th>Pair of numbers, in either order</th><th>Product</th></tr><tr><td>1 and 10</td><td>10</td></tr><tr><td>2 and 9</td><td>18</td></tr><tr><td>3 and 8</td><td>24</td></tr><tr><td>4 and 7</td><td>28</td></tr><tr><td>5 and 6</td><td>30</td></tr></table>	Pair of numbers, in either order	Product	1 and 10	10	2 and 9	18	3 and 8	24	4 and 7	28	5 and 6	30
Pair of numbers, in either order	Product													
1 and 10	10													
2 and 9	18													
3 and 8	24													
4 and 7	28													
5 and 6	30													

4ii	3m	30.25 or equivalent
	Or 2m	Shows or implies that the numbers are 5.5 and 5.5 Or Answer between 30.24 and 30.25 exclusive, or 30.24 Or Shows at least two pairs of numbers that sum to 11, with both between 5 and 6 exclusive, e.g. <ul style="list-style-type: none"> 5.1 and 5.9 5.45 and 5.55
	Or 1m	Shows one pair of numbers that sum to 11, with both between 5 and 6 exclusive

◀ Has assumed the two symbols cannot be equal in value

Question 4i: Exemplars

$5, 6 = 5 \times 6 = 30$
 $4, 7 = 4 \times 7 = 28$
 $3, 8 = 3 \times 8 = 24$
 $2, 9 = 2 \times 9 = 18$
 $1, 10 = 1 \times 10 = 10$
 $\star \times \text{pentagon} = \boxed{}$

At least two pairs with their products; **1 mark**

- This learner works systematically, but because it is not explicit that 30 is the highest product only 1 mark can be given.

$12 \times 3 = 36$
 $12 \times 5 = 60$
 $12 \times 7 = 84$
 $12 \times 9 = 108$
 $12 \times 11 = 132$
 $12 \times 13 = 156$
 $12 \times 17 = 204$
 $12 \times 21 = 252$
 $\star \times \text{pentagon} = \boxed{999800}$

Incorrect; **0 marks**

- Common error** Ignoring the condition that the symbols add to 11 is a common error, yet without it there is an infinite number of products as any two numbers can be chosen.

Question 4ii: Exemplars

~~5.9×6.1~~
 ~~5.9×6.1~~
 $4.9 \times 6.1 = 29.89$
 $5.1 \times 5.9 = 30.09$
 $5.5 \times 5.5 = 30.25$
 $5.6 \times 5.4 = 30.24$
 $5.7 \times 5.3 = 30.21$
 $5.8 \times 5.2 = 30.16$
 $\diamond \times \text{plus} = \boxed{30.24}$
They are different, otherwise it would be \diamond^2 or plus^2

Answer 30.24; **2 marks**

- Common error** It is a common error to assume that two symbols cannot be equal in value. 30.24 results from 5.4×5.6 , which assumes that each value has just one decimal place.

$.5 \times 5 = 25$
 $5 \times 5 = 25$
 $\underline{50}$
 $5.5 \times 5.5 = 30.25$
 $\diamond \times \text{plus} = \boxed{50}$

Implies the numbers are 5.5 and 5.5; **2 marks**

- Common error** This learner shows understanding of the numbers required, but is unable to multiply them together.

$4.5 + 6.5 = 29.5$
 $5.9 \times 5.1 = 30.9$
 $\diamond \times \text{plus} = \boxed{30.9}$

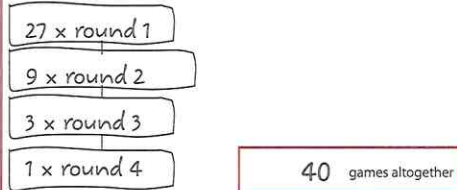
One pair within required range; **1 mark**

- Although $4.5 + 6.5 = 11$, the values are not within the range 5 to 6 exclusive. The incorrect product of 5.9 and 5.1 can be ignored.

Q	Marks	Answer
5	3m	40 games altogether
	Or 2m	<p>Answer 121 or 39</p> <p>Or</p> <p>Shows or implies at least three repeated divisions by 3, e.g.</p> <ul style="list-style-type: none"> • $81 \div 3$, then $\div 3$, then $\div 3$ again • 27, 9, 3
	Or 1m	<p>Shows or implies $\div 3$, e.g.</p> <ul style="list-style-type: none"> • 27

Has included the number of players at the start or omitted the final game

Question 5: Exemplars



Correct; **3 marks**

There were 81 players so if each person plays 1 game then 27 games would be played. Then those players who win play again so another 9 games would be played. Then the winners play again making another 3 games. Then if those 3 players play again it would make another 1 game which is the final game as that person is the winner of the whole competition.

40 games altogether

Correct; **3 marks**

- This learner understands the numeracy being assessed but needs encouragement to work concisely.

81 → 27 → 9 → 3 → 1
 $81 + 27 + 9 + 3 + 1 = 121$

121 games altogether

Answer 121 (or repeated $\div 3$); **2 marks**



It is a common error to include the number of players at the start.

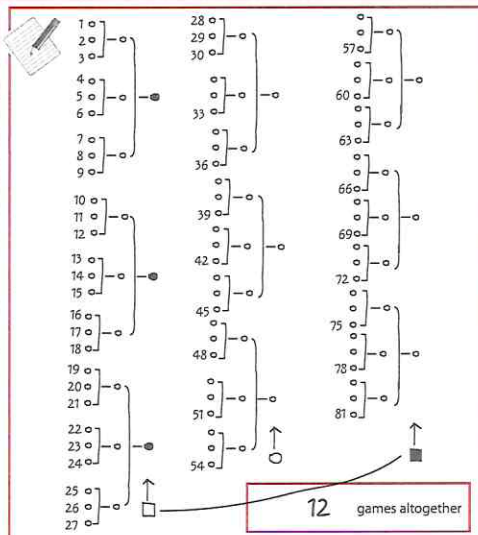
1st round $81 \div 3 = 27$
 2nd round $27 \div 3 = 8$
 3rd round $8 \div 3 = 2\text{r}2$ so 2 people don't play that leaves 2 winners and 2 more so 4 people so maybe they do 2 in a game so 3
 4th round $4 \div 2 = 2$
 5th round $2 \div 2 = 1$

27 + 8 + 3 + 2 + 1 = 41

41 games altogether

At least three repeated $\div 3$; **2 marks**

- The need for five rounds contravenes information given in the question so this learner should have recognised the need to check their work ($27 \div 3$ does not equal 8).



At least three repeated $\div 3$; **2 marks**

- This learner adopts the time-consuming approach of grouping in 3's (equivalent to $\div 3$ for three rounds) but gets confused when finding the total number of games. Actively seeking efficient ways of working is part of becoming numerate.

