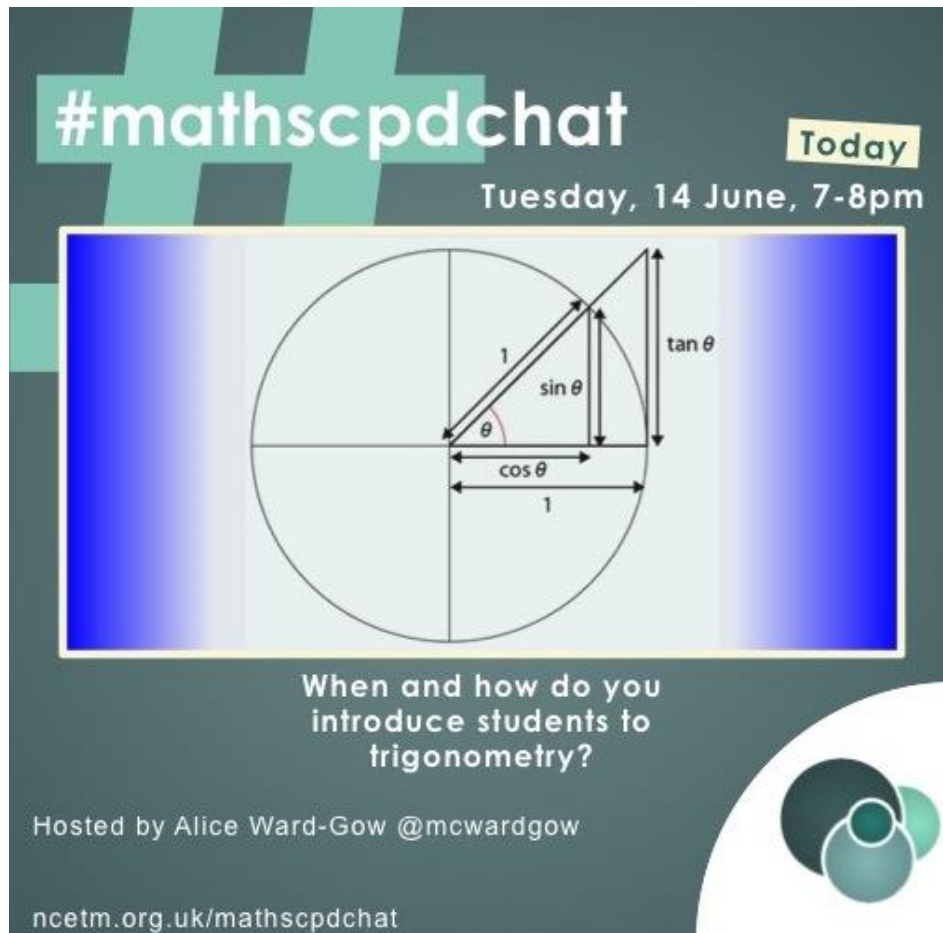


#mathscpdchat 14 June 2022

When and how do you introduce students to trigonometry?

Hosted by [Alice Ward-Gow](#)

This is a summary of the discussion – to see all the tweets, follow the hashtag #mathscpdchat in Twitter



#mathscpdchat

Today
Tuesday, 14 June, 7-8pm

When and how do you introduce students to trigonometry?

Hosted by Alice Ward-Gow @mcwardgow

ncetm.org.uk/mathscpdchat

The links shared during this discussion were:

[Deeper Maths](#) which is a new innovative suite of resources from MEI that support excellent practice in the teaching of secondary (KS3/4) maths to all students. The development of these resources is in progress, and, so far, two topics are available, one of which is Trigonometry! It was shared by [Alison Hopper](#)

[Dr Austin Maths: Pythagoras and Trigonometry](#) which is a large collection of (mainly practice) material presented in the form of attractively-produced worksheets. It was shared by [Alice Ward-Gow](#)

[Resourceaholic: Teaching Trigonometry](#) which is an illustrated blog by [Jo Morgan](#) in which she describes in detail approaches and strategies in teaching trigonometry that she has found to be effective. It includes clearly-presented examples of resources from well-known maths educators such as Don Steward. It was shared by [Alice Ward-Gow](#)

[Resourceaholic: Topics in Depth Project](#) which is a collection of packs developed by [Jo Morgan](#) that are intended to be used by secondary maths teachers in department meetings or CPD sessions. 'Each pack covers subject knowledge, teaching approaches, misconceptions and resources.' The names of the packs include 'Angles in polygons', 'Surds' and 'Exact Trig Values'. It was shared by [Alice Ward-Gow](#)

[Teaching Maths with Worked Examples](#) which is the part of [Karen Hancock](#)'s website containing resource material/guidance that she has created on the overall theme of 'Teaching Maths with Worked Examples'. The five component parts are 'Initial Thoughts and Experiences', 'Another half term of Year 7-11', 'Worked Examples at A level', 'Worked Examples – specific uses of self-explanation prompts', and a conference presentation called 'Worked Examples: The Power of Self-Explanation'. It was shared by [Karen Hancock](#)

[Trigonometry - starting from similar triangles and pythagorean triples](#) which is where on [Karen Hancock](#)'s website you will find a free downloadable editable PPT file containing tasks for students, some of which she shared during this #mathsCPDchat. It was shared by [Karen Hancock](#)

[Interwoven Maths: Similar Shapes, Trigonometry, and Pythagoras Proofs](#) which is material (a free fully editable PPT file) developed by [Nathan Day](#) 'inspired by Teaching Together with [Jonathan Hall](#) and [Charlotte Hawthorne](#)' while they were on a collaborative quest 'to see how they could introduce proofs of Pythagoras' Theorem to pupils without just telling them'. It was shared by [Karen Hancock](#)

[Beautiful Trigonometry - Numberphile](#) which is a YouTube video featuring Ben Sparks. It was shared by [Karen Brockway](#)

[Trigonometry with Year 8: Part 1](#) which is an article in MT214 (from the ATM) in which Jessica Steer, Maria Antoneta de Vila and James Eaton explore the teaching of trigonometry using a method developed by Jeremy Burke of King's College, London. It was shared by [Mary Pardoe](#)

[The History of Trigonometry – Part 1](#) which is an article from NRICH by Leo Rogers. It is the first of three such articles on the NRICH website. It was shared by [Mary Pardoe](#)

[Teaching and Learning the Trigonometric Functions through Their Origins](#) which is an article from the MAA (Mathematical Association of America) by Daniel E. Otero of Xavier University. It contains a wealth of interesting information that may be useful when preparing to teach trigonometry. It was shared by [Mary Pardoe](#)

[Developing creative thinking in mathematics: trigonometry](#) which is a pdf article/unit from TESS-India (Teacher Education through School-based Support). TESS-India is led by The Open University, UK. The unit aims to help teachers work on trigonometry with students 'in a playful and creative way, using the students' mental thinking powers'. It was shared by [Mary Pardoe](#)

[Working group on trigonometry: notes by Anne Watson](#) which is an extract (as a PDF) from the Proceedings of the British Society for Research into Learning Mathematics, November 2008. It was shared by [Mary Pardoe](#)

[Trig Tables](#) which is a task from Underground Mathematics which is part of the 'Trigonometry: triangles to functions' resource. It was shared by [Mary Pardoe](#)

[Sesame Street: My Triangle with James Blunt](#) which is a YouTube video. 'James Blunt sings to Telly about his lost triangle and hopes he can help him find it.' It was shared by [Em Bell](#)

A full illustrated summary of the discussions in this #mathsCPDchat follows.

Alice's first question ...



Miss Ward-Gow @mcwardgow · 14h

Q1. You check your scheme of work and see that you're teaching Trigonometry next week... what's your reaction? GIFs only!

[#mathscpdchat](#)



... resulted in the sharing of two GIFs and four conversations. This reply ...



Sharon Malley @mathsmumof2 · 14h

Replying to @mcwardgow



... generated the following conversation:



Miss Ward-Gow @mcwardgow · 14h

Is it a good rollercoaster? 😊 [#mathscpdchat](#)



Sharon Malley @mathsmumof2 · 14h

Definitely has a lot of positive parts but there is always a conflict in how to start the teaching and what approaches to use. [#mathscpdchat](#)



Miss Ward-Gow @mcwardgow · 15h

Replying to @mathsmumof2

I agree - love the topic, but I'm always left feeling like "maybe there was a better way to do that?" 🤔 have you found any good resources that have helped with the sequence of lessons? [#mathscpdchat](#)



Sharon Malley @mathsmumof2 · 14h

With this years year 9 we've had a big push on proportionality so we've gone down the similar triangles route. We've adapted the @WRMathsSec y10 resources #mathscpdchat



Mary Pardoe @PardoeMary · 14h

Thinking about history before planning how to start can help? This may be useful ...

maa.org/press/periodic..

