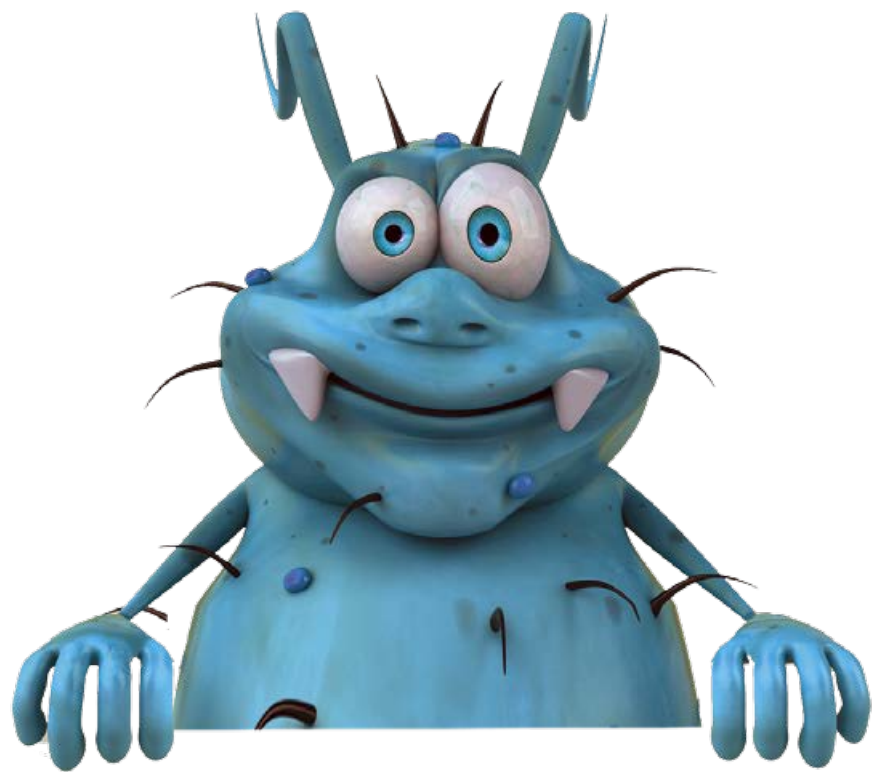


Reasoning in the classroom

Tons of teeth



Support materials for teachers

Year 6



Llywodraeth Cymru
Welsh Government

Year 6 Reasoning in the classroom – Tons of teeth

These Year 6 activities encourage learners to use and apply number patterns.

Activity 1

Tons of teeth

Learners investigate number patterns, including graphs, within the fantasy context of dragons' teeth.

Includes:

- Teachers' script
- PowerPoint presentation
- Tons of teeth questions
- Markscheme

Activity 2

My dragon's teeth

They create their own rules and interpret graphs showing changes in the number of teeth.

Includes:

- Explain and question – instructions for teachers
- Whiteboard – My dragon's teeth
- Resource sheet – Three more dragons

Activity 3

Human teeth

They research human teeth and use their understanding of fractions, decimals and percentages to write a report about them.

Includes:

- Explain and question – instructions for teachers
- Whiteboard – Human teeth



Reasoning skills required

Identify

Learners choose appropriate methods to solve problems.

Communicate

They explain their results and summarise information in a report.

Review

They interpret graphs and draw conclusions.

Procedural skills

- The four rules of number
- Inverse operations
- Graphs
- Fractions, decimals and percentages

Numerical language

- Increases/decreases
- Horizontal/vertical
- Proportion

Activity 1

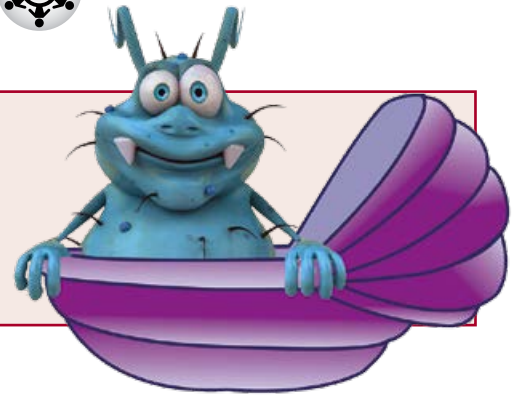
Tons of teeth

Activity 1 – Tons of teeth



Outline

This activity requires learners to use their numerical skills and understanding of simple graphs, within the fantasy context of dragons growing, and losing, teeth.



