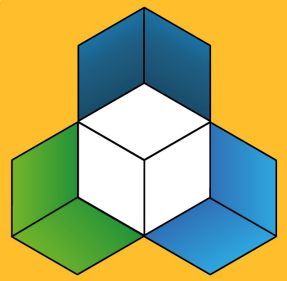
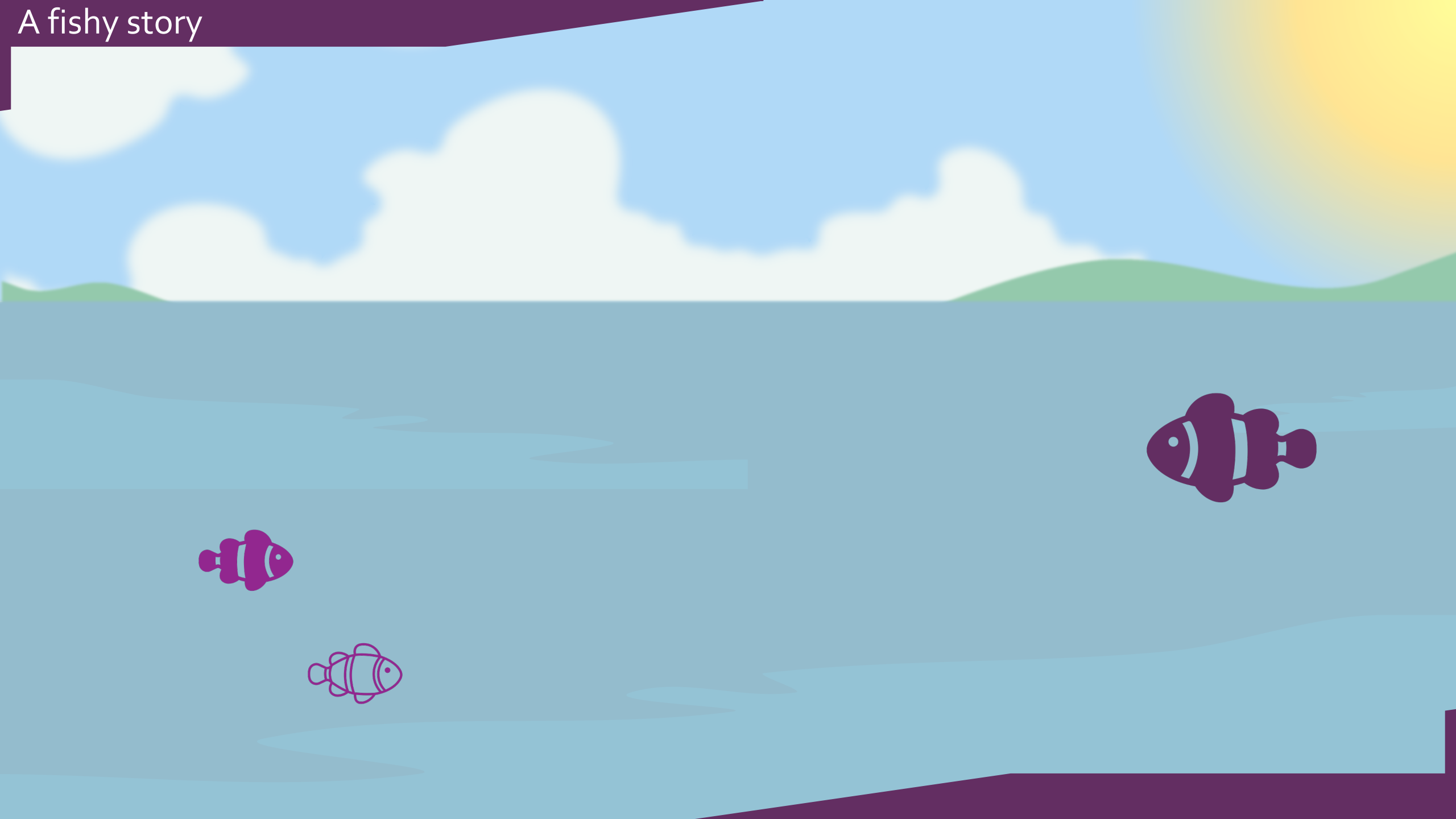


The Complete Mathematics Conference

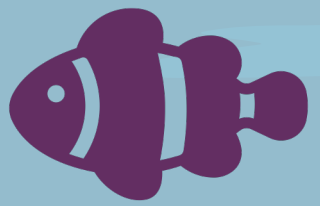
Nathan Day

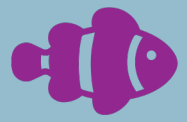
Don't Stop Interweavin' (Hold On to That Feelin')

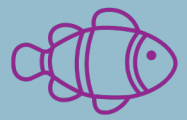
A fishy story



What is the *mathematical* water our pupils are swimming through?