#mathscpdchat

Teaching and Learning the Trigonometric Functions through Their Origins

Author(s): Daniel E. Otero (Xavier University)



In this series, we present a collection of curricular units based on primary historical sources and designed to serve students as an introduction to the study of trigonometry. Each unit may be incorporated, either individually or in various combinations, into a standard course in College Algebra with Trigonometry, a stand-alone Trigonometry course, or a Precalculus course. These lessons have also been used in courses on the history of mathematics and as part of a capstone experience for pre-service secondary mathematics teachers.

Trigonometry is concerned with measurements of angles about a central point (or of arcs of circles centered at that point and quantities, geometrical and otherwise, that depend on the sizes of such angles (or the lengths of the corresponding arcs). It is one of those subjects that has become a standard part of the toolbox of every scientist and applied mathematician. Why is it so valuable?



Episode 6: Regiomontanus and the Beginnings of Modern Trigonometry

Daniel E. Otero*

Trigonometry is concerned with the measurements of angles about a central point (or of arcs of circles centered at that point) and quantities, geometrical and otherwise, which depend on the sizes of such angles (or the lengths of the corresponding arcs). It is one of those subjects that has become a standard part of the toolbox of every scientist and applied mathematician. Today an introduction to trigonometry is normally part of the mathematical preparation for the study of calculus and other forms of mathematical analysis, as the trigonometric functions make common appearances in applications of mathematics to the sciences, wherever the mathematical description of cyclical phenomena is needed. This project is one of a series of curricular units that tell some of the story of where and how the central ideas of this subject first emerged, in an attempt to provide context for the study of this important mathematical theory. Readers who work through the entire collection of units will encounter six milestones in the history of the development of trigonometry. In this unit, we read selections from a systematic work on trigonometry written in the fifteenth century in central Europe to see how the subject began to be separated from its practical astronomical roots to become a purely geometric study of plane triangles and the measures of their angles and sides. Connections will be made between this work and the modern practice of defining trigonometric quantities as ratios of side lengths in a right triangle.

(link provided above)



Sharon Malley @mathsmumof2 · 14h

Wow what a treasure trove! I usually only go back as far as trig tables 🤓
#mathscpdchat



Mary Pardoe @PardoeMary · 14h

NRICH have three useful articles too ... this is the first:
nrich.maths.org/6843
#mathscpdchat

I think everyone perhaps ought to know about this ...?

12. The Final Chapter: Trigonometry Changes the World System

Nicolaus Copernicus (1473 - 1543)

Copernicus wrote a brief outline of his proposed system called the *Commentariolus* that he circulated to friends somewhere between 1510 and 1514. By this time he had used observations of the planet Mercury and the Alfonsine Tables to convince himself that he could explain the motion of the Earth as one of the planets. The manuscript of Copernicus' work has survived and it is thought that by the 1530s most of his work had been completed, but he delayed publishing the book.



(link provided above)

The following discussion, also prompted by Q1, happened without a GIF ...



Miss Ward-Gow @mcwardgow · 14h

Q1. You check your scheme of work and see that you're teaching Trigonometry next week... what's your reaction? GIFs only!
#mathscpdchat



Cat @CMaths3 · 14h

Replying to @mcwardgow

We've planned a unit on the unit circle to introduce to year 9 and I'm so excited to try it out next week!



Miss Ward-Gow @mcwardgow · 14h

This sounds interesting 😊 have you seen this and is it similar to what you're doing? twitter.com/SegarRogers/st.. #mathscpdchat

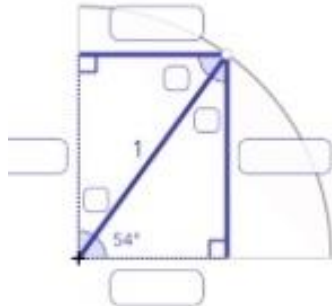
Segar Rogers @SegarRogers · Jun 13

A short unit-circle trig task. Sine and cosine as lengths. The use of complementary angles to write sides in terms of either sine or cos, as required. Worked well with my Higher class today ... didn't take long to complete but they are indeed a lot more fluent now.

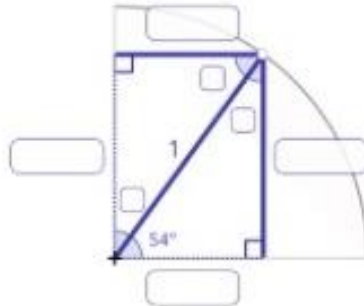
Trigonometry: Building Unit-Circle Fluency

1

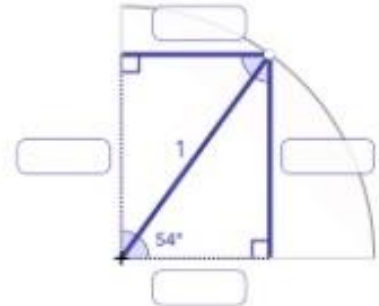
Complete this diagram in terms of sine.



Complete this diagram in terms of cosine.

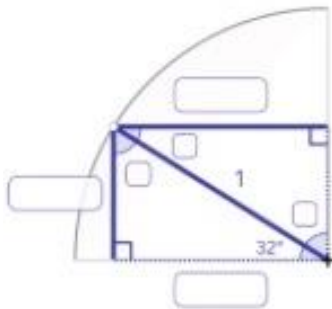


Complete this diagram in terms of the angle 54° .

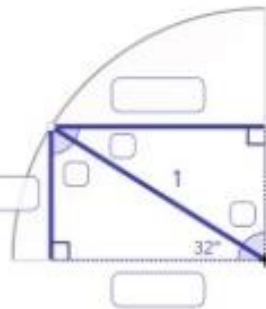


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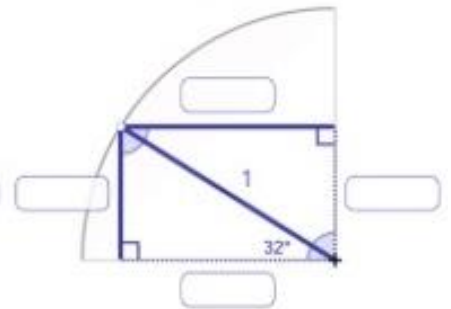
Complete this diagram in terms of sine.



Complete this diagram in terms of cosine.

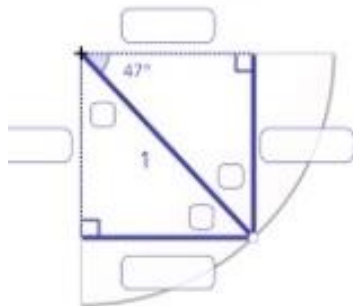


Complete this diagram in terms of the angle 32° .

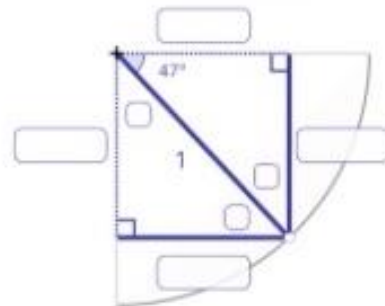


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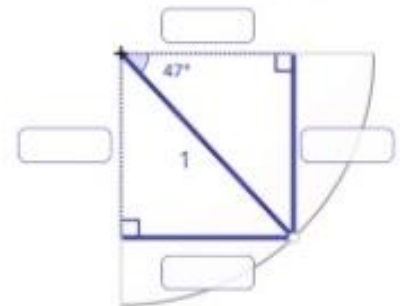
Complete this diagram in terms of sine.



Complete this diagram in terms of cosine.

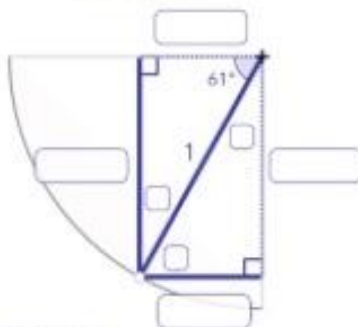


Complete this diagram in terms of the angle 47° .

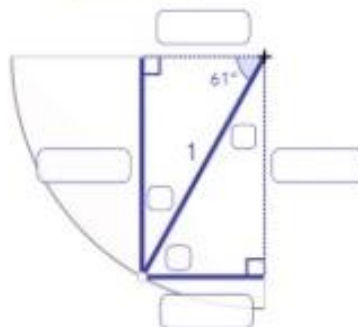


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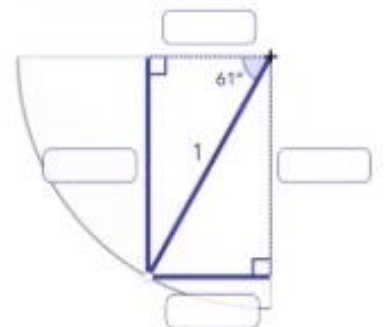
Complete this diagram in terms of sine.



Complete this diagram in terms of cosine.



Complete this diagram in terms of the angle 61° .





Cat @CMaths3 · 14h

...

Ours is more introduction than this. Lots of using trig tables. Initially all using triangles with a hypotenuse of 1. Lots of ratio tables and enlarging. No SOHCAHTOA until year 10 (maybe never). I would share but lots borrowed from others



Segar Rogers @SegarRogers · 13h

...