You will need



Teachers' script



PowerPoint presentation



Tons of teeth questions


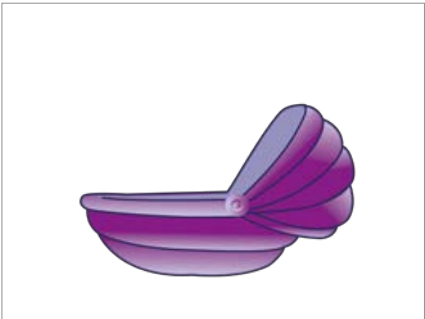

Two pages for each learner, can be printed double-sided





Markscheme

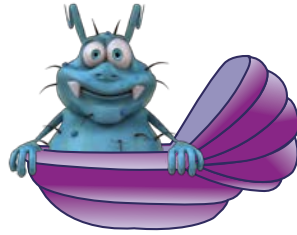
Presentation to be shown to learners before they work on Tons of teeth

The text in the right-hand boxes (but not italics) should be read to learners. You can use your own words, or provide additional explanation of contexts, if necessary. However, if you are using this as an assessment item, no help must be given with the numeracy that is to be assessed.

<p>Slide 1</p>		<p><i>(Keep this slide on the screen until you are ready to start the presentation.)</i></p>
<p>Slide 2</p>		<p>Shhh . . . I wonder what is sleeping inside this cot? It's a baby . . .</p>
<p>Slide 3</p>		<p>. . . dragon! And what a beautiful dragon it is too. It has just been born and already it has two teeth. Of course, dragons need a lot of teeth so that they can eat all the nasty things that dragons eat. But just like we do, dragons get more teeth as they grow. And, just like we do, dragons lose some teeth as they grow, to make room for the new teeth coming through. Let's find out more.</p>

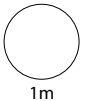
<p>Slide 4</p>	<div style="border: 1px solid black; padding: 10px; text-align: center;"> <p>Every month, 2 fall out but 6 more grow</p>  </div>	<p>How strange! Every month exactly the same thing happens. Two teeth fall out, but six more grow.</p> <p>The baby dragon has two teeth now. How many teeth will it have in one month's time? That's right, it will have six teeth because these two teeth will fall out but six new ones will grow.</p>
<p>Slide 5</p>	<div style="border: 1px solid black; padding: 10px; text-align: center;"> <p>Every month, 2 fall out but 6 more grow</p>  <p>1 month old 6 teeth 2 months old ? teeth</p> </div>	<p>So when the baby dragon is one month old it will have six teeth. Talk with the person next to you. How many teeth will it have when it is two months old?</p> <p><i>(Allow discussion and then agree the dragon will have 10 teeth because two of the six teeth will fall out, leaving four teeth, but another six will grow, and four and six equals 10. If learners mention number patterns do not seek to develop their ideas as this will influence the assessment that follows.)</i></p> <p>So, every month the same thing happens. It's a good job that dragons have such large mouths!</p> <p>Now you are going to answer some questions about dragons and their teeth.</p> <p>Remember to show your working so that someone else can understand what you are doing and why.</p> <p><i>(If you are using this item for assessment purposes, you may wish to limit the time available, e.g. 10 minutes.)</i></p>

Every month,
2 teeth fall out but **6 more** grow.



How many teeth will the dragon have when it is **3** months old?

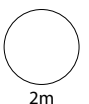
Age of the dragon	Number of teeth
1 month old	6
2 months old	10
3 months old	



How many teeth will the dragon have when it is **12** months old?



teeth

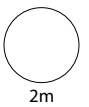


When the dragon is **100** months old it will have **402** teeth!

How many teeth will it have when it is **90** months old?



