Trigonometry: Double Angles 1ii

A Level
C C C

Part A The form $a\sin^2\theta + b\sin\theta + c = 0$

Express the equation $(\text{cosec}\,\theta)(3\cos 2\theta + 7) + 11 = 0$ in the form $a\sin^2\theta + b\sin\theta + c = 0$, where a, b, and c are constants and $a > 0$.

Enter the values of a, b and c:

$a =$ ☐

$b =$ ☐

$c =$ ☐

Part B Solve

Hence solve, for $-180^\circ < \theta < 180^\circ$, the equation $(\text{cosec}\,\theta)(3\cos 2\theta + 7) + 11 = 0$.

Give your answers in degrees, to three significant figures.

Enter your answers in order from lowest value of θ to highest.

☐ (lowest value)

☐ (highest value)

Physics. You work it out.

Trigonometry: Double Angles 2ii

A Level

C C C

Part A $\sin$ Double Angle

Write down the identity expressing $\sin 2\theta$ in terms of $\sin\theta$ and $\cos\theta$.

The following symbols may be useful: `theta`

Part B $\sin 2\alpha$

Given that $\sin\alpha = \frac{1}{4}$ and α is acute, find the exact value of $\sin 2\alpha$.

The following symbols may be useful: `alpha`

Part C Solve

Solve in degrees, for $0^\circ < \beta < 90^\circ$, the equation $5\sin 2\beta \sec\beta = 3$, giving your answer in degrees to three significant figures.

Gameboard:
STEM SMART Single Maths 31 - Compound and Double-Angle Formulae

Trigonometry: Combined Angles 5i

A Level

The value of $\tan 10^\circ$ is denoted by p. Find, in terms of p, the value of:

Part A $\tan 55^\circ$

$\tan 55^\circ$

The following symbols may be useful: `p`

Part B $\tan 5^\circ$

$\tan 5^\circ$

The following symbols may be useful: `p`

Part C $\tan\theta$

$\tan\theta$, where θ satisfies the equation $3\sin\left(\theta + 10^\circ\right) = 7\cos\left(\theta - 10^\circ\right)$.

The following symbols may be useful: `p, theta`

Gameboard:

STEM SMART Single Maths 31 - Compound and Double-Angle Formulae

Functions: Reciprocal Trig 2i

A Level

It is given that A and B are angles such that

$$\sec^2 A - \tan A = 13 \quad \text{and} \quad \sin B \sec^2 B = 27 \cos B \operatorname{cosec}^2 B.$$

Part A Largest value of $\tan(A - B)$

Find the largest possible exact value of $\tan(A - B)$.

The following symbols may be useful: `A`, `B`

Part B Smallest value of $\tan(A - B)$

Give the smallest possible value of $\tan(A - B)$.

The following symbols may be useful: `A`, `B`

Gameboard:
STEM SMART Single Maths 31 - Compound and Double-Angle Formulae

Trigonometry and R-Form 1

A Level

C C C

Part A $5\cos x + 12\sin x$

Express $5\cos x + 12\sin x$ in the form $R\cos(x - \alpha)$, where $R > 0$ and $0° < \alpha < 90°$.

State the value of R:

$R =$ ☐

Give the value of α in degrees, to three significant figures:

$\alpha =$ ☐

Part B Transformations

Give details of a pair of transformations which transform the curve $y = \cos x$ to the curve $y = 5\cos x + 12\sin x$.

Available items

- Stretch parallel to the x-axis by a factor of $\frac{1}{R}$.
- Stretch parallel to the y-axis by a factor of $\frac{1}{R}$.
- Stretch parallel to the y-axis by a factor of R.
- Translation in the positive y direction by α.
- Translation in the negative y direction by α.
- Stretch parallel to the x-axis by a factor of R.
- Translation in the positive x direction by α.
- Translation in the negative x direction by α.

Part C Solve

Solve, for $0° < x < 360°$, the equation $5\cos x + 12\sin x = 2$, giving your answers in degrees correct to the nearest $0.1°$.

Enter your answers in order from lowest value of θ to highest.

[ ] (lowest value)

[ ] (highest value)

Gameboard:
STEM SMART Single Maths 31 - Compound and Double-Angle Formulae

Trigonometry: Combined Angles 3i

A Level

In **Figure 1**, ABCD represents a rectangular table with sides $3.5\,\text{m}$ and $1.5\,\text{m}$. It has been turned so it wedges in a passage of width $2.5\,\text{m}$.

