INKMATHS FLASHCARDS

Further Mechanics 2
circles, balance and oscillation

13 cards · fronts and backs

Print double-sided, flipping on the long edge, and each answer lands behind its question. Cut along the card borders.

Definitions in precise wording, the standard results the formulae booklet does not print, a check-yourself question per topic, and the slips that lose marks. The same cards run on the website with spaced-repetition scheduling, at inkmaths.co.uk/flashcards.

STANDARD RESULT

Circular motion:

v = ?, a = ?

FURTHER MECHANICS 2: CIRCLES, BALANCE AND OSCILLATION

STANDARD RESULT

Banked track:

no friction needed when tan θ = ?

FURTHER MECHANICS 2: CIRCLES, BALANCE AND OSCILLATION

DEFINITION

Define: Completing a vertical circle.

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STANDARD RESULT

Centre of mass:

discrete: mean x = ?

FURTHER MECHANICS 2: CIRCLES, BALANCE AND OSCILLATION

DEFINITION

Define: Lamina against framework.

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STANDARD RESULT

Centre of mass by integration:

lamina: mean x = ?, mean y = ?

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STANDARD RESULT

Topple or slide:

topples when tan θ = ?, slides when tan θ = ?

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DEFINITION

Define: Choosing the acceleration.

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STANDARD RESULT

$(v^2)/(rg)$: the mass cancels

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STANDARD RESULT

$r\omega$, $r\omega^2 = (v^2)/(r)$ towards the centre

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STANDARD RESULT

$(\Sigma\, m_i x_i)/(\Sigma\, m_i)$: a mass-weighted average

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DEFINITION

On a string the tension must stay non-negative, so $v^2 \geq gr$ at the top and $u^2 \geq 5gr$ at the bottom. On a rod, which can push, the particle need only arrive at the top with $v > 0$.

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STANDARD RESULT

$(\int xy\, dx)/(\int y\, dx)$, $(\int (1)/(2) y^2\, dx)/(\int y\, dx)$

FURTHER MECHANICS 2: CIRCLES, BALANCE AND OSCILLATION

DEFINITION

A uniform lamina weights each piece by its area at its own centroid, with a negative area for anything removed. A framework weights each rod by its length at its own midpoint, so the two differ for the same shape.

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DEFINITION

Use $v\, dv/dx$ when the force depends on position, dv/dt when it depends on time. The constant-acceleration equations are not available at all, whatever average is taken.

FURTHER MECHANICS 2: CIRCLES, BALANCE AND OSCILLATION

STANDARD RESULT

$(a)/(h)$, μ: the smaller angle happens first

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STANDARD RESULT

Simple harmonic motion:

condition? $T = ?$

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STANDARD RESULT

Speed in simple harmonic motion:

$v^2 = ?$

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STANDARD RESULT

Spring oscillation:

$\omega^2 = ?$

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SPOT THE ERROR

Say what is wrong with this claim:

A particle going round a circle at constant speed has no acceleration.

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CHECK YOURSELF

A lamina is suspended freely from a corner. Where does its centre of mass end up?

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STANDARD RESULT

$\omega^2(a^2 - x^2)$: fastest at the centre

FURTHER MECHANICS 2: CIRCLES, BALANCE AND OSCILLATION

STANDARD RESULT

acceleration = $-\omega^2 x$, $(2\pi)/(\omega)$ whatever the amplitude

FURTHER MECHANICS 2: CIRCLES, BALANCE AND OSCILLATION

SPOT THE ERROR

Velocity is a vector and its direction is changing continually, so there is an acceleration of $r\omega^2$ directed at the centre. Some real force has to supply it.

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STANDARD RESULT

$(\lambda)/(ml)$: centred on the equilibrium position

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CHECK YOURSELF

Vertically below the point of suspension, because otherwise the weight would have a moment about the pivot and the lamina would turn.

FURTHER MECHANICS 2: CIRCLES, BALANCE AND OSCILLATION