What is the *mathematical* water our pupils are swimming through?

The Logicalness

The Beauty

The Depth

The Connections

The Applications

The History

What is the *mathematical* water our pupils are swimming through?

The Logicalness

The Beauty

The Depth

The Connections

The Applications

The History

Maths should be less magical.

What is the *mathematical* water our pupils are swimming through?

The Logicalness

The Beauty

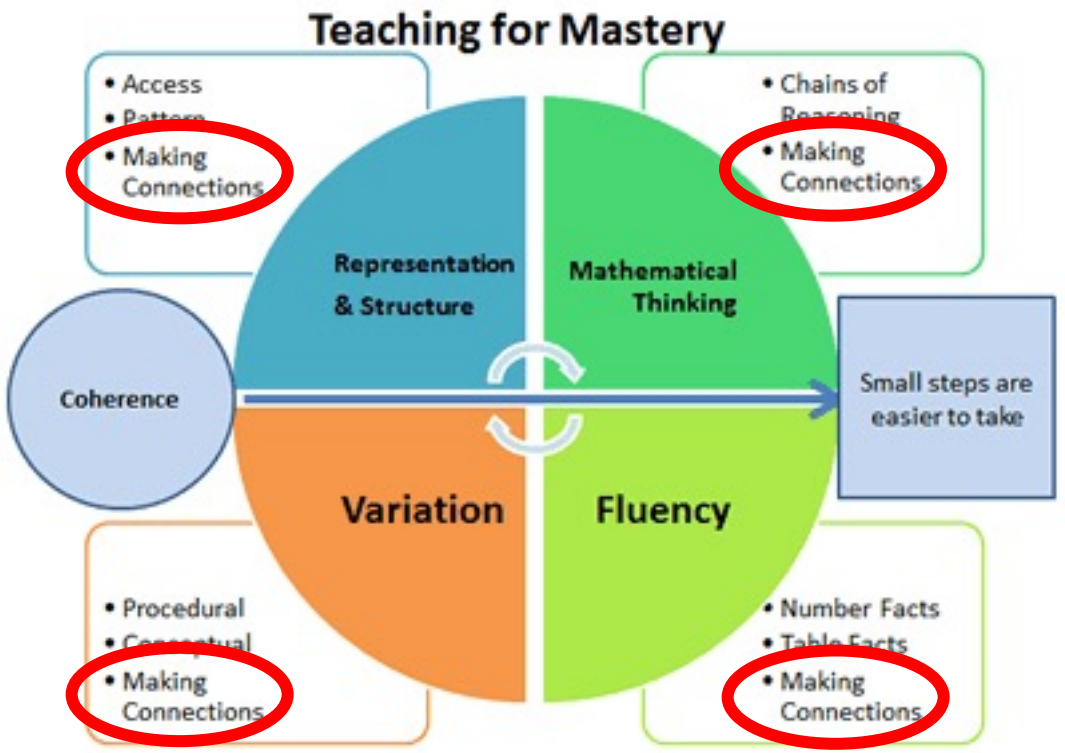
The Depth

The Connections

The Applications

The History

Maths should feel like *Game of Thrones*. Not *Friends*.



What?

Great Maths Teaching Ideas

Sharing great ideas and resources with maths teachers

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THE ELEMENTS- INTERWEAVING

Iw

INTERWEAVING

Interweaving is my own term for building previously learned skills into questions on the current topic being studied. For example, if your class have previously studied fractions and are now studying perimeter, make sure that they work on some perimeter questions featuring fractional lengths.

Interweaving is related to interleaving because students need to **identify** the previously learned strategies required to solve a problem in addition to executing strategies taught in the current lesson. Both interleaving and interweaving also give students additional spaced learning practice benefits. Furthermore, by applying their previous learning in a new context, they also get transferability benefits to the prior learning.

What?

Interweaving:

Using questions and tasks that bring together multiple different topics from across mathematics.