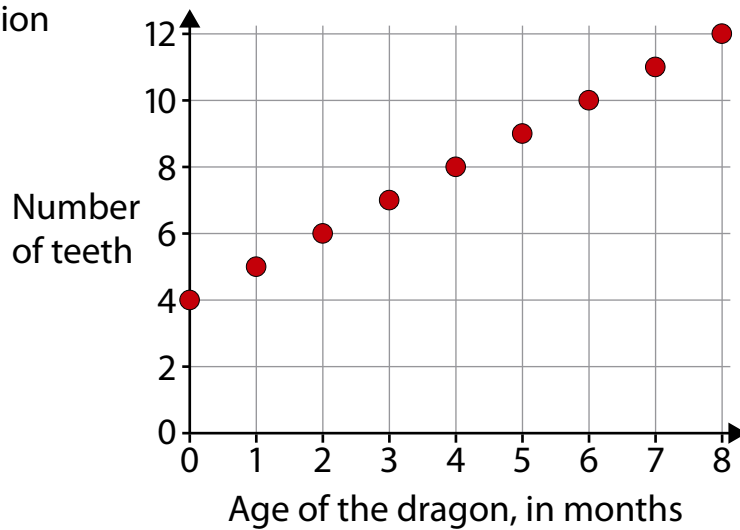
teeth



This is a different dragon.

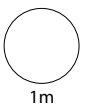


The graph shows information about how its teeth grow.

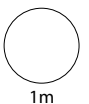


Use the graph to work out the missing numbers below.

When the dragon is born it has teeth.



Every month it loses **2** teeth but it grows more.



Activity 1 – Tons of teeth – Markscheme

Q	Marks	Answer
i	1m	14

ii	2m	50
	Or 1m	Shows 36 Or Shows 11×4 (or 44) or 12×4 (or 48) Or Shows the intent to count on in fours , even if there are numerical errors

Accept 36 + their answer to part i, e.g. from 12 in part i accept 48

The number of additional teeth

Efficient method, from
– 2 (teeth lost) + 6 (teeth gained),
but has omitted teeth at 1 or 0 months old

Efficient method

iii	2m	362
	Or 1m	Shows the intent to subtract 40 Or Shows 89×4 (or 356) or 90×4 (or 360)

The difference in the number of teeth


Has omitted teeth at 1 or 0 months old

iv	1m	4 teeth
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v	1m	3 more
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Activity 1 – Tons of teeth – Exemplars

Part ii


 If 2 fall out and 6 more grow he is gaining 4 every month. So in 12 months he will have 50 teeth because $12 \times 4 = 48$ and 2 more born.

6, 10, 14, 18, 22, 26, 30, 34, 38, 42, 46, 50

50 teeth

Correct; **2 marks**


- The work at the top of the page shows good numerical insight. This learner then checks their method by adding in 4's.

 $3=14$ $1=6$ $2=10$
 $4=18$ $2=10$ $4=18$
 $5=22$ $6=26$
 $6=26$ $8=34$
 $7=30$ $10=42$
 $8=34$ $12=50$
 $9=38$
 $10=42$
 $11=46$
 $12=50$

~~40~~ 50 teeth

Correct; **2 marks**


- This learner repeatedly adds 4, then checks their work by repeatedly adding 8.

 $4=18$ $8=34$
 $5=22$ $9=38$
 $6=26$ $10=42$
 $7=30$ $11=48$
 $12=52$

52 teeth

Counts on in 4's; **1 mark**

- This learner also repeatedly adds 4, but makes an error when adding 4 to 42.


 3 months = 14
 $14 \times 4 = 56$

56 teeth

Incorrect; **0 marks**



This learner needs support to understand simple sequences: the assumption that the number of teeth at 12 months is $4 \times$ the number at 3 months is incorrect since although the sequence increases by a constant amount each month, it does not start at zero.

 $6 \times 12 = 72$

72 teeth


Incorrect; **0 marks**



This method, multiplying the number of teeth at 1 month old by the number of months, is incorrect. It is a common error to consider only the first (or last) value in a sequence.

Activity 1 – Tons of teeth – Exemplars (continued)


Part iii

 $t = \text{teeth}$
 $m = \text{month}$
 $10m = 40t$
 $100m - 10m = -40t$
 $402 - 40 = 362t$

362t teeth

Correct; **2 marks**


- This learner is trying to use algebraic notation to explain why 40 teeth should be subtracted. The inclusion of 't' in the answer box can be ignored.

 $402 - 40 = 362$
 $100 = 402$ $94 = 378$
 $99 = 398$ $93 = 374$
 $98 = 394$ $92 = 370$
 $97 = 390$ $91 = 366$
 $96 = 386$ $90 = 362$
 $95 = 382$

teeth

Correct; **2 marks**


- The learner uses correct numerical reasoning, then checks their method by subtracting 4's. No answer is given in the answer box, but their answer is clearly shown in the working.

