MATHS FORENSICS
CASE FILE WORKSHEET · GCSE

MF-CF-GEO-TRIGGRAPHS
GCSE HIGHER · ABOUT 50 MINUTES

CASE FILE SERIES · GRAPHS

TRIG GRAPHS

Sine, cosine and tangent repeat for ever. Secure their shapes, extend to finding every angle in a range, then master transformations and trig equations.

SECURING · GRADES 4–5 | EXTENDING · GRADES 6–7 | MASTERY · GRADES 8–9

Name _____ Class _____ Date _____

CASE BRIEFING

WHAT YOU NEED TO KNOW

y = sin x and **y = cos x** are waves between −1 and 1 that repeat every 360°. **y = tan x** repeats every 180° and has asymptotes at 90°, 270°...

Your calculator gives **one** angle. The graph's symmetry gives the others: for sin, the second angle is 180° − *x*; for cos, it's 360° − *x*; for tan, add 180°.

1. Sketch the graph for the range you're given.
2. Use your calculator (or exact values) for the first angle.
3. Use the symmetry of the graph to find every other angle in the range.
4. Check each answer by substituting it back.

WORKED EXAMPLE **Solve sin *x* = −0.5 for 0° ≤ *x* ≤ 360°.**

SOLUTION

1 $\sin^{-1}(-0.5) = -30°$, which is outside the range.

2 $\sin 30° = 0.5$, and the sine graph is negative between 180° and 360°.

3 By symmetry the angles are 180° + 30° and 360° − 30°.

4 Check: $\sin 210° = -0.5$ ✓ and $\sin 330° = -0.5$ ✓

✓ ***x* = 210° or 330°**

KNOWLEDGE CHECK

Use your investigative skills to solve each case. Show full working: the method marks are where most students lose out.

Securing
The shapes of y = sin x, cos x and tan x, and reading values.
Secured ☐

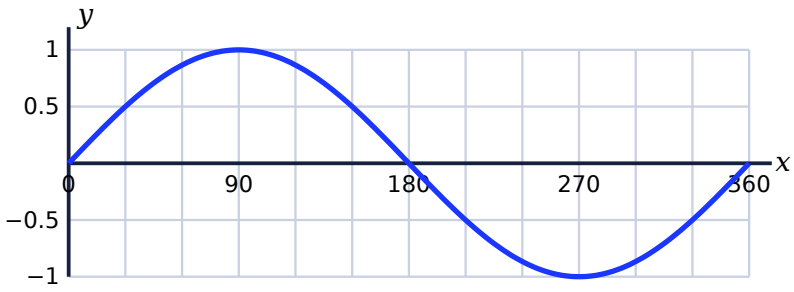
Extending
Using symmetry to find a second angle, simple transformations, and tampered evidence.
Secured ☐

Mastery
Trig equations with two solutions, and stretched or shifted graphs.
Secured ☐

SECURING

The method, step by step. Show every line.

1 The graph of y = sin *x* is shown. Write down the value of sin 90°. [1]

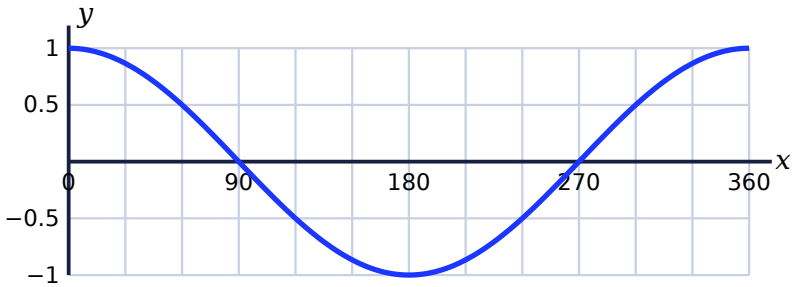


Answer _____

2 Use the graph to solve sin *x* = 0.5 for 0° ≤ *x* ≤ 360°. [2]

x = _____

3 The graph of y = cos *x* is shown. Where does it cross the *x*-axis between 0° and 360°? [2]



x = _____

4 Write down the maximum value of y = cos *x*, and the values of *x* between 0° and 360° where it happens. [2]

Max ___ at _____

5 How often does the graph of y = tan *x* repeat? [1]

° _____

EXTENDING

A step is hidden, or there's a context to unpick. One piece of tampered evidence.