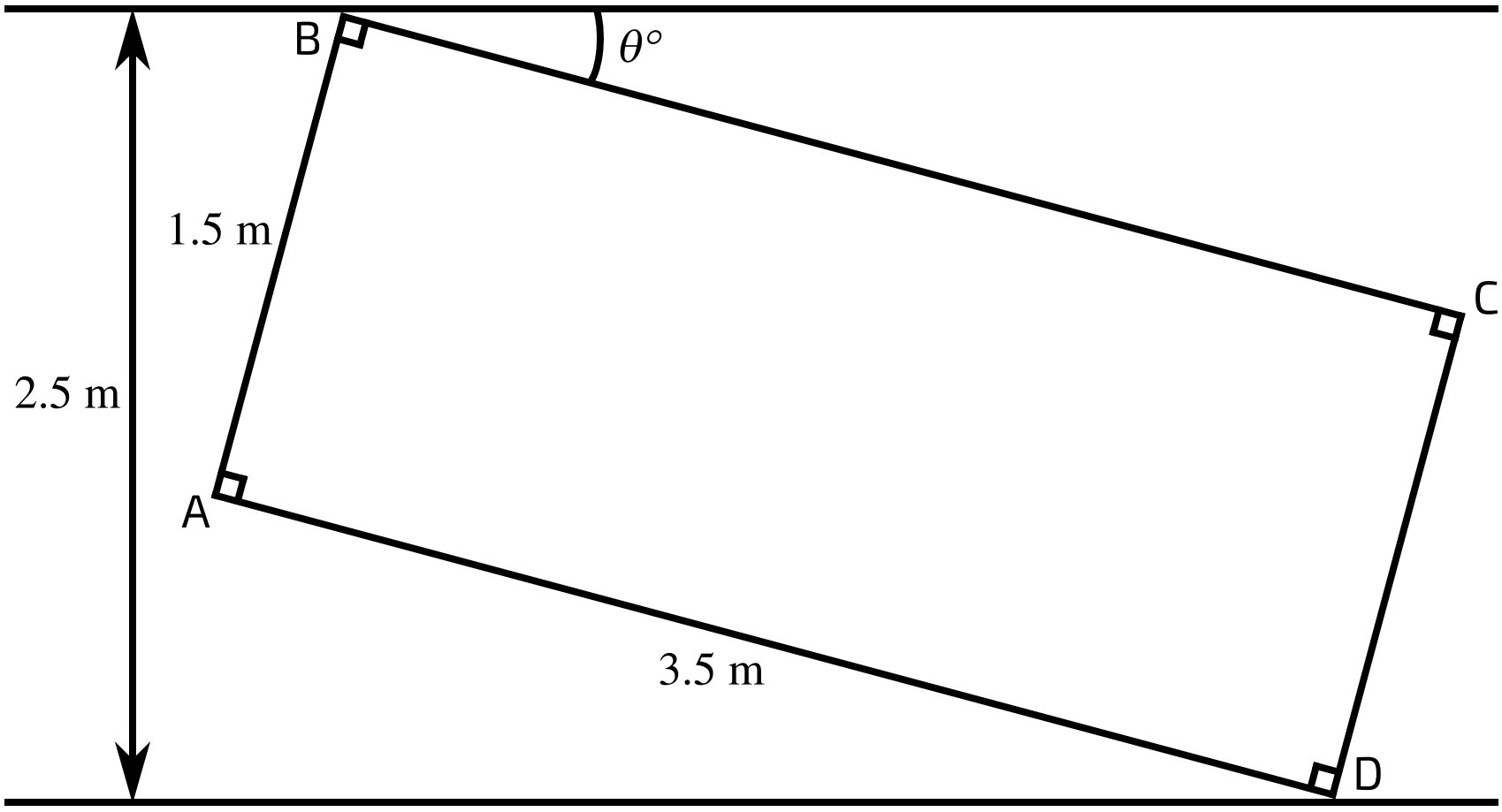

Figure 1: The rectangular table ABCD.

Part A Value of $7\sin\theta^\circ + 3\cos\theta^\circ$

Given that θ is the acute angle between the longer side and the passage, as shown in the diagram, find the exact value of $7\sin\theta + 3\cos\theta$.

The following symbols may be useful: `cos(), sin(), tan(), theta`

Part B The form $R\sin\left(\theta^\circ + \alpha^\circ\right)$

Express $7\sin\theta + 3\cos\theta$ in the form $R\sin\left(\theta + \alpha\right)$, where $R > 0$ and $0^\circ < \alpha < 90^\circ$.

Give the exact value of R.

The following symbols may be useful: R

Give the value of α to 3 significant figures.

Part C Find θ

Find θ, to 3 significant figures.

Gameboard:

STEM SMART Single Maths 31 - Compound and Double-Angle Formulae

Wave Interference

A Level

C C C

Pre-Uni Maths for Sciences H4.10

Two waves

$$\psi_1 = A\cos\left(2\pi f t - \left(\frac{2\pi}{\lambda}\right)x + \phi\right)$$

and

$$\psi_2 = A\cos\left(2\pi f t - \left(\frac{2\pi}{\lambda}\right)x - \phi\right)$$

interfere, such that the resultant wave is given by $\psi = \psi_1 + \psi_2$. Express ψ as the product of two trigonometric functions.

The following symbols may be useful: `A, f, lambda, phi, pi, t, x`

Created for isaacphysics.org by Julia Riley.