Trig tables, ratio tables, and enlarging ... sounds great! I like the no sohcahtoa too :-)

... but this conversation was prompted by a GIF:



Jessica Durant @_MissDurant · 14h

...

Replying to [@mcwardgow](#)



Miss Ward-Gow @mcwardgow · 14h

...

Love the GIF 🤔 what makes you feel nervous? [#mathscpdchat](#)



Jessica Durant @_MissDurant · 14h

...

I think because the kids get nervous as they've "heard trigonometry is really hard" and it can be difficult to start when that's their mindset going in!!



Miss Ward-Gow @mcwardgow · 14h

...

And it probably gets that reputation because it's sometimes mentioned in films isn't it?! 😬 [#mathscpdchat](#)

The following conversation, also in response to Q1, focussed on the love of triangles!

 **W E Cookson** @WECmathventures · 14h ...
Replying to @mcwardgow
Triangles are fascinating #mathscpdchat


 **W E Cookson** @WECmathventures · 14h ...
Replying to @mcwardgow
#mathscpdchat Bored by numbers, confused by need for algebra, many pupils seem more engaged often for first time when introduced to geometry/shape.
And the ratio of sides in right-angle triangles can help introduce trigonometry.

 **Miss Ward-Gow** @mcwardgow · 14h ...
So you would introduce it with triangles to make it feel more like a new topic? 😊 #mathscpdchat

 **Miss Ward-Gow** @mcwardgow · 16h ...
Are triangles the favourite shape? 😊 #mathscpdchat

 **W E Cookson** @WECmathventures · 16h
Replying to @mcwardgow
Triangles are fascinating #mathscpdchat

 **Em Bell** @El_Timbre · 16h ...
Replying to @mcwardgow
youtu.be/Z4cUQ1ltK-w #mathscpdchat



youtube.com
Sesame Street: My Triangle with James Blunt (You'...
James Blunt sings to Telly about his lost triangle and hopes he can help him find it!--Subscribe to the ...

 **Miss Ward-Gow** @mcwardgow · 16h ...
🤔 wonder if we can get a retweet from @JamesBlunt ?? #mathscpdchat

Alice's second question ...



Miss Ward-Gow @mcwardgow · Jun 14

...

Q2. When do your students first come across trigonometry?

[#mathscpdchat](#)



93 votes · Final results

... prompted a few comments:



Angry Maths Teacher @GrumpyMathTeach · 10h

...

Replying to @mcwardgow

Year 10, but now that I'm KS3 leader, it'll be year 9.



Mr R @northerntangent · 12h

...

Replying to @mcwardgow

Interesting how many introduce it in Y10 (or 11) when it is on the KS3 curriculum



Fossie @fossiefos · 10h

...

Replying to @mcwardgow

Year 10 for foundation students

The screenshots below show conversations and single replies generated by **Alice's third question**. Strategies discussed included starting work on trigonometry by focussing on 30° , 60° , 90° triangles only, and working from Pythagorean triples. **Click on any of the following screenshots-of-a-tweet to go to that actual tweet on Twitter.** The single replies and conversations were generated by this question from [Alice Ward-Gow](#):



Miss Ward-Gow @mcwardgow · 15h

Q3. What does your first lesson on trigonometry look like? And is it affected by which Year group you start teaching trigonometry to? 🤔

[#mathscpdchat](#)

One of the single replies was from [Alison Hopper](#) ...



Alison Hopper @AlisonHopperMEI · 13h

Replying to @mcwardgow and @PardoeMary

Have you looked at the @MEIMaths Deeper Maths resources Trig units?



mei.org.uk

MEI's Deeper Maths resources are now free! - MEI

We're delighted to announce that our Deeper Maths suite of resources is now available free of charge. These resources support...

(link provided above)

... and another was from [Mary Pardoe](#):



Mary Pardoe @PardoeMary · 15h

...

Replying to [@mcwardgow](#)

Helpful to think about prior knowledge/understanding.

bsrlm.org.uk/wp-content/upl..

[#mathscpdchat](#)

Joubert, M. (Ed.) Proceedings of the British Society for Research into Learning Mathematics 28(3) November 2008

Working group on trigonometry: meeting 1

Notes by Anne Watson

Department of Education, University of Oxford

Prior or concurrent understandings entailed in trigonometry

Similarity: proportionality; multiplicative relationships: scaling of one line is experienced differently to enlargement of one line in relation to another.

Angle: measuring the amount of turn, embodied sense of turn; eventual understanding of angle as independent variable in functions.

Length: why comparing lengths multiplicatively is appropriate, rather than additively.

Enlargements as transformations; trigonometric activity as transforming enlargements.

Angle as variable; functions.

(link provided above)

One of the conversations generated by Q3 ...

Q3. What does your first lesson on trigonometry look like? And is it affected by which Year group you start teaching trigonometry to? 🤔

... was between [Jsh](#) and [Alice Ward-Gow](#):



Jsh @jshmtn · 15h

...

Replying to [@mcwardgow](#)

Only involves the angle 30 and sine and is built on the idea of the triangles being similar.

Plenty of Qs asking if they can identify a 30 angle based on side lengths/identify whether it is 30 based on side lengths/ identify side lengths if an angle of 30 is given...



Miss Ward-Gow @mcwardgow · 15h

...

Replying to [@jshmtn](#)

Sounds great 👍 which year group would you do this with? [#mathscpdchat](#)



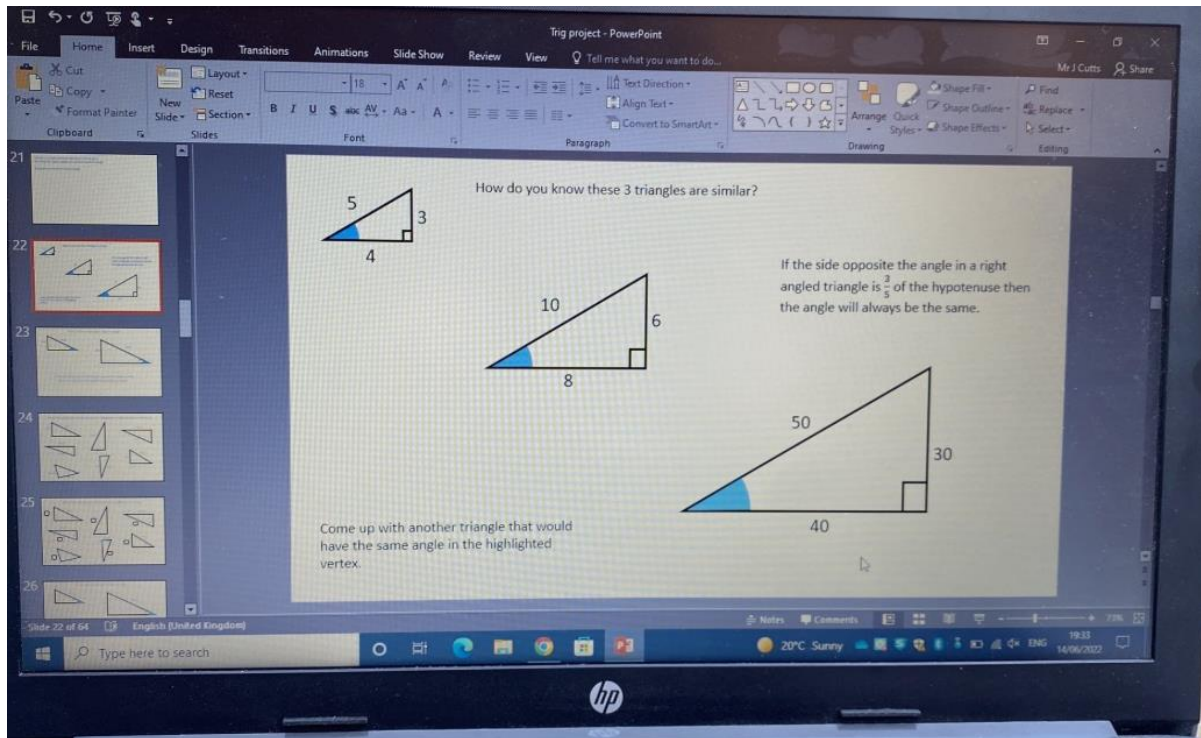
Jshm @jshmtm · 15h

Whichever year group is due to be introduced to it for the first time. NC has it down as being the end of geometry pretty much for KS3 so end of year 9?



Jshm @jshmtm · 15h

[#mathscpdchat](#) so this sort of sequence after doing some work on inter and intra side ratios of similar triangles in a previous lesson.

