AS Mathematics Exam Questions by Topic
Chapter 6: Trigonometry

These questions are taken from the Specimen Exam materials and the real 2018 papers for the new syllabus AS and A-level mathematics courses and arranged by chapter of the textbooks by Goldie et al (available here: `https://amzn.to/39umfr5` and `https://amzn.to/3hE8kBL`). There are a mixture of questions from OCR A, OCR B (MEI), Edexcel and AQA. Although the style of questions varies a little across the exam boards the content of the syllabus is almost identical so these are suitable for students preparing for any exam board.

Free problem sets for all other chapters, as well as video solutions, full past papers and other content for GCSE and A-level maths can be found at:

`https://mathsaurus.com/`

OCR B MEI AS Sample Paper 2 Question 6:

6 **(i)** The graph of $y = 3\sin^2\theta$ for $0° \le \theta \le 360°$ is shown in Fig. 6. On the copy of Fig. 6, sketch the graph of $y = 2\cos\theta$ for $0° \le \theta \le 360°$. **[2]**

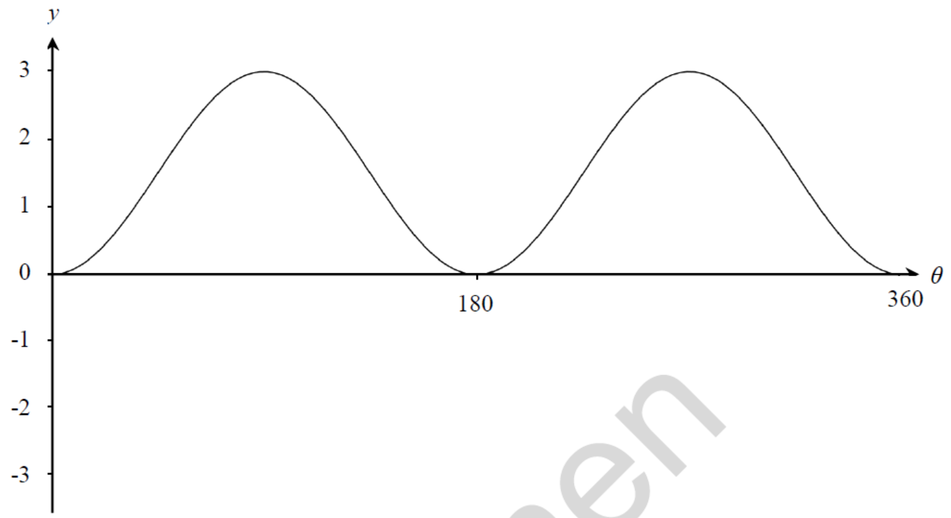

Fig. 6

(ii) **In this question you must show detailed reasoning.**

Determine the values of θ , $0° \le \theta \le 360°$, for which the two graphs cross. **[6]**

OCR B MEI AS Sample Paper 2 Question 12:

12 Given that $\arcsin x = \arccos y$, prove that $x^2 + y^2 = 1$. [Hint: Let $\arcsin x = \theta$] **[3]**

AQA AS 2018 Paper 1 Question 3:

3 State the interval for which $\sin x$ is a decreasing function for $0° \leq x \leq 360°$

[2 marks]

AQA AS 2018 Paper 2 Question 4:

4 Solve the equation $\tan^2 2\theta - 3 = 0$ giving all the solutions for $0° \leq \theta \leq 360°$

[4 marks]

AQA AS 2018 Paper 2 Question 9:

9 It is given that $\cos 15° = \frac{1}{2}\sqrt{2 + \sqrt{3}}$ and $\sin 15° = \frac{1}{2}\sqrt{2 - \sqrt{3}}$

Show that $\tan^2 15°$ can be written in the form $a + b\sqrt{3}$, where a and b are integers.

Fully justify your answer.

[3 marks]

AQA AS Sample Paper 2 Question 7:

7 Solve the equation

$$\sin\theta\tan\theta + 2\sin\theta = 3\cos\theta \quad \text{where} \quad \cos\theta \neq 0$$

Give **all** values of θ to the nearest degree in the interval $0° < \theta < 180°$

Fully justify your answer.

[5 marks]

Edexcel 2018 Paper 1 Question 8:

8. The depth of water, D metres, in a harbour on a particular day is modelled by the formula

$$D = 5 + 2\sin(30t)^\circ \qquad 0 \leqslant t < 24$$

where t is the number of hours after midnight.

A boat enters the harbour at 6:30 am and it takes 2 hours to load its cargo.
The boat requires the depth of water to be at least 3.8 metres before it can leave the harbour.

(a) Find the depth of the water in the harbour when the boat enters the harbour.

