

Name	Date started	Target end date
------	--------------	-----------------

## GCE A LEVEL – PURE MATHEMATICS B QUESTION PACK

0975-01 (Legacy C3) · New spec Unit 3 Topic 6 · A2 unit, 35% of A-level, 120 marks, 2h 30min paper

# REVISE

.wales

## MATHEMATICS – PURE B · TRIGONOMETRY - SEC, COSEC, COT

### *Trigonometry (sec, cosec, cot identities)*

*Every reciprocal trig identity question from the legacy WJEC C3 papers (June 2011 – June 2017) for new-spec A2 Unit 3 trigonometry*

LEGACY 2008 SPECIFICATION

**Estimated time for entire question pack: ~1 hours 39 minutes**

*Derived from the legacy C3/C4 paper's pace of ~1.25 min/mark (79 marks over 10 questions).*

*You are advised to **not** attempt to complete all of this in one sitting.*

### ABOUT THIS QUESTION PACK

This is a **comprehensive practice question pack**, not a single mock paper. It contains questions from the legacy WJEC C3 and C4 papers (2008 modular spec) that maps onto new-spec A2 Unit 3 Topic 6 (2.3.5).

Questions are ordered chronologically.

### INSTRUCTIONS

Use black ink or black ball-point pen. Show all working – method marks are awarded for clear setup.

*A calculator is allowed (except where specified by individual questions). The WJEC Formula Booklet may be referred to.*

*All question content is © WJEC CBAC Ltd. and reproduced for revision purposes.*

*For Examiner's use only*

Q	Source	Max	Mark	Q	Source	Max	Mark
1	Jun 11 Q2	6		6	Jan 14 Q2	8	
2	Jan 12 Q2	8		7	Jun 14 Q2	6	
3	Jun 12 Q2	8		8	Jun 15 Q2	7	
4	Jan 13 Q2	9		9	Jun 16 Q2	9	
5	Jun 13 Q2	9		10	Jun 17 Q2	9	
				<b>Total</b>		<b>79</b>	

# Trigonometry (sec, cosec, cot identities) – what the new spec asks

WJEC GCE A Level Mathematics (from 2017) · Unit 3: Pure Mathematics B · Topic 2.3.5.

## Reciprocal identities 2.3.5

- $\sec \theta = \frac{1}{\cos \theta}$ ,  $\csc \theta = \frac{1}{\sin \theta}$ ,  $\cot \theta = \frac{\cos \theta}{\sin \theta}$ .
- $1 + \tan^2 \theta = \sec^2 \theta$ .
- $1 + \cot^2 \theta = \csc^2 \theta$ .

## Solving sec/cosec equations 2.3.5

- Convert everything to a single ratio using the identities above.
- Substitute  $u = \sec \theta$  (or  $\tan$ ) to get a polynomial.
- Discard roots outside the principal range; find all solutions in the given interval.

# Trigonometry - sec, cosec, cot in one page

Quick-reference notes – revisit before each section. Don't use during questions.

## The three reciprocal ratios

$$\sec \theta = 1 / \cos \theta.$$

$$\csc \theta = 1 / \sin \theta.$$

$$\cot \theta = 1 / \tan \theta = \cos \theta / \sin \theta.$$

## Pythagorean identities

$$\sin^2 \theta + \cos^2 \theta = 1.$$

$$1 + \tan^2 \theta = \sec^2 \theta.$$

$$1 + \cot^2 \theta = \csc^2 \theta.$$

## Solving strategy

Convert everything to sec and tan (or csc and cot).

Substitute  $u = \sec \theta$  to reduce to a polynomial.

Discard  $u$  values outside the principal range.

## Principal values

$$\sec \theta \geq 1 \text{ or } \sec \theta \leq -1.$$

$$\csc \theta \geq 1 \text{ or } \csc \theta \leq -1.$$

$\cot \theta$  can take any real value.

## Quadratic structure

Equations like  $a \sec^2 \theta + b \sec \theta + c = 0$ :

solve as quadratic in  $\sec \theta$ .

Then find all  $\theta$  in the range.

## No-solution case

If  $|\sec \theta| < 1$  in your solution: no real  $\theta$  exists.

State this explicitly – don't leave blank.