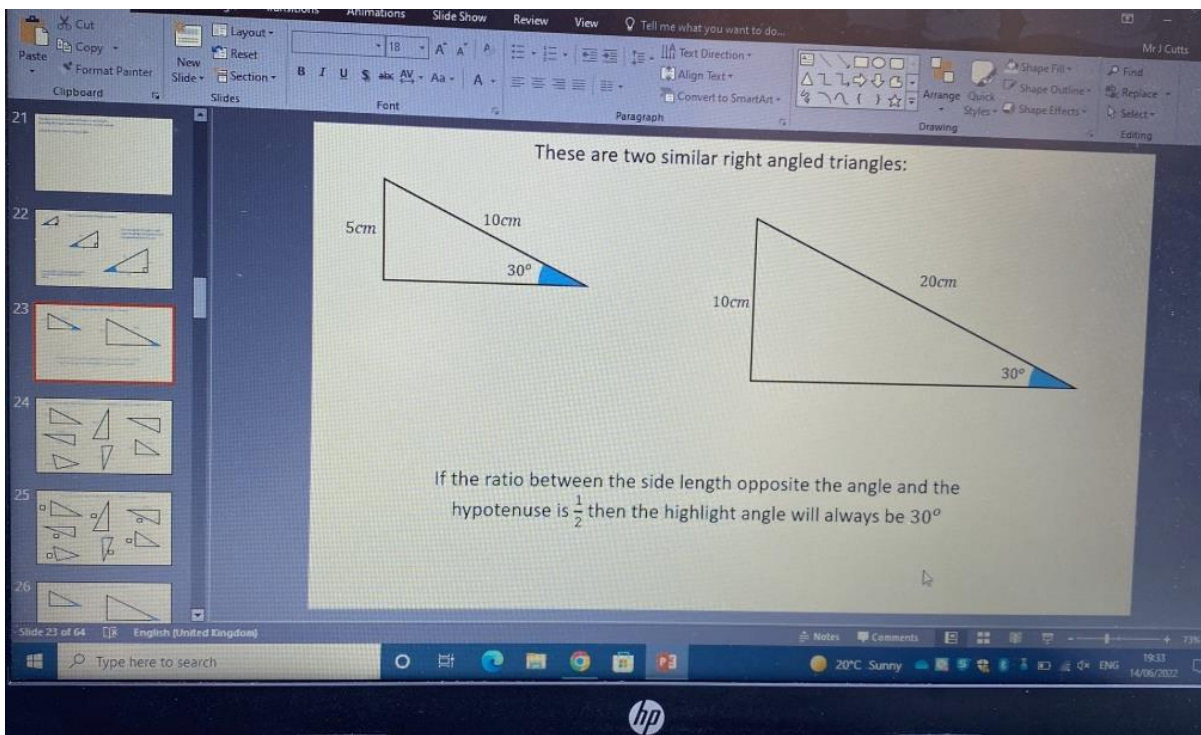


Trig project - PowerPoint

How do you know these 3 triangles are similar?

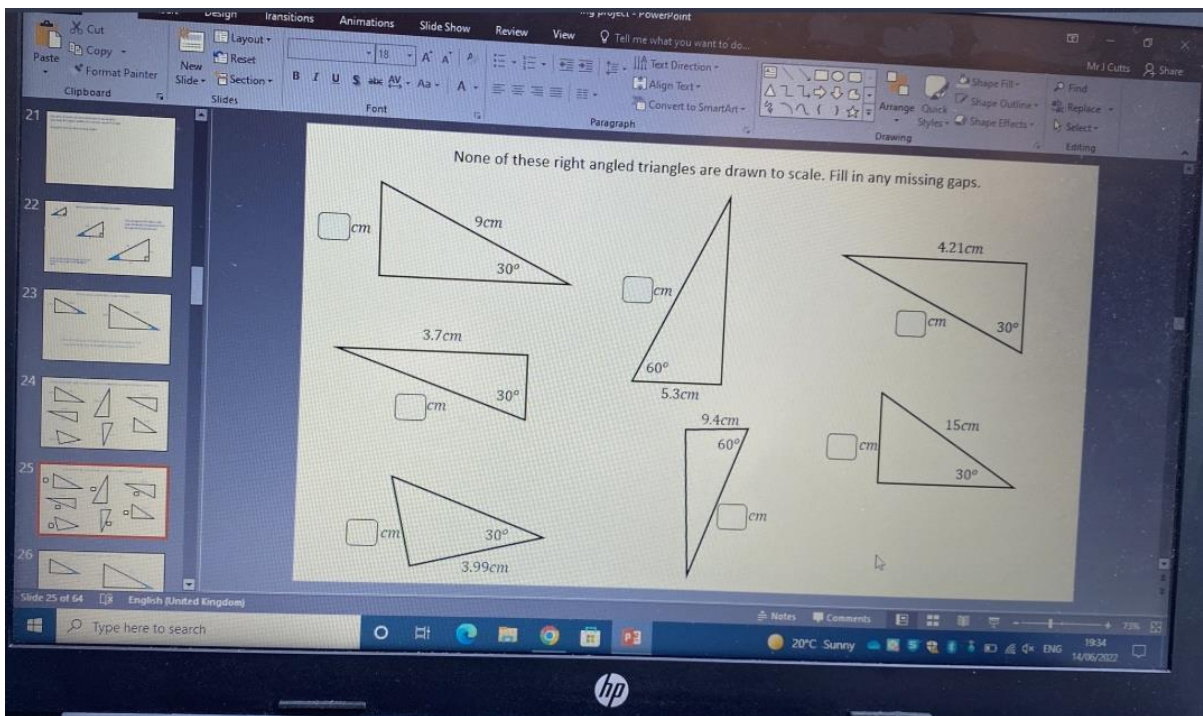
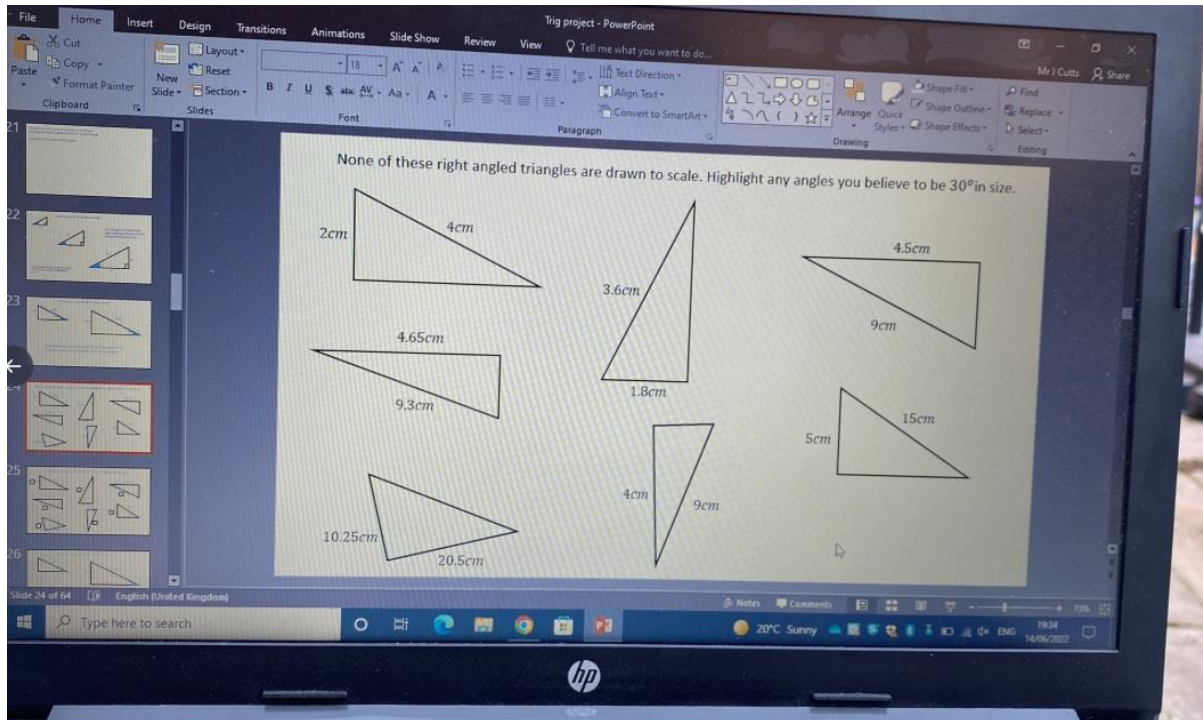
If the side opposite the angle in a right angled triangle is $\frac{2}{3}$ of the hypotenuse then the angle will always be the same.

Come up with another triangle that would have the same angle in the highlighted vertex.



These are two similar right angled triangles:

If the ratio between the side length opposite the angle and the hypotenuse is $\frac{1}{2}$ then the highlight angle will always be 30°



Miss Ward-Gow @mcwardgow · 14h

Thank you for sharing these. Would you teach similar shapes just before this? [#mathscpdchat](#)



Jshm @jshmtn · 14h

I'd always do 1 lesson recapping similarity focusing particularly on the ratios between sides on the same triangle being the same as other similar triangles

A reply to Q3 from [Karen Hancock](#) generated another conversation between her, [Fossie](#), [Mary Pardoe](#) and [Alice Ward-Gow](#):



Karen @karensancock · 15h

...