6 sin 40° ≈ 0.643. Find another angle between 0° and 360° with the same sine. [2]

° _____

7 cos 70° ≈ 0.342. Find the two angles between 0° and 360° for which cos *x* = −0.342. [3]

x = _____

8 Describe how the graph of y = sin *x* + 2 is related to the graph of y = sin *x*. [2]

9 Write down the maximum and minimum values of y = 3 cos *x*. [2]

Max ___ Min _____

10 Tom solved cos x = 0.5 for 0° ≤ x ≤ 360°. Find his mistake. [2]

TAMPERED EVIDENCE · FIND THE MISTAKE

$\cos^{-1}(0.5) = 60°$, so $x = 60°$

x = _____

FORENSIC TIP Always sketch the graph across the whole range. Count how many times it crosses your line, then find that many answers.

MASTERY

No hints. Plan before you calculate.

11 Solve 2 sin x + 1 = 0 for 0° ≤ x ≤ 360°. [3]

x = _____

12 The graph of y = sin(x + 90°) is the same as the graph of another trig function. Which one? Explain. [2]

y = _____

13 The graph of y = a sin(bx) has a maximum value of 4 and repeats every 180°. Find a and b. [3]

a = ___ b = _____

14 Solve tan x = √3 for 0° ≤ x ≤ 360°. [2]

x = _____

15 Find the coordinates of the maximum point of y = 1 − 2 cos x for 0° < x < 360°. [3]

(___ , ___) _____

KNOWLEDGE CHECK: SOLUTIONS

Check your method as well as your answer. In the exam, an answer with no working usually earns the final mark at most.

Q1 SECURING

✓ **1**

Q2 SECURING

Draw across at 0.5.

✓ **x = 30° and 150°**

Q3 SECURING

✓ **90° and 270°**

Q4 SECURING

✓ **1, at 0° and 360°**

Q5 SECURING

✓ **Every 180°**

Q6 EXTENDING

180° − 40°.

✓ **140°**

Q7 EXTENDING

180° − 70° and 180° + 70°.

✓ **110° and 250°**

Q8 EXTENDING

Every point moves up 2.

✓ **A translation 2 units up**

Q9 EXTENDING

✓ **Max 3, min −3**

Q10 EXTENDING

The cos graph is at 0.5 twice in the range. He found only one.

✓ **x = 60° and x = 300°**

Mastery solutions are in the Lab. Grades 8 and 9 are won on method, so a bare answer won't tell you much. Photograph or write your Mastery working in **Forensic Marking** and get it marked mark by mark, with the full solution and the mistake behind every lost mark. Your first marked question is free.

lab.mathsforensics.com/written/?sheet=CF-GEO-TRIGGRAPHS

Mark your evidence

Level	Marks	My score	Secured? (every mark)
Securing	8		☐
Extending	11		☐
Mastery	13		☐

R · Reading
Misread or missed part of the question

M · Method
Didn't know how to do it

A · Accuracy
Knew how, slipped in the working

Write R, M or A next to every mark you lost. Mostly R or A? The fix is technique, not more practice of the topic.

CASE CLOSED: TRIG GRAPHS

In this case file you've learned to:

- Sketch y = sin x, y = cos x and y = tan x, with their key points.
- Use symmetry to find every solution in a range.
- Describe translations and stretches of trig graphs.
- Solve trig equations after rearranging.
- Find a and b from a graph's height and period.

Because every case comes down to one principle: numbers don't lie.

YOUR NEXT ASSIGNMENT

Practise every GCSE topic in the Lab

New numbers every time, feedback that names the mistake behind each wrong answer, and handwritten working marked like an examiner. Start free.

https://www.mathsforensics.com/the-lab