Why?

1 – Connections

2 – Retrieval

3 – Depth

4 – Challenge

5 – Purpose

(6 – The Hannah Questions)

19 There are n sweets in a bag.
6 of the sweets are orange.
The rest of the sweets are yellow.

Hannah takes at random a sweet from the bag.
She eats the sweet.

Hannah then takes at random another sweet from the bag.
She eats the sweet.

The probability that Hannah eats two orange sweets is $\frac{1}{3}$

(a) Show that $n^2 - n - 90 = 0$ (3)

(b) Solve $n^2 - n - 90 = 0$ to find the value of n. (3)

Who? When?

Year 7 Transition

Year 11 Revision

Year 12 Consolidation

How?

How?

Inputs

Processes

Contexts

How?

Inputs	Processes	Contexts
Fractions		
Surds		
Standard Form		

How?

Inputs	Processes	Contexts
Fractions	Equations	
Surds	Ratios	
Standard Form	Sequences	

How?

Inputs	Processes	Contexts
Fractions	Equations	Geometry
Surds	Ratios	Averages
Standard Form	Sequences	Rounding

How?

Inputs

Fractions

Surds

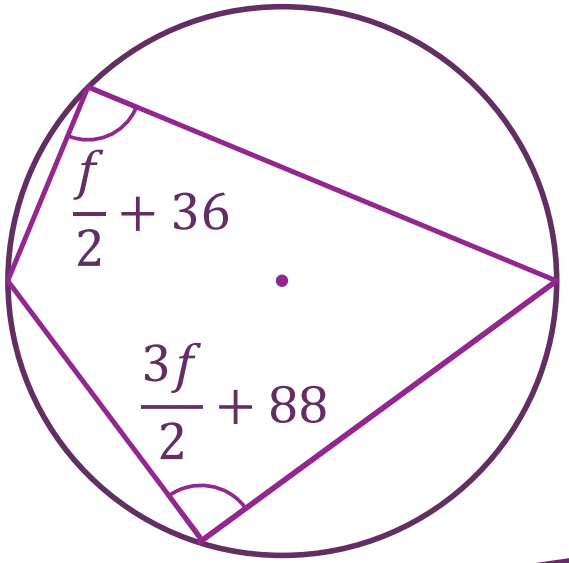
Standard Form

Processes

Equations

Ratios

Sequences



Contexts

Geometry

Averages

Rounding

How?

Inputs	Processes	Contexts
Fractions	Equations	Geometry
Surds	**Ratios**	**Averages**
Standard Form	Sequences	Rounding

An irrational amount of money is shared in the ratio $2 : 3 : 7$.
The mean amount shared is £ $\sqrt{128}$.
What is the size of the smallest share?

How?

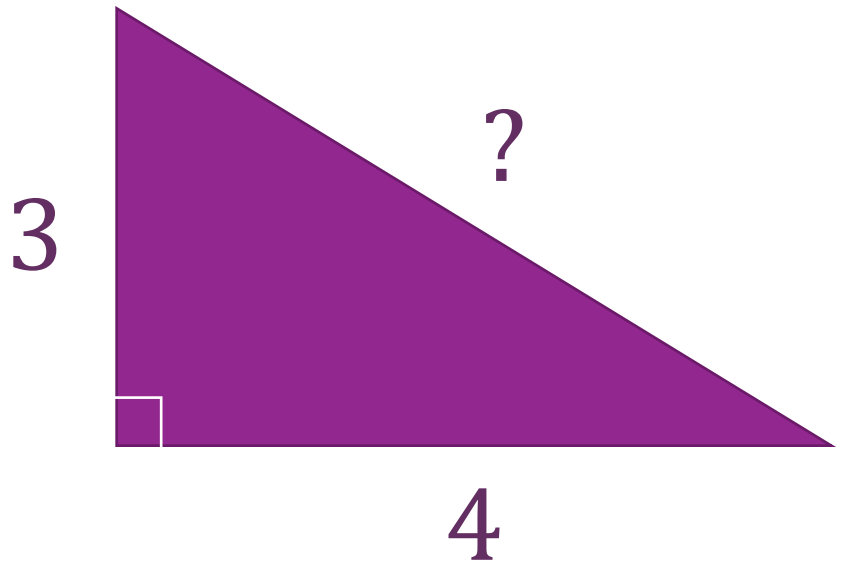
Inputs	Processes	Contexts
Fractions	**Equations**	Geometry
Surds	Ratios	Averages
Standard Form	**Sequences**	**Rounding**

The first two terms of an arithmetic sequence are 4×10^{-3} and 4.4×10^{-3}. Find the position of the first term in the sequence that rounds to 3 to the nearest whole number.