 $402 \div 100 = 4.02$
 $4.02 \times 10 = 40.2$
 $402 - 40.2 = 362.2$

362 teeth

Correct; **2 marks**

- Although the method of $\div 100$ to find 4.02 teeth per month is incorrect, and there is an error in the subtraction, this learner has given the correct answer so (sadly) scores 2 marks. However, teacher support is needed!


 $100 \text{ months old} = 402$
 $10 \text{ months old} = 42$
 $90 \text{ months old} = 402 - 42 = 360$

360 teeth

Answer 360; **1 mark**



Had the sequence started at zero, this method would have been correct. Giving learners opportunities to experience a wide range of sequences helps to avoid incorrect generalisations.

 398, 394, 390, 376, 372, 368, 364, 360, 356, 352

352 teeth

Incorrect; **0 marks**

- Although inefficient, the method of repeatedly subtracting 4 would lead to a correct answer. However, there is an error so no marks are available. This shows the importance of checking work.

Activity 2

My dragon's teeth

Activity 2 – My dragon’s teeth



Outline

This activity is designed to carry on from **Activity 1 – Tons of teeth**.

Learners create their own rule(s) for the ways in which a dragon’s teeth grow. They make a poster showing the numbers of teeth in different months.

Then they interpret graphs showing how the teeth of different dragons grow.



You will need



Whiteboard – My dragon’s teeth



Resource sheet – Three more dragons

Activity 2 – My dragon’s teeth



Explain

Show **My dragon’s teeth** on the whiteboard and explain that each group is going to decide how many teeth their dragon is born with and how its teeth change each month.

Ask them to create a poster to show the number of teeth in each month: this should include a graph.

When learners have finished their posters, give them the resource sheet **Three more dragons** and ask them to find rules to show how these dragons’ teeth grow.

(Purple dragon: born with 1 tooth, then every month (teeth gained – teeth lost) must equal 1, e.g. ‘4 teeth fall out but 5 more grow.’

Green dragon: born with 4 teeth, then the number of teeth does not change except for when the dragon is 3 months old and 6 months old, when the number of teeth increases by 4 each time.

Orange dragon: born with 6 teeth. When the dragon is 1, 4 and 7 months old the number of teeth decreases by 2 each time, but in all other months the number of teeth increases by 2.)

Or

Give the creation of the poster as a homework activity.



Question

- How are you working out how the number of teeth changes each month? Is there a quick way to do this? How?
- Would your graph continue in a straight line for ever? How do you know?
- Suppose when your dragon was 10 years old it stopped growing new teeth, and none ever fell out. What would your graph look like then? *(It would then show a horizontal line of dots.)*
- For the worksheet dragons, is there just one rule for each, or lots of rules? How do you know?

Extension (the use of a spreadsheet is recommended)

- Doris dragon was born with 1 tooth. When she was 1 month old, the number of teeth doubled. When she was 2 months old the number of teeth doubled again, and so on. (None of her teeth ever fell out.) How old will Doris be when she first has more than 100 000 teeth?

(At 16 months old, she will have 65 536 teeth. At 17 months old, she will have 131 072 teeth so the answer is 17 months.)



I was born with teeth.

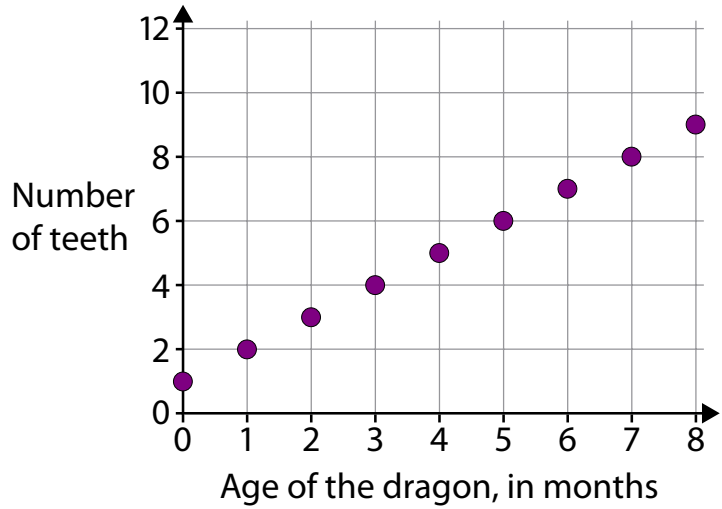
Every month, I lose teeth

but I grow more.