Replying to @mcwardgow

This year I tried something new:

Pythagorean triples to create a trig table and then using these ratios linked with similar triangles to introduce trig. [#mathscpdchat](#)

TASK: Use Pythagoras' Theorem to complete this table of side ratios

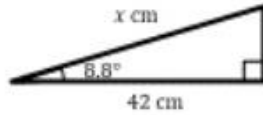
Angle (θ) rounded to 1dp	$\frac{\text{opp}}{\text{hyp}}$	$\frac{\text{adj}}{\text{hyp}}$	$\frac{\text{opp}}{\text{adj}}$
8.8°	$\frac{13}{85}$		
10.4°	$\frac{11}{61}$		
11.4°		$\frac{99}{101}$	
12.7°		$\frac{40}{41}$	
14.3°			$\frac{16}{63}$
16.3°			$\frac{7}{24}$
18.9°	$\frac{12}{37}$		
22.6°	$\frac{5}{13}$		
25.1°		$\frac{77}{85}$	
26.0°		$\frac{80}{89}$	
28.1°			$\frac{8}{15}$
30°			$\frac{\sqrt{3}}{3}$
30.5°	$\frac{33}{65}$		
31.9°	$\frac{28}{53}$		
33.4°		$\frac{91}{109}$	
36.9°		$\frac{4}{5}$	
41.1°			$\frac{48}{55}$
42.1°			$\frac{65}{72}$
43.6°	$\frac{20}{29}$		
45°	$\frac{\sqrt{2}}{2}$		

TABLE OF SIDE RATIOS

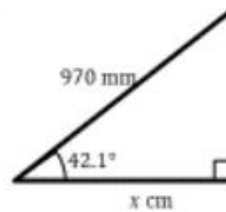
Angle (θ) rounded to 1dp	$\frac{\text{opp}}{\text{hyp}}$	$\frac{\text{adj}}{\text{hyp}}$	$\frac{\text{opp}}{\text{adj}}$
8.8°	$\frac{13}{85}$	$\frac{84}{85}$	$\frac{13}{84}$
10.4°	$\frac{11}{61}$	$\frac{60}{61}$	$\frac{11}{60}$
11.4°	$\frac{20}{101}$	$\frac{99}{101}$	$\frac{20}{99}$
12.7°	$\frac{9}{41}$	$\frac{40}{41}$	$\frac{9}{40}$
14.3°	$\frac{16}{65}$	$\frac{63}{65}$	$\frac{16}{63}$
16.3°	$\frac{7}{25}$	$\frac{24}{25}$	$\frac{7}{24}$
18.9°	$\frac{12}{37}$	$\frac{35}{37}$	$\frac{12}{35}$
22.6°	$\frac{5}{13}$	$\frac{12}{13}$	$\frac{5}{12}$
25.1°	$\frac{36}{85}$	$\frac{77}{85}$	$\frac{36}{77}$
26.0°	$\frac{39}{89}$	$\frac{80}{89}$	$\frac{39}{80}$
28.1°	$\frac{8}{17}$	$\frac{15}{17}$	$\frac{8}{15}$
30°	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{3}}{1}$
30.5°	$\frac{33}{65}$	$\frac{56}{65}$	$\frac{33}{56}$
31.9°	$\frac{28}{53}$	$\frac{45}{53}$	$\frac{28}{45}$
33.4°	$\frac{60}{109}$	$\frac{91}{109}$	$\frac{60}{91}$
36.9°	$\frac{3}{5}$	$\frac{4}{5}$	$\frac{3}{4}$
41.1°	$\frac{48}{73}$	$\frac{55}{73}$	$\frac{48}{55}$
42.1°	$\frac{65}{97}$	$\frac{72}{97}$	$\frac{65}{72}$
43.6°	$\frac{20}{29}$	$\frac{21}{29}$	$\frac{20}{21}$
45°	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$	1

TASK: Using the table of side ratios, find the lettered sides and angles.

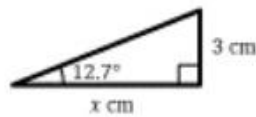
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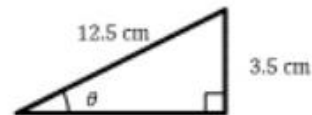
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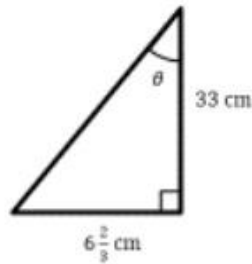
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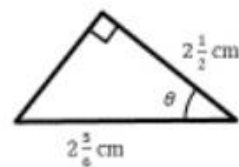
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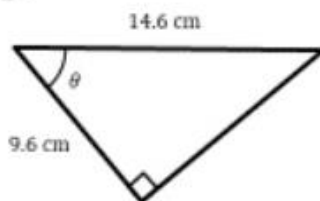
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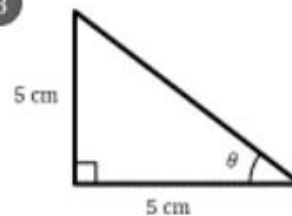
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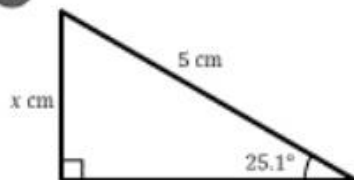
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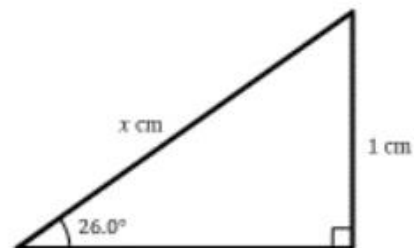
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9



10



Fossie @fossiefos · 3h

What a great idea!

...



Miss Ward-Gow @mcwardgow · 20h

Definitely going to use this next time I teach trigonometry! Thank you for sharing @karenshancock 😊 #mathscpdchat

...



Karen @karensancock · 20h



Replying to @mcwardgow

The whole powerpoint can be downloaded here:

kshancock.co.uk/lessonresource... #mathscpdchat

(link provided above)



Mary Pardoe @PardoeMary · 20h



Replying to @mcwardgow and @karensancock

Reminds me a bit of this: undergroundmathematics.org/trigonometry-t...

#mathscpdchat



In the tables below, $0 \leq \theta \leq 2\pi$ and any missing functions are from the following list.

$\sin \theta$ $\cos \theta$ $\tan \theta$ $\sec \theta$ $\operatorname{cosec} \theta$ $\cot \theta$

Some of the row and column headings are missing. Without using a calculator, try to work out what they could be and complete the table. A function does not appear twice in the same table.

If you think you know what a missing function or value is, make sure you check that it works for all the entries in its row and column!

	$\theta = \dots$	$\theta = \dots$	$\theta = \dots$
	-1	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$
$\tan \theta$	undefined	$\sqrt{3}$	
$\sec \theta$			$-\frac{2}{\sqrt{3}}$

In the next table we have given some more information about θ . Try to identify the missing functions and complete the table. Remember not to use a calculator!

	θ is reflex	$\theta = \dots$	θ is obtuse
		0	$-\frac{3}{5}$
$\operatorname{cosec} \theta$		1	$\frac{5}{4}$

(link provided above)

Q3 ...

Q3. What does your first lesson on trigonometry look like? And is it affected by which Year group you start teaching trigonometry to? 🤔

... also generated a single reply from [Mary Pardoe](#) ...



Mary Pardoe @PardoeMary · 15h

Replying to [@mcwardgow](#)

This is one way ...

(In 'Developing creative thinking in mathematics: trigonometry ... here: open.edu/openlearncreat.)

[#mathscpdchat](#)

Ask your students the following: **Activity 1: Students investigate triangles in polygons**

- In how many ways can you divide each of the shapes in Figure 1 into right-angled triangles?

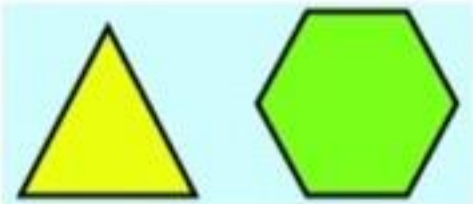


Figure 1 An equilateral triangle and a hexagon.

- Draw any right-angled triangle (Figure 2). What kind of closed polygons can you construct by using this triangle as a building block?




Figure 2 A right-angled triangle.

Figure 3 shows an example.




Figure 3 A square made up of eight right-angled triangles.

- Do you think that all closed polygons can be formed by right angled triangles? Give reasons to justify your answer.
- Why do you think this activity asks you to investigate whether any closed polygons can be made up of right-angled triangles?

(link provided above)

... and two connected single replies from [Alan Wood](#) ...



Alan Wood 3.5% ❤️ @alwoodwork · 14h

...

Replying to @mcwardgow

One of my last is to measure the height of trees in and around the school grounds plus the height of any tall buildings. Great this time of year. All that's required is a protractor and some way of measuring distance (stride length will do!) . 1/2



Alan Wood 3.5% ❤️ @alwoodwork · 14h

...