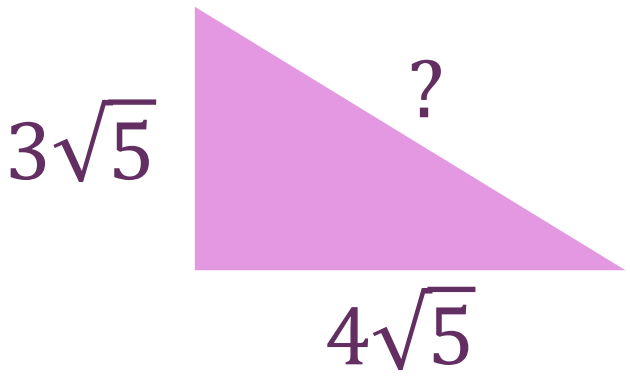
Considerations

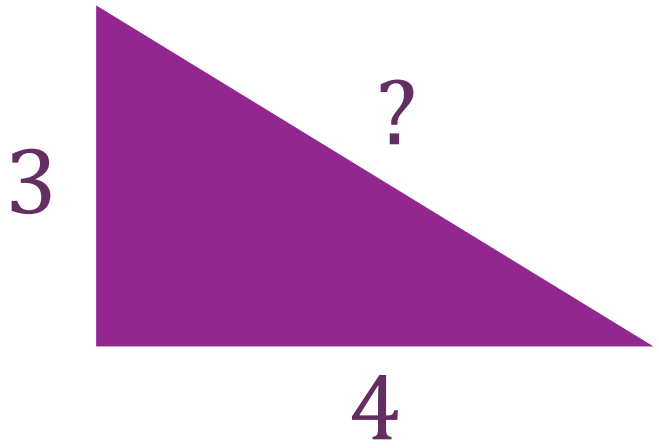
- Overcoming novelty
- Avoiding chaining
- Giving structure

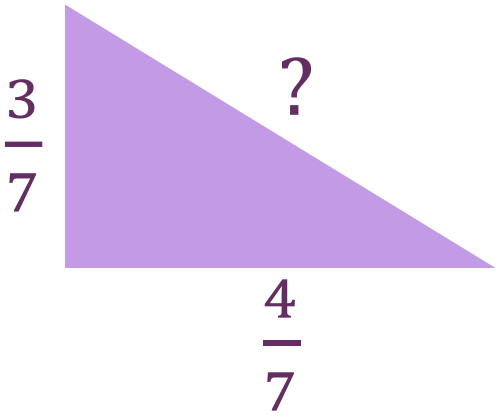
Interweave this question.

