6.2) Horizontal and vertical components

Worked example

A particle is projected from a point on a horizontal plane with an initial velocity of $39\ ms^{-1}$ at an angle α above the horizontal, where $\tan\alpha = \frac{5}{12}$.

a) Find the horizontal and vertical components of the initial velocity

b) Express the initial velocity as a vector in terms of $\boldsymbol{i}$ and $\boldsymbol{j}$

Your turn

A particle is projected from a point on a horizontal plane with an initial velocity of $40\ ms^{-1}$ at an angle α above the horizontal, where $\tan\alpha = \frac{3}{4}$.

a) Find the horizontal and vertical components of the initial velocity

b) Express the initial velocity as a vector in terms of $\boldsymbol{i}$ and $\boldsymbol{j}$

a) $u_x = 32\ ms^{-1}$; $u_y = 24\ ms^{-1}$

b) $(32\boldsymbol{i} + 24\boldsymbol{j})\ ms^{-1}$

Worked example

A particle is projected with velocity $\boldsymbol{U} = (2\boldsymbol{i} + 7\boldsymbol{j})\ ms^{-1}$ where $\boldsymbol{i}$ and $\boldsymbol{j}$ are the unit vectors in the horizontal and vertical directions respectively.
Find the initial speed of the particle and its angle of projection.

Your turn

A particle is projected with velocity $\boldsymbol{U} = (3\boldsymbol{i} + 5\boldsymbol{j})\ ms^{-1}$ where $\boldsymbol{i}$ and $\boldsymbol{j}$ are the unit vectors in the horizontal and vertical directions respectively.
Find the initial speed of the particle and its angle of projection.

$5.8\ ms^{-1}$ (2 sf) at an angle of 59° (2 sf) above the horizontal

Worked example

A particle is projected with velocity $\boldsymbol{U} = (5k\boldsymbol{i} +$

Your turn

A particle is projected with velocity $\boldsymbol{U} = (3k\boldsymbol{i} +$

a) 66.8° above the horizontal
b) $k = \pm 4$