Guidance for tutors

Outcome	SPT5	**Student can consistently:**	Use the sine rule to find missing sides and angles in non-right angled triangles

How the topic is examined

- Examined through test paper questions.
- It is most likely that these questions will appear on calculator papers.
- Sometimes students can be asked to find a missing side on a non-calculator paper. In this instance students will be given the value of the specific ratio or they could be one of the ratios that students are expected to know off by heart
- Students are likely to be provided with a diagram, but students may be expected to draw a diagram for a given question. It is important that students meet questions like this.

Prior knowledge

- Students should be confident
  - Solving basic equations (AEq1)
  - Rearranging simple formulae (AEx8)
  - Trigonometry (SPT2 and SPT3)
- In addition questions on this topic can have links to:
  - Cosine rule (SPT6)
  - Pythagoras's Theorem (SPT1)
  - Area and perimeter (SLAV1)

Suggested tuition approaches

- The sine rule is used for non-right angled triangles.
- To be able to use the sine rule you need to know at least one side opposite a known angle.
- Sides are labelled a, b and c and opposite angles are labelled A, B and C respectively. It is possible to use other letters.
- There are two versions of sine rule that people use:

Finding sides	Finding angles
$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$	$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$

Guidance for tutors

	• Students should only ever use two parts of the rule (the one you know and the one you want to find out $\frac{15}{\sin 32} = \frac{x}{\sin 85}$
	• The steps involved in solving sine rule problems are:
	  ○ Draw a triangle (if necessary) and label the sides and opposite angles.
	  ○ You only tend to use two parts of either rule.
	  ○ Substitute the numbers into the sine rule and solve the resulting equation
	  ○ Remember if finding an angle you will need to use sin^{-1}
	• It is common for students to have to use the sine and cosine rules together in one question.
	• Encourage students to show all their working and make sure they do not round answers too prematurely when working with sides and angles as this can lead to accuracy errors later on.
	• With sine rule there is a special ambiguous case that the higher attaining students should consider. The link below provides details of this http://www.softschools.com/math/calculus/the_ambiguous_case_of_the_law_of_sines/

Common errors and misconceptions	• Questions might ask students to find particular sides or angles (e.g. side AB or angle CDE). Some students may struggle to understand the side or angle it is referring to. • The triangle's angles may already be labelled with other letters. If this is the case students can stick with these letters or rename them A, B and C. The letters are not important as long a lowercase letter for the side is opposite uppercase letter for the angle. • Students can round prematurely and they end up getting the wrong answer (e.g. $\sin x = \frac{7}{19}$ students then will work out $7 \div 19 = 0.4$ and then find the inverse and get 23.6, when they should have done the inverse sine of a number to at least 6 decimal places. Advise students to get the best answer by doing $x = \sin^{-1}\left(\frac{7}{19}\right)$ • Ask students to double check the calculation they put into their calculator. • On most modern calculators it is important that students close the bracket after the fraction. • Students should check that the calculator they are using is in degrees (deg) mode.

Suggested resources	• Questions
	  ○ http://www.cimt.org.uk/projects/mepres/allgcse/bka4.pdf (pp 142 - 149)
	  ○ https://corbettmaths.files.wordpress.com/2013/02/sine-and-cosine-rule-pdf1.pdf
	• Past GCSE Questions

Guidance for tutors

	○ https://keshgcsemaths.files.wordpress.com/2013/11/104_sine-and-cosine-rules-area-of-triangles-using-c2bdab-sin-c.pdf • Video tutorial ○ http://corbettmaths.com/2013/05/03/sine-rule-missing-sides/