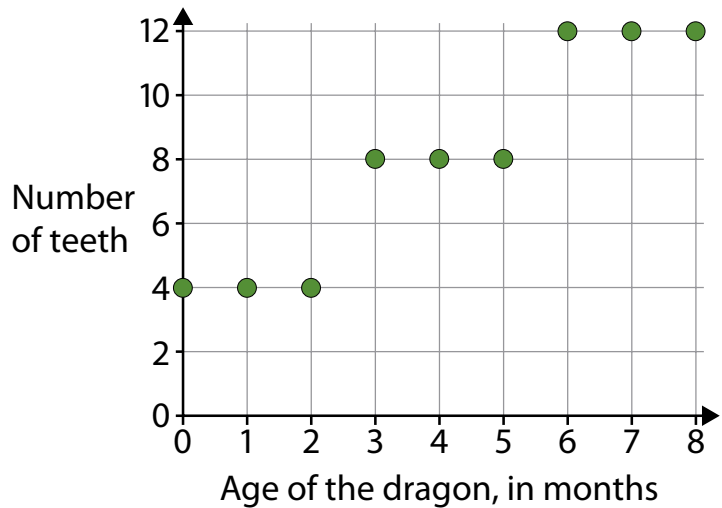
Three different dragons, but how do their teeth grow?

Work out what the rules could be.

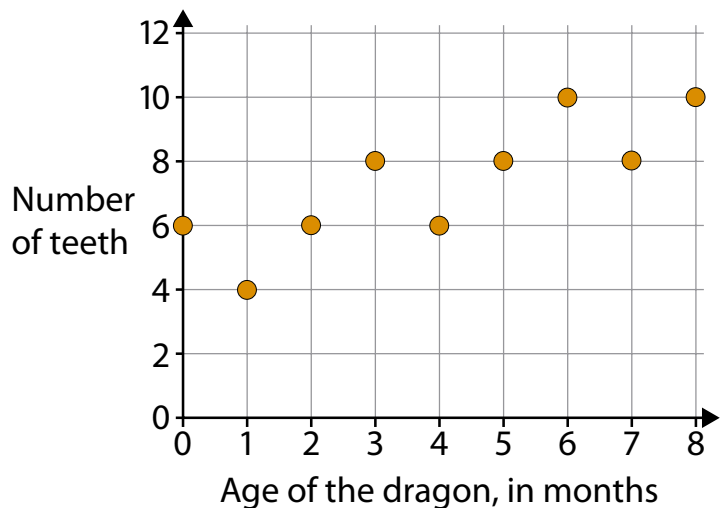
Purple dragon



Green dragon



Orange dragon



Activity 3

Human teeth

Activity 3 – Human teeth



Outline

This activity is designed to carry on from **Activity 2 – My dragon’s teeth**.

Learners research information about different types of human teeth, then write a report about them using fractions, decimals and percentages.



You will need

WB

Whiteboard – Human teeth

Activity 3 – Human teeth



Explain

Use the whiteboard to show learners **Human teeth**. Ask them to find out how many of each type of teeth adults have: this could be done as a homework activity as the information is freely available on the web, e.g. www.biotopics.co.uk/nutrition/teeth.html

Then ask learners to create their own report about human teeth, using their knowledge of proportions. If necessary, give an example such as 'Altogether, humans have 32 teeth. $\frac{1}{8}$ of these are incisors.'



Question

- Which do you find easiest, fractions, decimals or percentages? Why?
- How can you find $\frac{1}{8}$ of something on a calculator? What about $\frac{3}{8}$?
- Do you know how to change a fraction into a decimal? Or a decimal into a percentage? Or...? How?
- Suppose an adult lost two of their molars, would the proportion of incisors change? How?



Adults have these types of teeth:
incisors, canines, premolars
and molars.

- Why do we have different types?
- How many of each do we have?

Find out about human teeth and then write a report. Use your knowledge of fractions, decimals and percentages in your report.