# SECTION T6

*Trigonometry (sec, cosec, cot identities)*

Questions 1-10 · 79 marks

2. Find all values of  $\theta$  in the range  $0^\circ \leq \theta \leq 360^\circ$  satisfying

$$2\operatorname{cosec}^2\theta + 3\cot^2\theta + 4\operatorname{cosec}\theta = 9.$$

[6]

2. (a) Show, by counter-example, that the statement

$$\sin(\theta + \phi) \equiv \sin\theta + \sin\phi$$

is false.

[2]

- (b) Find all values of  $\theta$  in the range  $0^\circ \leq \theta \leq 360^\circ$  satisfying

$$\sec^2\theta + 8 = 4\tan^2\theta + 5\sec\theta.$$

[6]

2. (a) Show, by counter-example, that the statement

$$\text{'If } \cos \theta = \cos \phi \text{ then } \sin \theta = \sin \phi \text{'}$$

is false.

[2]

- (b) Find all values of  $\theta$  in the range  $0^\circ \leq \theta \leq 360^\circ$  satisfying

$$13 \tan^2 \theta = 5 \sec^2 \theta + 6 \tan \theta.$$

[6]

2. (a) (i) Show, by counter-example, that the statement
- $$\cos^3\theta \equiv 1 - \sin^3\theta$$
- is false.
- (ii) **Write down** a value of  $\theta$  which does satisfy the equation
- $$\cos^3\theta = 1 - \sin^3\theta. \quad [3]$$
- (b) Find all values of  $\theta$  in the range  $0^\circ \leq \theta \leq 360^\circ$  satisfying
- $$4\operatorname{cosec}^2\theta = 9 - 8\cot\theta. \quad [6]$$

2. (a) Find all values of  $\theta$  in the range  $0^\circ \leq \theta \leq 360^\circ$  satisfying

$$4\cot^2\theta - 8 = 2 \operatorname{cosec}^2\theta - 5 \operatorname{cosec}\theta. \quad [6]$$

- (b) Find all values of  $\phi$  in the range  $0^\circ \leq \phi \leq 360^\circ$  satisfying

$$\sec\phi + 2\tan\phi = 0. \quad [3]$$

2. (a) Show, by counter-example, that the statement

‘If  $x$  is an acute angle then  $\sin(x + 30^\circ) > \sin x$ ’

is false.

[2]

- (b) Find all values of  $\theta$  in the range  $0^\circ \leq \theta \leq 360^\circ$  satisfying

$$15 \operatorname{cosec}^2 \theta + 2 \cot \theta = 23.$$

[6]

2. Find all values of  $\theta$  in the range  $0^\circ \leq \theta \leq 360^\circ$  satisfying

$$8 \tan^2 \theta - 5 \sec^2 \theta = 7 + 4 \sec \theta.$$

[6]

2. (a) Find all values of  $\theta$  in the range  $0^\circ \leq \theta \leq 360^\circ$  satisfying

$$7 \operatorname{cosec}^2 \theta - 4 \cot^2 \theta = 16 + 5 \operatorname{cosec} \theta. \quad [6]$$

- (b) Without carrying out any calculations, explain why there are no values of  $\phi$  in the range  $0^\circ \leq \phi \leq 90^\circ$  which satisfy the equation

$$4 \sec \phi + 3 \operatorname{cosec} \phi = 6. \quad [1]$$

2. (a) Find all values of  $\theta$  in the range  $0^\circ \leq \theta \leq 360^\circ$  satisfying

$$3 \operatorname{cosec} \theta (\operatorname{cosec} \theta - 1) = 5 \cot^2 \theta - 9. \quad [6]$$

- (b) Find all values of  $\phi$  in the range  $0^\circ \leq \phi \leq 360^\circ$  satisfying

$$2 \operatorname{cosec} \phi + 3 \sec \phi = 0. \quad [3]$$

2. (a) Find all values of  $\theta$  in the range  $0^\circ \leq \theta \leq 360^\circ$  satisfying

$$6 \tan^2 \theta - 6 = 4 \sec^2 \theta + 5 \sec \theta. \quad [6]$$

- (b) Find all values of  $\phi$  in the range  $0^\circ \leq \phi \leq 360^\circ$  satisfying

$$3 \sec \phi + 5 \tan \phi = 0. \quad [3]$$

## **END OF TRIGONOMETRY - SEC, COSEC, COT PACK**

Source: WJEC C3 + C4 (2008 modular spec) · 2011–2017  
Curated for WJEC Maths 2017 spec A2 Unit 3 – Topic 6 (2.3.5)

© WJEC CBAC Ltd. Pack layout © revise.wales for revision purposes only.