(1)

(b) Find, to the nearest minute, the earliest time the boat can leave the harbour.
(*Solutions based entirely on graphical or numerical methods are not acceptable.*)

(4)

Edexcel AS 2018 Paper 1 Question 12:

12. (a) Show that the equation

$$4\cos\theta - 1 = 2\sin\theta\tan\theta$$

can be written in the form

$$6\cos^2\theta - \cos\theta - 2 = 0$$

(4)

(b) Hence solve, for $0 \leqslant x < 90^\circ$

$$4\cos 3x - 1 = 2\sin 3x\tan 3x$$

giving your answers, where appropriate, to one decimal place.
(*Solutions based entirely on graphical or numerical methods are not acceptable.*)

(4)

Edexcel AS Sample Paper 1 Question 9:

9. Solve, for $360^\circ \leqslant x < 540^\circ$,

$$12\sin^2 x + 7\cos x - 13 = 0$$

Give your answers to one decimal place.

(*Solutions based entirely on graphical or numerical methods are not acceptable.*)

(5)

Edexcel Sample Paper 2 Question 2:

2. Some A level students were given the following question.

Solve, for $-90° < \theta < 90°$, the equation

$$\cos\theta = 2\sin\theta$$

The attempts of two of the students are shown below.

Student A	Student B
$\cos\theta = 2\sin\theta$	$\cos\theta = 2\sin\theta$
$\tan\theta = 2$	$\cos^2\theta = 4\sin^2\theta$
$\theta = 63.4°$	$1 - \sin^2\theta = 4\sin^2\theta$
	$\sin^2\theta = \frac{1}{5}$
	$\sin\theta = \pm\frac{1}{\sqrt{5}}$
	$\theta = \pm 26.6°$

(a) Identify an error made by student A.

(1)

Student B gives $\theta = -26.6°$ as one of the answers to $\cos\theta = 2\sin\theta$.

(b) (i) Explain why this answer is incorrect.

(ii) Explain how this incorrect answer arose.

(2)

OCR A AS 2018 Paper 1 Question 3:

3 **(i)** Solve the equation $\sin^2\theta = 0.25$ for $0° \leqslant \theta < 360°$. **[3]**

(ii) **In this question you must show detailed reasoning.**

Solve the equation $\tan 3\phi = \sqrt{3}$ for $0° \leqslant \phi < 90°$. **[3]**

OCR A AS 2018 Paper 2 Question 7:

7 **(i)** Show that the equation

$$2\sin x\tan x = \cos x + 5$$

can be expressed in the form

$$3\cos^2 x + 5\cos x - 2 = 0.$$ **[3]**

(ii) Hence solve the equation

$$2\sin 2\theta \tan 2\theta = \cos 2\theta + 5,$$

giving all values of θ between $0°$ and $180°$, correct to 1 decimal place. **[5]**

OCR A AS Sample Paper 2 Question 2:

2 **In this question you must show detailed reasoning.**

Solve the equation $2\cos^2 x = 2 - \sin x$ for $0° \leq x \leq 180°$. **[5]**

OCR B MEI AS 2018 Paper 1 Question 5:

5 **(i)** Sketch the graphs of $y = 4\cos x$ and $y = 2\sin x$ for $0° \leqslant x \leqslant 180°$ on the same axes. **[2]**

(ii) Find the exact coordinates of the point of intersection of these graphs, giving your answer in the form $(\arctan a, k\sqrt{b})$, where a and b are integers and k is rational. **[4]**

(iii) A student argues that without the condition $0° \leqslant x \leqslant 180°$ all the points of intersection of the graphs would occur at intervals of $360°$ because both $\sin x$ and $\cos x$ are periodic functions with this period. Comment on the validity of the student's argument. **[1]**

AQA AS Sample Paper 1 Question 5:

5 Jessica, a maths student, is asked by her teacher to solve the equation $\tan x = \sin x$, giving all solutions in the range $0° \le x \le 360°$

The steps of Jessica's working are shown below.

$$\tan x = \sin x$$

		$\tan x = \sin x$	
Step 1	$\Rightarrow$	$\dfrac{\sin x}{\cos x} = \sin x$	Write $\tan x$ as $\dfrac{\sin x}{\cos x}$
Step 2	$\Rightarrow$	$\sin x = \sin x \cos x$	Multiply by $\cos x$
Step 3	$\Rightarrow$	$1 = \cos x$	Cancel $\sin x$
	$\Rightarrow$	$x = 0°$ or $360°$	

The teacher tells Jessica that she has not found all the solutions because of a mistake.

Explain why Jessica's method is not correct.

[2 marks]