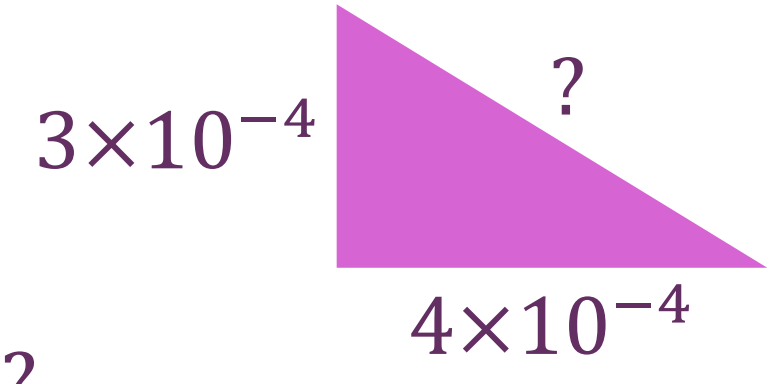


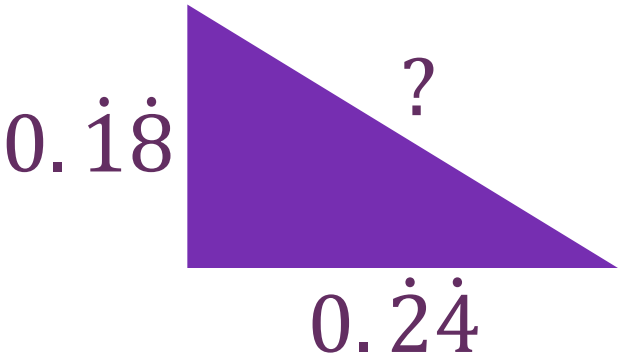
Creating Interwoven Questions

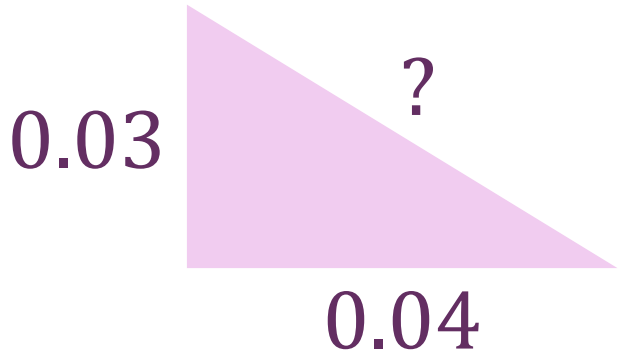


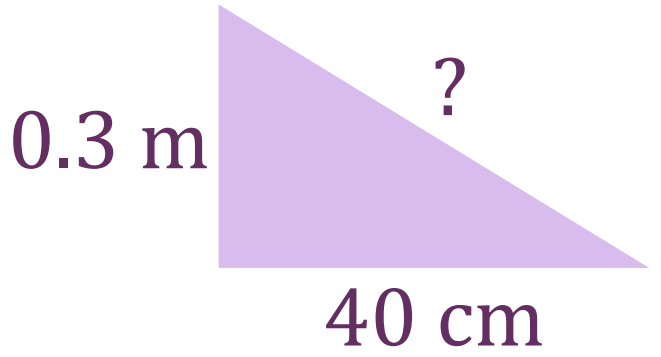




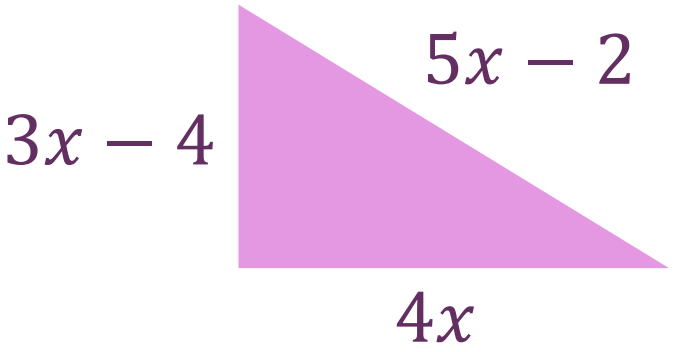


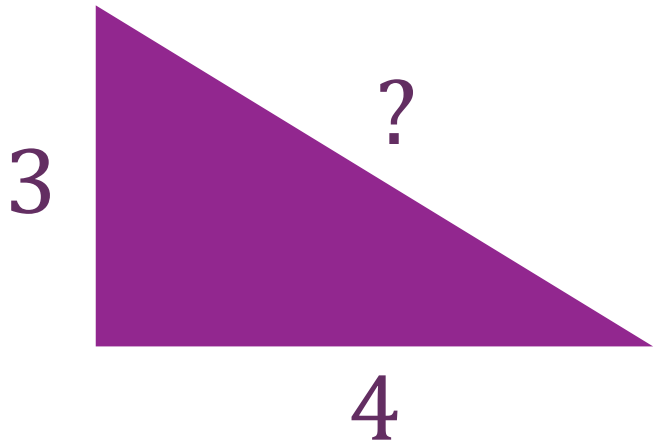




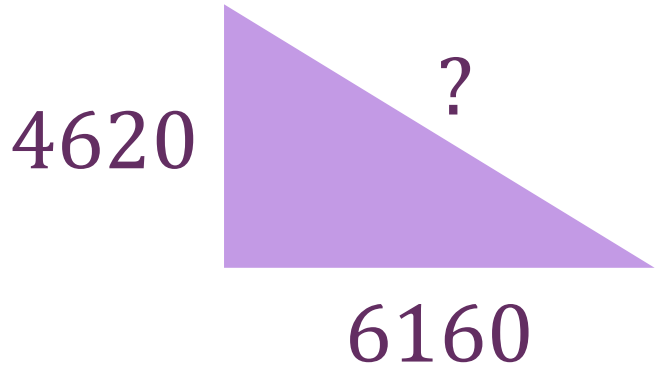


