



# Edexcel International A Level (IAL) Maths: Pure 3



Your notes

## Further Trigonometric Equations

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- \* Strategy for Further Trigonometric Equations



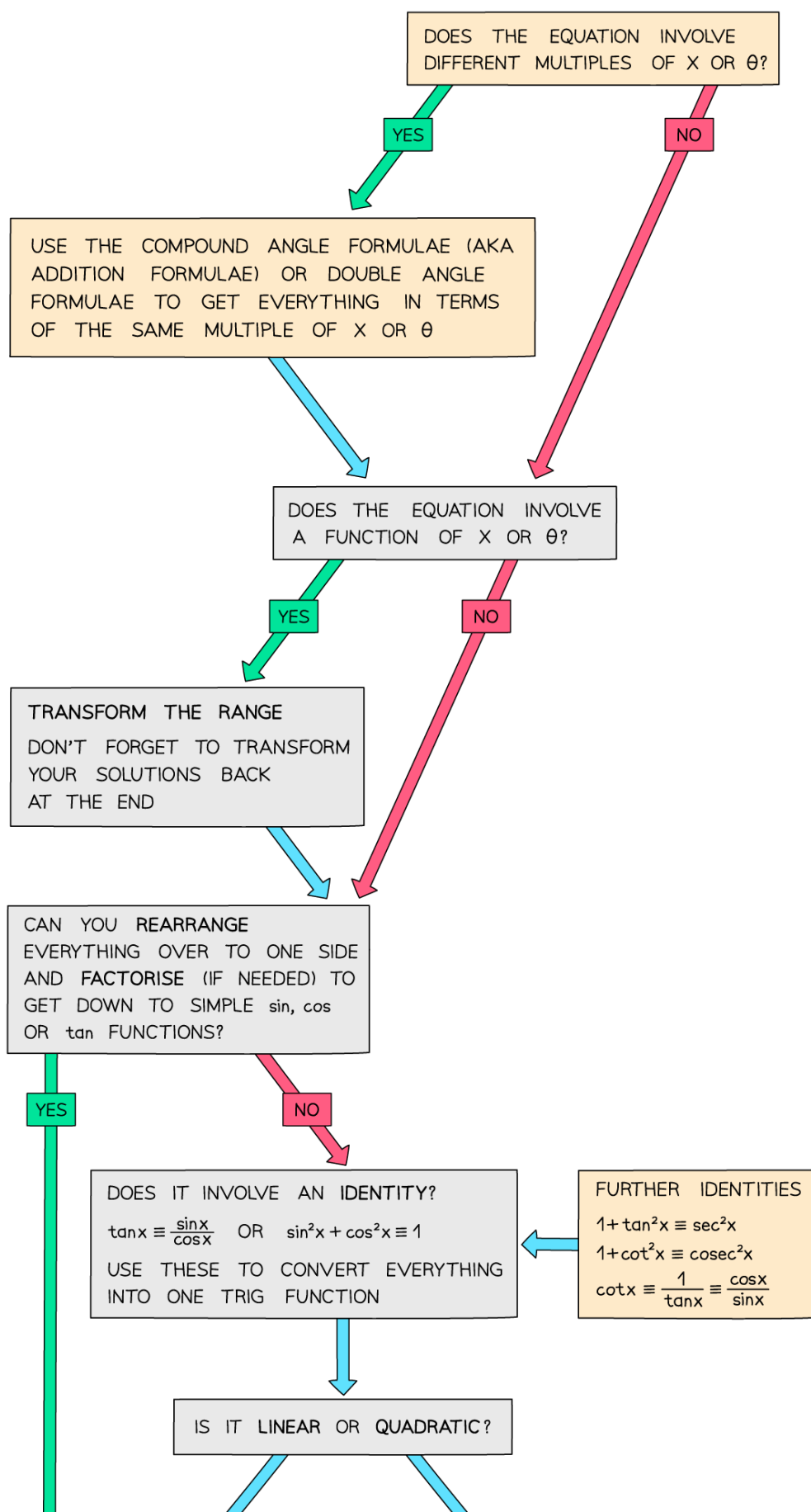
# Strategy for further trigonometric equations

