

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:

$$\mathbf{v = ?, a = ?}$$

FURTHER MECHANICS 2: CIRCLES, BALANCE AND OSCILLATION

STANDARD RESULT

Banked track:

$$\mathbf{no\ friction\ needed\ when\ \tan\ \theta = ?}$$

FURTHER MECHANICS 2: CIRCLES, BALANCE AND OSCILLATION

DEFINITION

Define: Completing a vertical circle.

FURTHER MECHANICS 2: CIRCLES, BALANCE AND OSCILLATION

STANDARD RESULT

Centre of mass:

$$\mathbf{discrete: mean\ x = ?}$$

FURTHER MECHANICS 2: CIRCLES, BALANCE AND OSCILLATION

DEFINITION

Define: Lamina against framework.

FURTHER MECHANICS 2: CIRCLES, BALANCE AND OSCILLATION

STANDARD RESULT

Centre of mass by integration:

$$\mathbf{lamina: mean\ x = ?, mean\ y = ?}$$

FURTHER MECHANICS 2: CIRCLES, BALANCE AND OSCILLATION

STANDARD RESULT

Topple or slide:

$$\mathbf{topples\ when\ \tan\ \theta = ?, slides\ when\ \tan\ \theta = ?}$$

FURTHER MECHANICS 2: CIRCLES, BALANCE AND OSCILLATION

DEFINITION

Define: Choosing the acceleration.

FURTHER MECHANICS 2: CIRCLES, BALANCE AND OSCILLATION

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

FURTHER MECHANICS 2: CIRCLES, BALANCE AND OSCILLATION

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

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STANDARD RESULT **$(\sum m_i x_i)/(\sum m_i)$: a mass-weighted average**

FURTHER MECHANICS 2: CIRCLES, BALANCE AND OSCILLATION

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 $v > 0$.

FURTHER MECHANICS 2: CIRCLES, BALANCE AND OSCILLATION

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.

FURTHER MECHANICS 2: CIRCLES, BALANCE AND OSCILLATION

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 **$(a)/(h), \mu$: the smaller angle happens first**

FURTHER MECHANICS 2: CIRCLES, BALANCE AND OSCILLATION

STANDARD RESULT

Simple harmonic motion:

condition? $T = ?$

FURTHER MECHANICS 2: CIRCLES, BALANCE AND OSCILLATION

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.

FURTHER MECHANICS 2: CIRCLES, BALANCE AND OSCILLATION

CHECK YOURSELF

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

FURTHER MECHANICS 2: CIRCLES, BALANCE AND OSCILLATION

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.

FURTHER MECHANICS 2: CIRCLES, BALANCE AND OSCILLATION

STANDARD RESULT

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

FURTHER MECHANICS 2: CIRCLES, BALANCE AND OSCILLATION

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