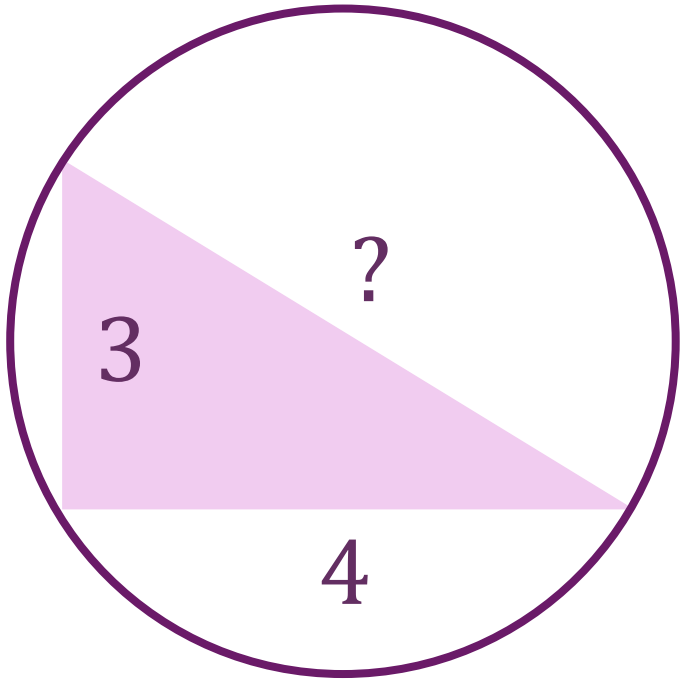
Creating Interwoven Questions



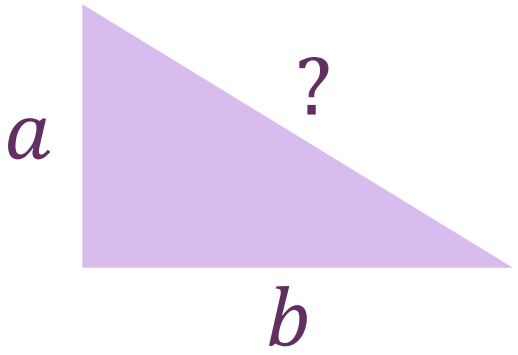


Prime Factorisation!

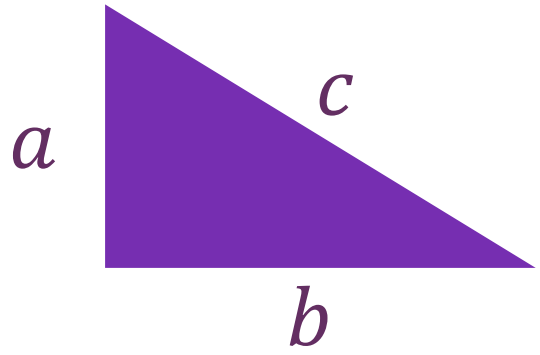




$P = 60, a : b = 3 : 4$



a and b are randomly chosen integers from 1 to 9.
Probability c greater than 5?



Interweave this question.