## How do I solve harder trig equations?

- You can solve harder trig equations, such as those involving **reciprocal** and **inverse** functions in a variety of different ways
  - Using **further trigonometric identities**
  - Using **compound or double angle** formulas
  - Factorising **quadratic** trig equations
  - Then finding all solutions using **CAST** or **sketching graphs**
- The final rearranged equation you solve will involve **sin**, **cos** or **tan** – don't try to solve an equation with **cosec**, **sec**, or **cot** directly
- If you're having trouble solving a trig equation, this flowchart might help:

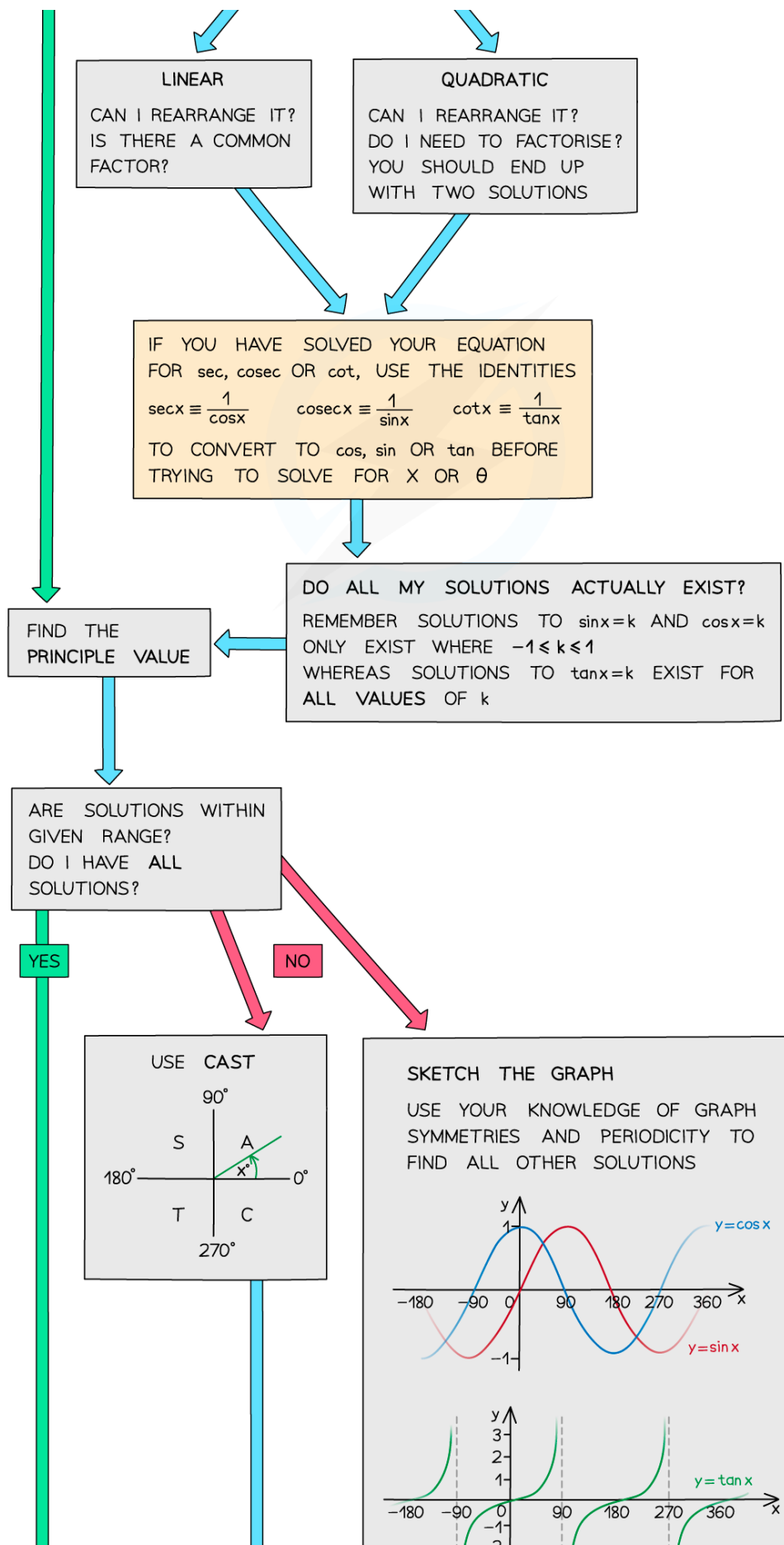


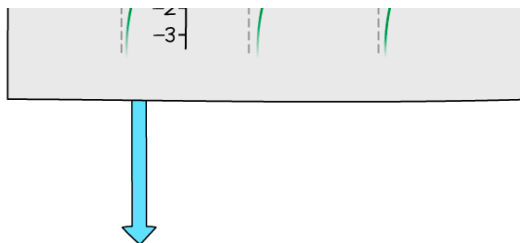
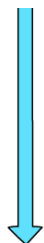
Your notes





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CHECK WHETHER YOU HAVE FOUND ALL SOLUTIONS AND THAT THEY ARE WITHIN THE GIVEN RANGE  
(DON'T FORGET TO TRANSFORM YOUR SOLUTIONS BACK AT THE END IF THEY WERE FROM A TRANSFORMED RANGE)

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### Examiner Tips and Tricks

- Try to use identities and formulas to reduce the equation into its simplest terms.
- Don't forget to check the function range and ensure you have included all possible solutions.
- If the question involves a function of  $x$  or  $\theta$  ensure you transform the range first (and ensure you transform your solutions back again at the end!).



### Worked Example



Your notes



Find the solutions for the equation

$$(1 + \cot^2 2\theta)(5\cos^2 \theta - 1) = \cot^2 2\theta$$