2/2 All calculations take place in the classroom. Typical questions: how far shall we stand from the tree? Shall we lay on the ground or stand up to measure the angle? Does it matter if the ground's not flat? There'll be some wonderful discussion I guarantee.

... and also two connected single replies from [David Burns](#):



David Burns 🇬🇧 🚲 🧑 📏 📐 📱 @mrburnsmaths · 14h

...

Replying to @mcwardgow and @PardoeMary

Coordinate axis. Protractor. Measuring angles from positive direction of x axis. Quadrant one only. Table of values collation as a class. Plot results on an x/y axis.



David Burns 🇬🇧 🚲 🧑 📏 📐 📱 @mrburnsmaths · 14h

...

Should have added. Ruler. Making RAT. Maybe three lessons in this. Defo... make a RAT of 10 degrees. 20 degrees. 30degrees. Etc.

(to read the discussion-sequence generated by any tweet look at the 'replies' to that tweet)

Alice's fourth question ...



Miss Ward-Gow @mcwardgow · 18h

...

Q4. What does your sequence of trigonometry lessons look like?

[#mathscpdchat](#)

... prompted this sequence of tweets with helpful images showing examples ...



Karen @karenshancock · 19h

Replying to @mcwardgow

After the exact value trig tables we introduced the names and did some worked examples and self explanation prompts (I'm a BIG fan of these) And I always teach find hypotenuse first. #mathscpdchat

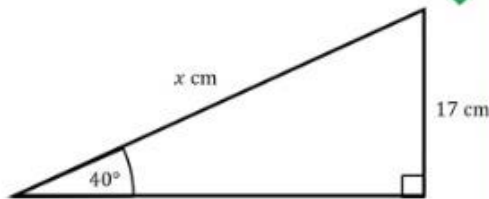
WORKED EXAMPLE – TRIGONOMETRY - FINDING LENGTHS

Veronica has answered this question correctly

Date:

Study the solution carefully and answer these questions.

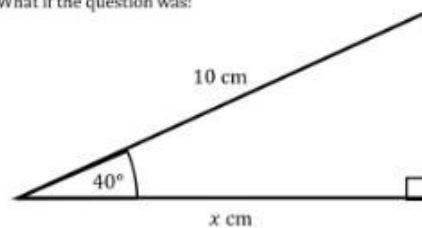
Find the length of x



$$\begin{aligned} \sin 40^\circ &= \frac{17}{x} \\ x(\sin 40^\circ) &= 17 \\ x &= \frac{17}{\sin 40^\circ} \\ &= \underline{\underline{26.4 \text{ cm}}} \end{aligned}$$

- (1) How does Veronica know to use the sine ratio?
- (2) Veronica's friend types $17(\sin 40^\circ)$ into their calculator and gets the answer:
10.9 cm
Explain how they can tell they have made a mistake.

(3) What if the question was:



- (a) Which trigonometric ratio would you use?
- (b) What would your working look like?



Dec (he/him) @forde_mr · 19h

Replying to @karenshancock and @mcwardgow

Really like the layout of these!



Karen @karenshancock · 19h

Thank you - after writing them for lessons 12 months -I've finally got something I'm happy with. :-)

#mathscpdchat



Dec (he/him) @forde_mr · 19h

I'm primary but I really like the way the problem prompts them to explore the solution in depth especially the variation with the "what if". Definitely food for thought with my own worked examples :)



Karen @karenshancock · 19h

Here's some ramblings on my journey over the last year, if you fancy a read.

kshancock.co.uk/workedexamplei...

(link provided above)



Dec (he/him) @forde_mr · 18h

Thanks!!

...



Karen @karenshancock · 19h

And one on inverse trig too #mathscpdchat

...

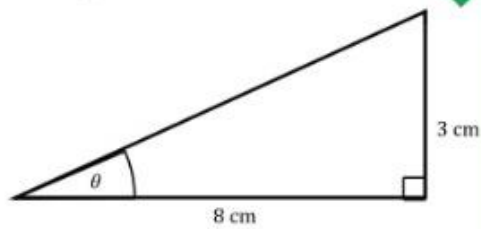
WORKED EXAMPLE - TRIGONOMETRY - FINDING ANGLES

Jordan has answered this question **correctly**

Date:

Study the solution carefully and answer these questions.

Find the length of x

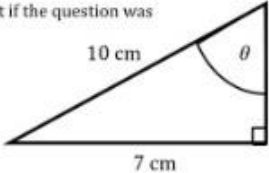


$$\tan \theta = \frac{3}{8}$$

$$\theta = \tan^{-1}\left(\frac{3}{8}\right)$$

$$\theta = \underline{20.6^\circ}$$

- (1) How does Jordan know to use the tangent ratio?
- (2) Jordan's friend has their calculator in the wrong mode. They get an answer of 0.359. Explain how they can tell they have a wrong answer.
- (3) (a) What mode should their calculator be in?
(b) How can they check this?
(c) What keys should they press to put it in the correct mode?
- (4) What if the question was



 What would your first line of working look like?



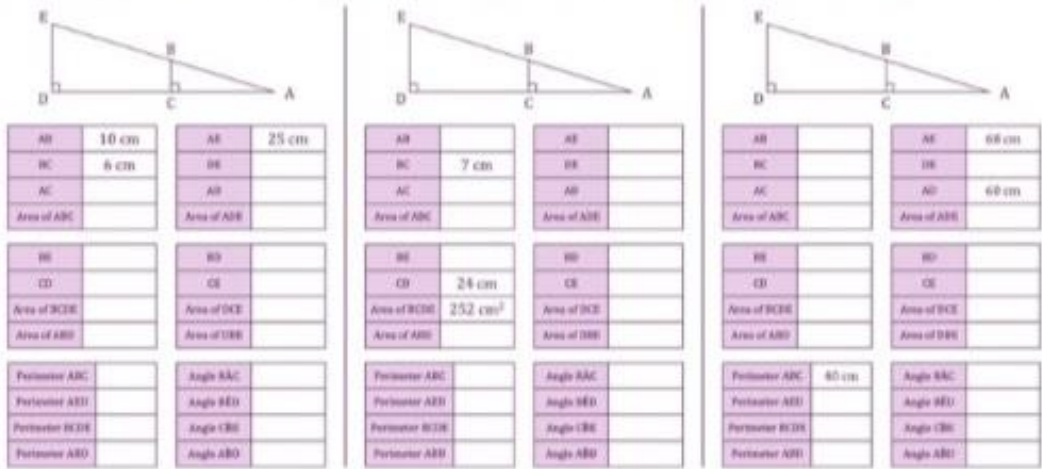
Karen @karenshancock · 19h

And then after a Shed Load of Practice (SLOP) I ended with this from @nathanday314

interwovenmaths.com/similar-shapes... #mathscpdchat

...

Pythagoras and Trigonometry with... Similar Shapes



AB	10 cm	AE	25 cm
BC	6 cm	DE	
AC		AD	
Area of ABC		Area of ABE	
BE		BD	
CD		CE	
Area of BCD		Area of DCE	
Area of ABD		Area of DBE	
Perimeter ABC		Angle BAC	
Perimeter ABE		Angle BED	
Perimeter BCD		Angle CBD	
Perimeter ABD		Angle ABO	

AB		AE	
BC	7 cm	DE	
AC		AD	
Area of ABC		Area of ABE	
BE		BD	
CD	24 cm	CE	
Area of BCD	252 cm ²	Area of DCE	
Area of ABD		Area of DBE	
Perimeter ABC		Angle BAC	
Perimeter ABE		Angle BED	
Perimeter BCD		Angle CBD	
Perimeter ABD		Angle ABO	

AB		AE	68 cm
BC		DE	
AC		AD	68 cm
Area of ABC		Area of ABE	
BE		BD	
CD		CE	
Area of BCD		Area of DCE	
Area of ABD		Area of DBE	
Perimeter ABC	80 cm	Angle BAC	
Perimeter ABE		Angle BED	
Perimeter BCD		Angle CBD	
Perimeter ABD		Angle ABO	

interwovenmaths.com

Similar Shapes, Trigonometry, and Pythagoras Proofs

This pair of tasks interweaves similar and congruent triangles with finding perimeters, areas, and angles using trigonometry and proving ...

(link provided above)

... and another tweet sequence:



Angel Grantham @TheNerdLP · 14h

...

Replying to @mcwardgow

- 1) pythag: highlighting RAT triangle has 2 sides labelled and no angle.
- 2) introducing a RAT with one side labelled and an angle to ask *how do we find the missing side now*?
- 3) show sine 30, sides and angles labelled similar triangles, as them to make observations.



Angel Grantham @TheNerdLP · 14h

...

- 4) explain there is always a relationship between the sides based on the angle.
- 5) find missing side using sine30.
- 6) practise labelling tri HOA.
- 7) identify which tri Qs use he sine rule.
- 8) discuss that means the relationship between the Opp and Hyp.



Angel Grantham @TheNerdLP · 14h ...

