Rods, Wire Frameworks and Wires of Different Densities

Specification: AQA 7367: ME1, ME2 · Edexcel 9FM0: FM2 Centres of mass of plane figures (frameworks, circular arcs)

HOMEWORK Consolidation

1 A uniform wire is bent at B into AB = 5 cm and BC = 10 cm, at right angles. Find the distances of the centre of mass from BC and from BA.

AQA 7367 ME2 · Edexcel FM2 (frameworks)

2 A framework OAB is made from uniform wire, with O at the origin, A at $(9, 0)$ and B at $(0, 12)$. Find its centre of mass.

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3 Uniform rods AB (2 m, 3 kg) and BC (3 m, 2 kg) are joined in a straight line ABC. Find the distance of the centre of mass from A.

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4 A framework has three rods: OA, length 6 m and mass 3 kg m^{-1}, along the x-axis from the origin O; AB and OC, each of length 2 m and mass 1 kg m^{-1}, in the positive y direction. Find the centre of mass.

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5 A uniform wire is bent into a semicircular arc of radius 9 cm. Find the distance of its centre of mass from the centre.

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6 A uniform wire is bent into a circular arc of radius 10 cm that subtends $60°$ at its centre. Find the distance of its centre of mass from the centre.

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7 A uniform wire forms a semicircular arc of radius 4 cm and the diameter joining its ends. Find the distance of the centre of mass from the diameter.

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8 A uniform wire of mass 0.5 kg m^{-1} is bent at B into AB = 4 m and BC = 8 m, at right angles. A particle of mass 3 kg is attached at A. Find the distances of the centre of mass from BC and from BA.

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9 A uniform wire is bent at B into AB = 6 m and BC = L m, at right angles. The centre of mass is 1 m from BC. Find L.

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10 Uniform rods AB and BC are joined in a straight line ABC. AB has length 2 m and mass 3 kg m^{-1}; BC has length 4 m and mass λ kg m^{-1}. The centre of mass is at B. Find λ.

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11 *AQA-style*. A framework is made from uniform wire of mass 0.01 kg per cm. It has rods OA, AB, BO and OC, where O is the origin, A is $(40, 0)$, B is $(40, 30)$ and C is $(0, 30)$, in cm.

(a) Find the coordinates of the centre of mass of the framework. [4 marks]

(b) A particle of mass m kg is attached at C. The centre of mass now lies on OB. Find m. [3 marks]

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12 *Edexcel-style*. A uniform semicircular arc of wire has radius r and mass λ per unit length. Its ends are joined by a straight uniform rod of mass 2λ per unit length.

(a) Show that the centre of mass is a distance $2r/(\pi + 4)$ from the rod. [4 marks]

(b) Find this distance when $r = 7$ cm. [2 marks]

AQA 7367 ME2 (formula booklet: circular arc) · Edexcel FM2 (circular arc) · Edexcel-style