Angles and Projection

A Level Further A

Part A Finding $\cos\phi$ and $\tan\phi$

Find, without using a calculator, $\cos\phi$ and $\tan\phi$ given that $\sin\phi = \frac{5}{13}$ and that ϕ is an obtuse angle.

- $\cos\phi = -\frac{5}{12}$, $\tan\phi = -\frac{12}{13}$
- $\cos\phi = -\frac{12}{13}$, $\tan\phi = \frac{5}{12}$
- $\cos\phi = \frac{5}{12}$, $\tan\phi = \frac{12}{13}$
- $\cos\phi = \frac{12}{13}$, $\tan\phi = \frac{5}{12}$
- $\cos\phi = -\frac{12}{13}$, $\tan\phi = -\frac{5}{12}$

Part B Value of θ

A particle is projected into the air with a speed of $50\,\mathrm{m\,s^{-1}}$ at an angle of θ to the horizontal. It lands a horizontal distance of $250\,\mathrm{m}$ away after $6.4\,\mathrm{s}$. Assuming that it travels at a constant velocity in the horizontal direction find the value of θ.

Created for isaacphysics.org by Julia Riley.

Exact Values of Angles 1

GCSE C C C A Level P P P

For the range $0 \leq \theta \leq 360°$, write down all the values of θ which have the following: (a) $\sin\theta = \sqrt{3}/2$, (b) $\sin\theta = -1/2$.

- (a) $60°$, $120°$, (b) $210°$, $330°$
- (a) $30°$, $150°$, (b) $240°$, $300°$
- (a) $30°$, $150°$, (b) $210°$, $330°$
- (a) $60°$, $300°$, (b) $150°$, $330°$
- (a) $60°$, $120°$, (b) $240°$, $300°$

Created for isaacphysics.org by Julia Riley.

Addition of Forces 2

A Level C C C Further A P P P

Forces $\underline{\boldsymbol{F_1}} = \begin{pmatrix} F_{1x} \\ F_{1y} \end{pmatrix}$ and $\underline{\boldsymbol{F_2}} = \begin{pmatrix} F_{2x} \\ F_{2y} \end{pmatrix}$ act in the $x-y$ plane, having magnitudes F_1 and F_2 and making angles of θ and ϕ with the positive x axis respectively. Find expressions for (a) F_{1x}, F_{1y}, F_{2x} and F_{2y}, (b) the magnitude of the vector sum of the two forces and (c) the angle the vector sum of the two forces makes with the x axis.

Part A The components of the forces

Write down an expression in terms of F_1 and θ for F_{1x}.

The following symbols may be useful: `F_1, arccos(), arcsin(), arctan(), cos(), sin(), tan(), theta`

Write down an expression in terms of F_1 and θ for F_{1y}.

The following symbols may be useful: `F_1, theta`

Write down an expression in terms of F_2 and ϕ for F_{2x}.

The following symbols may be useful: `F_2, phi`

Write down an expression in terms of F_2 and ϕ for F_{2y}.

The following symbols may be useful: `F_2, phi`

Part B The magnitude

Consider the sums of the components of the two forces in the x-direction and the y-direction. Hence find an expression for the magnitude of the vector sum of the two forces.

The following symbols may be useful: `F_1x, F_1y, F_2x, F_2y`

Part C The angle

Consider the sums of the components of the two forces in the x-direction and in the y-direction. Hence find an expression for the angle the vector sum of the two forces makes to the x-axis,.

The following symbols may be useful: `F_1x, F_1y, F_2x, F_2y, arccos(), arcsin(), arctan(), cos(), sin(), tan()`

Created for isaacphysics.org by Julia Riley.

Values of Angles 1

GCSE C C C A Level P P P

For the range $-180^\circ \leq \alpha \leq 180^\circ$, consider all the values of α which satisfy $\sin\alpha = 0.2$.

Part A Values of α

How many values of α, satisfying the equation, are in this range?

Part B Largest value of α

What is the largest positive value of α satisfying the equation in this range? Give your answer to 3.s.f.

Created for isaacphysics.org by Julia Riley.

Simplify Trig Expressions

A Level Further A

Simplify the following trigonometric expressions.

Part A $1/(\cos^2 t - 1)$

Simplify the following expression to give a single trigonometric function:

$$\frac{1}{\cos^2 t - 1}$$

The following symbols may be useful: `cos()`, `cosec()`, `cot()`, `sec()`, `sin()`, `t`, `tan()`

Part B $(1 - \sin^2 x)/(\cos^2 t - 1)$

Simplify the following expression to give a single trigonometric function:

$$\frac{1 - \sin^2 x}{\cos x}$$

The following symbols may be useful: `cos()`, `cosec()`, `cot()`, `sec()`, `sin()`, `tan()`, `x`

Part C $\sin\alpha\cos\alpha - 1/(\cos^2 t - 1)$

Simplify the following expression to give a single trigonometric function:

$$\sin\alpha\tan\alpha - \frac{1}{\cos\alpha}$$

The following symbols may be useful: `alpha`, `cos()`, `cosec()`, `cot()`, `sec()`, `sin()`, `tan()`

Part D $\tan w - \frac{\cos w}{1-\sin w}$

Simplify the following expression to give a single trigonometric function:

$$\tan w - \frac{\cos w}{1 - \sin w}$$

The following symbols may be useful: `cos()`, `cosec()`, `cot()`, `sec()`, `sin()`, `tan()`, `w`

Created for isaacphysics.org by Julia Riley.