Solve

$3x + 5 = 17$

Solving Linear Equations…

…with **Fractions**

…with **Decimals**

…with **Standard Form**

…with **Surds**

…with **Brackets**

…with **Substitution**

…with **Rounding**

…from **Indices**

…from **Areas**

…from **Perimeters**

…from **Percentages**

…from **Ratio**

…from **Probability**

…from **Sequences**

…from **Angle Sums**

…from **Parallel Lines**

…from **Circle Theorems**

…from **Similar Shapes**

…from **Averages**

…from **Functions**

…from **?**

Solving Linear Equations with… **Standard Form**

1) $x + 3\times10^{6} = 5\times10^{6}$

2) $0.7x + 3.3\times10^{6} = 5.4\times10^{6}$

3) $1.3x - 3.7\times10^{-3} = 5.4\times10^{-3}$

4) $(2.3\times10^{3})x = 9.2\times10^{-5}$

5) $(6.1\times10^{11})x = 8\times10^{6} - (3.5\times10^{11})x$

6) $3\times10^{-2} + 5x = 3x + 8\times10^{-2}$

7) $(3\times10^{-2})x + 5 = 3 + (8\times10^{-2})x$

8) $8x + 2.6\times10^{8} = 12x + 1.2\times10^{8}$

9) $x + 3\times10^{5} = 5\times10^{6}$

10) $0.7x - 1.1\times10^{4} = 5.4\times10^{6}$

11) $1.3x + 5.3\times10^{-4} = 9\times10^{-7}$

12) $(9.2\times10^{3})x = 2.3\times10^{-5}$

13) $(1.2\times10^{11})x = 8\times10^{6} - (5\times10^{9})x$

14) $3\times10^{-2} + 5x = 3x + 8\times10^{-3}$

15) $(2\times10^{-2})x - 7 = 11 + (8\times10^{-3})x$

16) $11x + 2.4\times10^{8} = 1.2\times10^{12} - 13x$

Solving Trig Equations with… The Factor Theorem

Solve each equation in the given region:

Round answers to 1 decimal place, where appropriate.

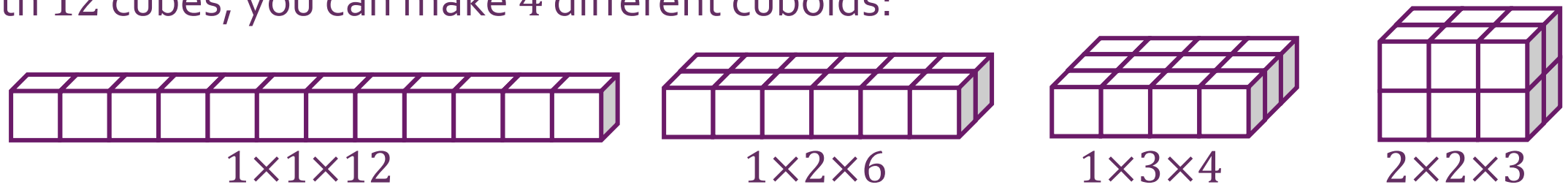
1) $\mathbf{6\sin^3 x - 5\sin^2 x - 3\sin x + 2 = 0}$, for $0° \leq x < 360°$,
2) $\mathbf{12\cos^4 x - \cos^3 x - 18\cos^2 x + \cos x + 6 = 0}$, for $-180° \leq x < 180°$,
3) $\mathbf{6\tan^5 x + 35\tan^4 x + 62\tan^3 x + 35\tan^2 x + 6\tan x = 0}$, for $0° \leq x < 180°$.

4) $\mathbf{2\cos^3 x + 3\sin^2 x - 8\cos x - 6 = 0}$, for $0° \leq x < 720°$,
5) $\mathbf{-3\sin(x)\cos^2 x + 11\sin^2 x - 16\sin x + 5 = 0}$, for $-360° \leq x < 360°$,
6) $\mathbf{\tan(x)\sin^2 x - 3\sin^2 x - 10\sin(x)\cos x + 24\cos^2 x = 0}$, for $-360° \leq x < 0°$.

7) $\mathbf{6\sin^4 2x - 5\sin^3 2x - 14\sin^2 2x - \sin 2x + 2 = 0}$, for $0° \leq x < 180°$,
8) $\mathbf{5\cos^5 3x - 19\cos^4 3x - 9\cos^3 3x + 79\cos^2 3x - 44\cos 3x - 12 = 0}$, for $0° \leq x < 120°$,
9) $\mathbf{\tan^4(4x + 5) - 27\tan^2(4x + 5) - 14\tan(4x + 5) + 120 = 0}$, for $0° \leq x < 90°$.

Investigation into… Factors and Volumes

With 12 cubes, you can make 4 different cuboids:



12 has 4 non-prime factors: 1, 4, 6, and 12.

12 has the same number of non-prime factors as there are cuboids made from 12 cubes.

Investigation prompts:

a) How many cuboids can be made from 16 cubes? How many non-prime factors does 16 have?

b) Find numbers of cubes that can be made into exactly:

i) 1 cuboid ii) 2 cuboids iii) 3 cuboids iv) 5 cuboids v) 6 cuboids

How many non-prime factors do each of your answers have?

c) Is it always true that the number of non-prime factors is equal to the number of possible cuboids?

Using Interwoven Tasks

interwovenmaths.com

1) Try the questions first
2) Model carefully
3) Be selective
4) Adapt and improve!