9) revise fact families and solving 1 step equations

10) find the value of various sine(N)

11) discuss this is still the relationship between Opp and Hyp.

12) give labelled Opp and Hyp to tell me which angle is missing using trig tables.

...



Angel Grantham @TheNerdLP · 14h ...

13) find Hyp using fact families then inverse operations.

14) repeat for Cos

15) choosing cos or sine

16) seaicion making: cos, sine, pythag, area or perimeter qs to interweave.
No answers. (in y10)

17) repeat for tan

18) choose cos, sine or tan.



Angel Grantham @TheNerdLP · 14h ...

...

19) chaser qs: double trig qs, trig and pythag, trig then area, pythag then area, pythag then perimeter

20) teach a few exact values

Sin30, cos60, sin90, cos0

If you stayed with my rambles, thanks for reading.

The end.

Also in response to Q4 ...

Q4. What does your sequence of trigonometry lessons look like?

... the next few tweets brought various approaches and resources to attention:



Mary Pardoe @PardoeMary · 18h

Replying to @mcwardgow

An interesting article in MT214 ... here: atm.org.uk/write/mediaapl..
#mathscpdchat



TRIGONOMETRY WITH YEAR 8: Part 1

Jessica Steer, Maria Antioneta de Vila and James Eaton explore the teaching of trigonometry using a method developed by Jeremy Burke of Kings College.

A series of lessons was planned using an approach which looks at moving from a mathematical description of the topic, to a sequence plan, to a set of activities, which students can use to help them come to understand the topic. This is referred to as ‘MNO’ (Burke and Olley 2008). M is the map of the terrain to be covered, in this case the mathematical structure of the topic, connections and potential problems that students might encounter. A consideration of the ‘map’ might be inaugurated with the question, ‘what do we mean by...?’ In this case, what do we mean by ‘trigonometry’. N is the narrative, the sequencing of the lessons and activities – the story being told. O is ‘orientation’ the activities which will serve as strategies to facilitate students engagement with the topic.



Mary Pardoe @PardoeMary · 18h

Replying to @PardoeMary and @mcwardgow

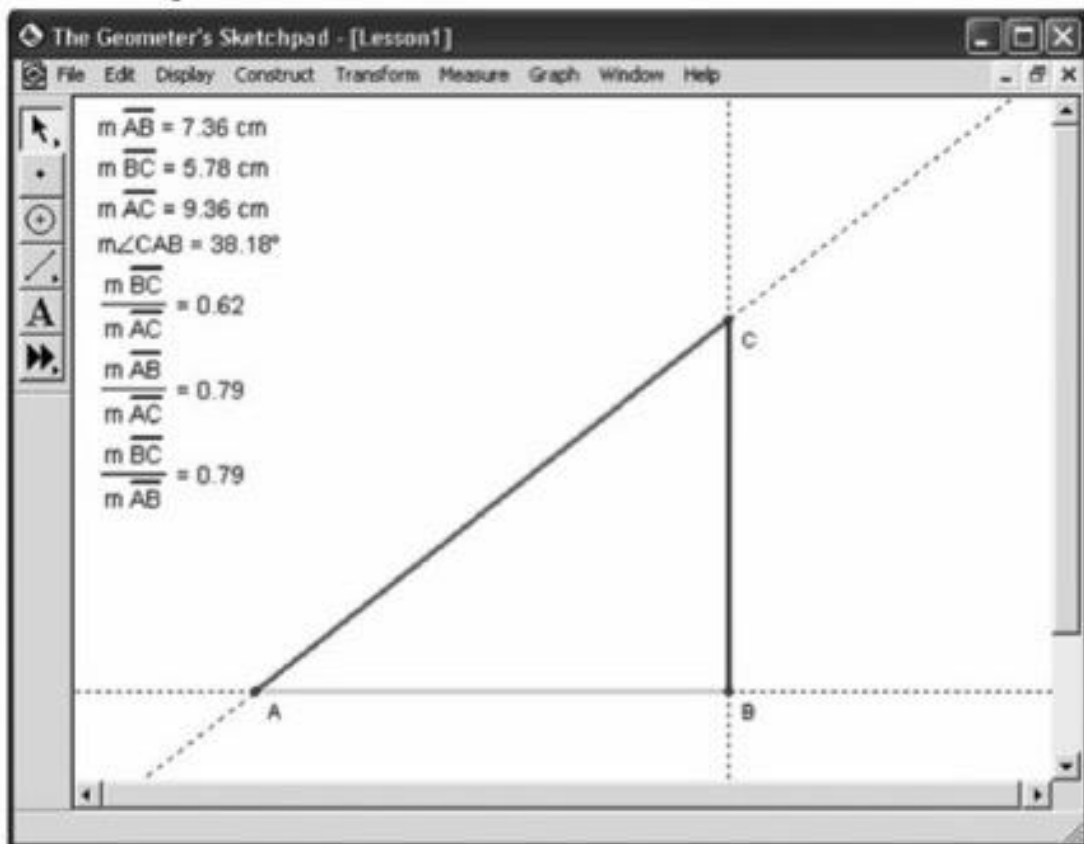
#mathscpdchat

... from the same MT article, here: atm.org.uk/write/mediaapl..



Lesson 1

Students build the dynamic system shown in *fig.1* from scratch using *GSP*. By manipulating point *C* they discover that as the angle changes, so too do the triangle ratios. Moving point *B* however, reveals that when the angle is fixed the ratios remain constant for any size of triangle. The angle is effectively a ‘ratio setter’.



(link provided above)



MIF, FSET, MCCT, NPQML @mathingabout · 17h

Great article! I often look at my old books for inspiration!

...

22. 30° and 60°.

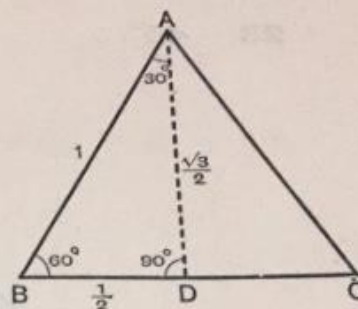
Let ABC be an equilateral triangle whose sides are the unit of length.

Draw AD perpendicular to BC .

Then by Geometry $BD = \frac{1}{2}$;

$$AD = \sqrt{AB^2 - BD^2} = \frac{\sqrt{3}}{2}$$

$\hat{A}BD = 60^\circ$ and $\hat{B}AD = 30^\circ$.



$$\sin 60^\circ = \frac{DA}{BA} = \frac{\sqrt{3}}{2} \quad \therefore \operatorname{cosec} 60^\circ = \frac{2}{\sqrt{3}}$$

$$\cos 60^\circ = \frac{BD}{BA} = \frac{1}{2} \quad \therefore \sec 60^\circ = 2$$

$$\tan 60^\circ = \frac{DA}{BD} = \sqrt{3} \quad \therefore \cot 60^\circ = \frac{1}{\sqrt{3}}$$

$$\sin 30^\circ = \frac{BD}{AB} = \frac{1}{2} \quad \therefore \operatorname{cosec} 30^\circ = 2$$

$$\cos 30^\circ = \frac{AD}{AB} = \frac{\sqrt{3}}{2} \quad \therefore \sec 30^\circ = \frac{2}{\sqrt{3}}$$

$$\tan 30^\circ = \frac{BD}{AD} = \frac{1}{\sqrt{3}} \quad \therefore \cot 30^\circ = \sqrt{3}.$$

The student should note that

$$\sin 60^\circ = \cos 30^\circ$$

$$\cos 60^\circ = \sin 30^\circ$$

$$\tan 60^\circ = \cot 30^\circ.$$

He will learn later that these properties always hold for complementary angles, *i.e.*, angles whose sum = 90° .



KarenB @brockway_karen · 18h

...

Replying to @mcwardgow

Just looked back at last year's y9 OneNote. Looks like I started with the SMILE card on investigating similar triangles, named the ratio with DrFrost resources and bit of practice, plotted Sine and Cosine using the big wheel SMILE card,... #mathscpdchat

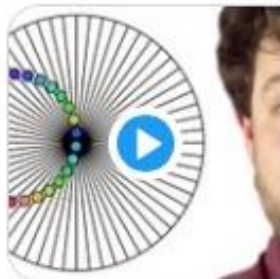


KarenB @brockway_karen · 18h

...

Replying to @brockway_karen and @mcwardgow

... did a bit of work on unit circle using @MEIMaths Deeper Maths resources and showed the pretty @numberphile video on beautiful trig youtu.be/snHKEpCv0Hk. Think I may have got them to work together to explain tan ...



youtube.com

Beautiful Trigonometry - Numberphile

Featuring Ben Sparks. Check out Brilliant (get 20% off their premium service): ...

(link provided above)



Alan Wood 3.5% ❤️ @alwoodwork · 18h

...

Replying to @brockway_karen and @mcwardgow

You have no idea how happy it makes me to think you are using SMILE resources. Thanks.



MIF, FSET, MCCT, NPQML @mathingabout · 18h

...