in the interval  $0 \leq \theta < 360^\circ$ .

$$5\cos^2 \theta - 1 = \frac{\cot^2 2\theta}{1 + \cot^2 2\theta}$$

$$5\left(\frac{1}{2}\cos 2\theta + \frac{1}{2}\right) - 1 = \frac{\cot^2 2\theta}{\operatorname{cosec}^2 2\theta}$$

USE TRIG IDENTITIES  
AND FORMULAE

$$1 + \cot^2 A = \operatorname{cosec}^2 A$$

$$\cos 2A \equiv 2\cos^2 A - 1$$

(DOUBLE ANGLE FORMULA)

$$\frac{1}{2}(5\cos 2\theta + 3) = \frac{\frac{\cos^2 2\theta}{\sin^2 2\theta}}{\frac{1}{\sin^2 2\theta}} = \cos^2 2\theta$$

$$\cot A \equiv \frac{\cos A}{\sin A} \quad \operatorname{cosec} A \equiv \frac{1}{\sin A}$$

$$5\cos 2\theta + 3 = 2\cos^2 2\theta$$

$$2\cos^2 2\theta - 5\cos 2\theta - 3 = 0$$

THIS QUADRATIC IN  $\cos 2\theta$  IS WHAT  
WE WILL ACTUALLY SOLVE!

FACTORISE

$$(2\cos 2\theta + 1)(\cos 2\theta - 3) = 0$$

$$\text{SO } \cos 2\theta = -\frac{1}{2} \quad \text{OR} \quad \cos 2\theta = 3$$

BUT  $\cos 2\theta = 3$  HAS NO SOLUTIONS

$$-1 \leq \cos 2\theta \leq 1$$

SO WE WANT SOLUTIONS TO  $\cos 2\theta = -\frac{1}{2}$

IN THE RANGE  $0 \leq 2\theta < 720^\circ$

TRANSFORM THE RANGE

$$2\theta = \cos^{-1}\left(-\frac{1}{2}\right) = 120^\circ$$

FIND PRINCIPAL VALUE

$$\text{OR } 2\theta = 360 - 120 = 240^\circ$$

USE CAST TO FIND OTHER  
VALUE IN RANGE  $0 \leq 2\theta < 360^\circ$

$$\text{SO } 2\theta = 120^\circ, 240^\circ, 480^\circ, 600^\circ$$

ADD  $360^\circ$  TO FIND ADDITIONAL  
ANSWERS IN RANGE  $360 \leq 2\theta < 720^\circ$

$$A = 60^\circ, 120^\circ, 240^\circ, 300^\circ$$

CONVERT BACK TO  $\theta$

0 = 00, 120, 240, 300

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