Replying to @mcwardgow

Basic introduction: 1) labelling sides, introduction to trigonometric relationships/calculator familiarisation 2) find the missing sides 3) determining the inverse operation to find θ 4) problem solving 5) 3D trig. 6) Pythagoras/trig combined 2D/3D

Alice also responded to her own Q4:

Q4. What does your sequence of trigonometry lessons look like?



Miss Ward-Gow @mcwardgow · 18h

...

Replying to @mcwardgow

There's a nice blog post here from @mathsjem resourceaholic.com/2014/10/trig.h... Couldn't tweet about trig without giving you a mention 😎 #mathscpdchat



Miss Ward-Gow @mcwardgow · 18h

...

And if you're looking for some CPD to do in your Y11 gained time, there's some here on exact trig values: resourceaholic.com/p/topics-in-de...
#mathscpdchat



Jo Morgan @mathsjem · 16h

...

Replying to @mcwardgow
Thanks! :)

(links provided above)



Suzanne Thornton @mathsThornton · 20h

...

Replying to @mcwardgow

What is this 'gain time' you talk of? We still have year 11 in school...and cover other teachers who are still doing lessons! Taught history/science and Chemistry so far this week!



Miss Ward-Gow @mcwardgow · 19h

...

It's not a myth 😊 We have Y11 in school and are doing the same, although it seems to have quietened down this week (maybe that's because the GCSE Maths exams have finished 😊) #mathscpdchat



Suzanne Thornton @mathsThornton · 19h

...

I'll believe you.... 🙄🙄

There were only a few replies to Alice's last (fifth) question:



Miss Ward-Gow @mcwardgow · 20h

...

Q5. (Which we've already started answering...) What are your favourite trigonometry resources? #mathscpdchat

Alice herself tweeted a suggestion ...



Miss Ward-Gow @mcwardgow · 20h

...

Replying to @mcwardgow

There are some nice questions on here from @draustinmaths 😊
#mathscpdchat



draustinmaths.com
PYTHAGORAS AND TRIGONOMETRY | Dr Austin
Maths

(link provided above)

... and Karen shared another example:



Karen @karenshancock · 20h

Replying to @mcwardgow

One of my new favourite "do now" questions #mathscpdchat

$$\textcircled{1} \quad \tan \theta = \frac{7}{5}$$



Work out one option for
the sides and angles
for this triangle

Finally, included at the end of this summary is a short conversation that was generated by a reply (posted during the chat) to a tweet from @mathscpdchat that had been posted on the day before the actual chat:



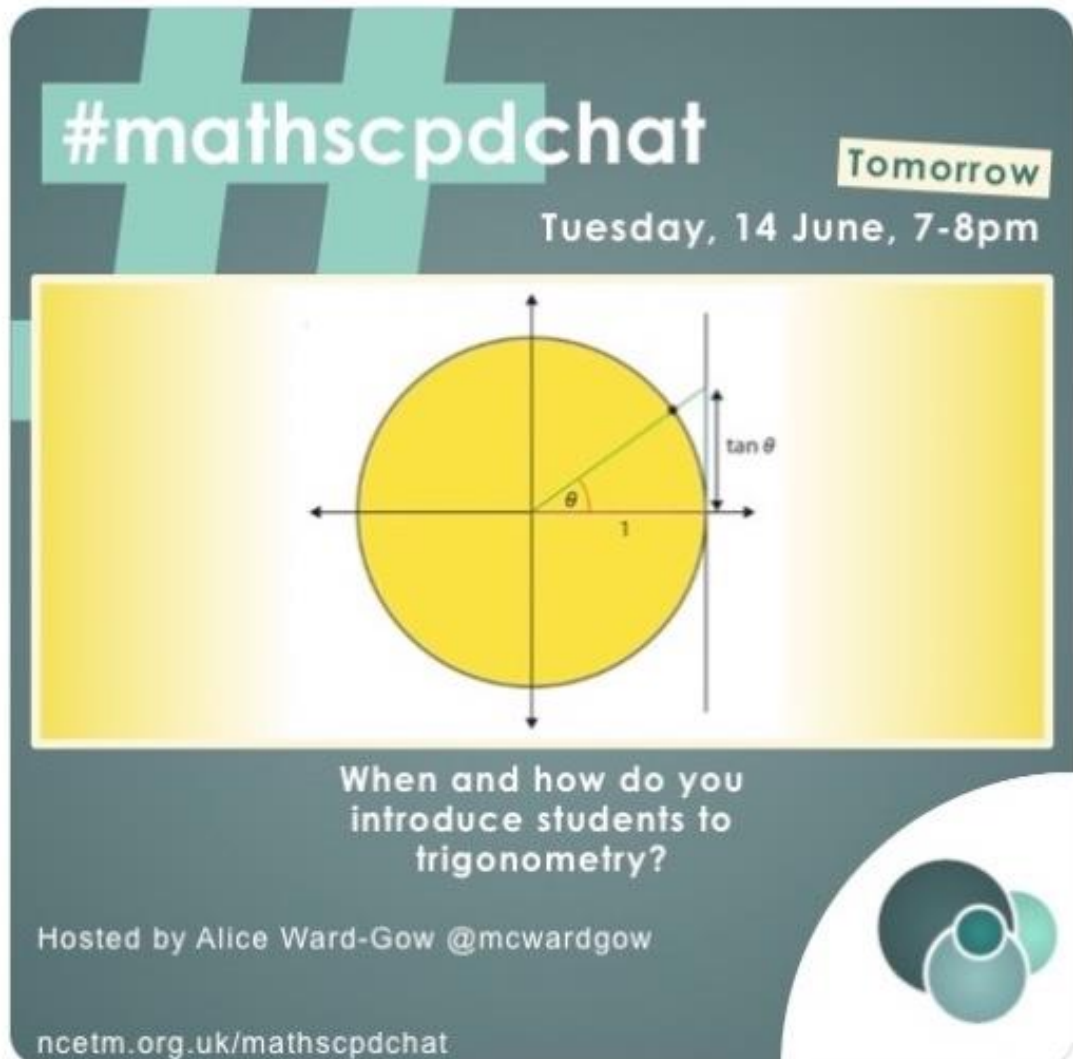
mathscpdchat @mathscpdchat · Jun 13



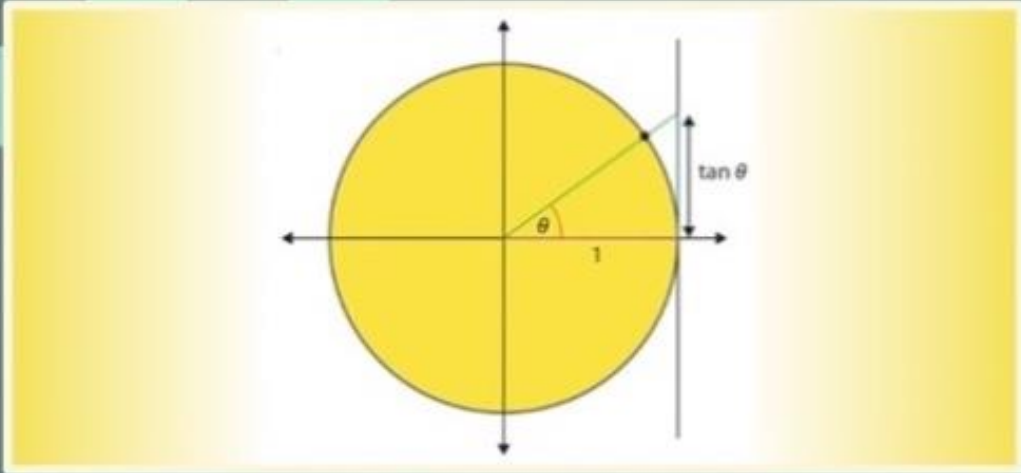
What are effective ways to introduce trigonometry?

Join [#mathscpdchat](#) TOMORROW at 7-8 pm to 'talk' and think about this!

Share with the host, Alice Ward-Gow, [@mcwardgow](#), and others, what has and hasn't worked for your students, and what you think might work ... and why.



#mathscpdchat **Tomorrow**
Tuesday, 14 June, 7-8pm



When and how do you introduce students to trigonometry?

Hosted by Alice Ward-Gow [@mcwardgow](#)

ncetm.org.uk/mathscpdchat



MIF, FSET, MCCT, NPQML @mathingabout · 16h



Replying to [@mathscpdchat](#) and [@mcwardgow](#)

Not being pedantic, but as lover of etymology I do talk about trigon (3 angles) and metron (measure) when introducing trigonometry. It follows on from Pythagoras. I introduce the 2 new sides and then the three basic functions and their relationship with each angle [#MathsCPDChat](#)



Miss Ward-Gow @mcwardgow · 16h

...

Replying to @mathingabout and @mathscpdchat

Nothing better than some Literacy 😎 do you teach trigonometry straight after Pythagoras? #mathscpdchat



MIF, FSET, MCCT, NPQML @mathingabout · 16h

...

Yes, definitely and surds preceding Pythagoras. #mathsCPDchat