Instructions for the Examinations Officer

Pearson Edexcel International A level Mathematics Mechanics Paper 1 WME01
Date: 10 January 2025

There is an error on page 2 of this question paper. A Clarification Notice is enclosed below.

At the start of the examination the Clarification Notice must be read aloud to the candidates taking the examination.

All other questions on the paper have been printed correctly.

Clarification Notice

There is an error on page 2, Question 1b.

Please amend your question paper as follows:

The question currently reads:

• The resultant of the four forces acts in **the direction of** the vector (7i +2j).

It should read:

• The resultant of the four forces acts in **a direction that is parallel to** the vector (7i +2j).

1. A particle of mass 2.5 kg moves on a smooth horizontal plane under the action of three horizontal forces, $\mathbf{F}_1$, $\mathbf{F}_2$ and $\mathbf{F}_3$, where

$$\mathbf{F}_1 = (6\mathbf{i} + 8\mathbf{j})\,\text{N}$$

$$\mathbf{F}_2 = (-16\mathbf{i} + 2\mathbf{j})\,\text{N}$$

$$\mathbf{F}_3 = (-2\mathbf{i} + 8\mathbf{j})\,\text{N}$$

(a) Find the magnitude of the acceleration of the particle.

(4)

A fourth force, $\mathbf{F}_4 = (p\mathbf{i} + p\mathbf{j})\,\text{N}$, where p is a constant, is added.

The resultant of the four forces acts in the direction of the vector $(7\mathbf{i} + 2\mathbf{j})$.

(b) Find the value of p.

(4)

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[*In this question* **i** *and* **j** *are horizontal perpendicular unit vectors.*]

2. A particle P rests in equilibrium on a smooth horizontal plane.

A system of **three** forces, $\mathbf{F}_1$ N, $\mathbf{F}_2$ N and $\mathbf{F}_3$ N where

$$\mathbf{F}_1 = (3c\mathbf{i} + 4c\mathbf{j})$$
$$\mathbf{F}_2 = (-14\mathbf{i} + 7\mathbf{j})$$

is applied to P.

Given that P remains in equilibrium,

(a) find $\mathbf{F}_3$ in terms of c, **i** and **j**.

(2)

The force $\mathbf{F}_3$ is **removed** from the system.

Given that $c = 2$

(b) find the size of the angle between the direction of **i** and the direction of the resultant force acting on P.

(4)

The mass of P is m kg.

Given that the magnitude of the acceleration of P is $8.5\,\text{m s}^{-2}$

(c) find the value of m.

(4)

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2. [*In this question* **i** *and* **j** *are perpendicular unit vectors in a horizontal plane.*]

Three forces, $(-10\mathbf{i} + a\mathbf{j})$ N, $(b\mathbf{i} - 5\mathbf{j})$ N and $(2a\mathbf{i} + 7\mathbf{j})$ N, where a and b are constants, act on a particle P of mass 3 kg. The acceleration of P is $(3\mathbf{i} + 4\mathbf{j})$ m s^{-2}

(a) Find the value of a and the value of b.

(5)

At time $t = 0$ seconds the speed of P is u m s^{-1} and at time $t = 4$ seconds the velocity of P is $(20\mathbf{i} + 20\mathbf{j})$ m s^{-1}

(b) Find the value of u.

(4)

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7. A force **F** is given by **F** = (9**i** + 13**j**) N.

(a) Find the size of the angle between the direction of **F** and the vector **j**.

(3)

The force **F** is the resultant of two forces **P** and **Q**. The line of action of **P** is parallel to the vector (2**i** – **j**). The line of action of **Q** is parallel to the vector (**i** + 3**j**).

(b) Find, in terms of **i** and **j**,

(i) the force **P**,

(ii) the force **Q**.

(9)

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5. Two forces $\mathbf{F}_1$ and $\mathbf{F}_2$ act on a particle. The resultant of the two forces is $\mathbf{R}$.

Given that $\mathbf{R}$ has the same direction as the vector $(3\mathbf{i} - 2\mathbf{j})$,

(a) find the size of the angle between $\mathbf{R}$ and the vector $\mathbf{j}$.

(2)

Given that $\mathbf{F}_1 = (a\mathbf{i} + 3\mathbf{j})$ N and $\mathbf{F}_2 = (-4\mathbf{i} + b\mathbf{j})$ N,

(b) show that $2a + 3b + 1 = 0$

(4)

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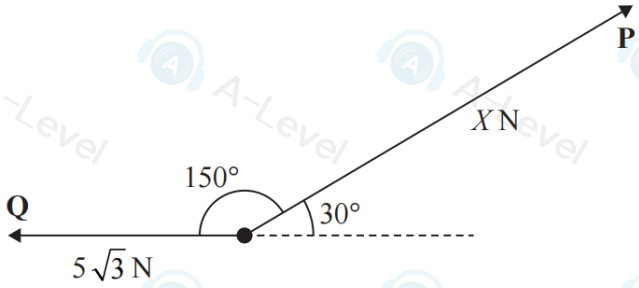

Figure 3

Figure 3 shows two horizontal forces **P** and **Q** acting on a particle.

The angle between the direction of **P** and the direction of **Q** is 150°

Force **P** has magnitude X newtons.

Force **Q** has magnitude $5\sqrt{3}$ N.

The resultant of **P** and **Q** has magnitude $\sqrt{129}$ N.

Find

(i) the value of X.

(ii) the angle between **Q** and the resultant, giving your answer to the nearest degree.

(8)

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7. Two forces, **F** and **G**, act on a particle. The force **F** has magnitude 4 N and acts in a direction with a bearing of 120° and the force **G** has magnitude 6 N and acts due north.

Given that $\mathbf{P} = 2\mathbf{F} + \mathbf{G}$, find

(i) the magnitude of **P**

(ii) the direction of **P**, giving your answer as a bearing to the nearest degree.

(7)

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5. Two forces, $\mathbf{F}_1$ and $\mathbf{F}_2$, act on a particle A.

$\mathbf{F}_1 = (2\mathbf{i} - 3\mathbf{j})$ N and $\mathbf{F}_2 = (p\mathbf{i} + q\mathbf{j})$ N, where p and q are constants.

Given that the resultant of $\mathbf{F}_1$ and $\mathbf{F}_2$ is parallel to $(\mathbf{i} + 2\mathbf{j})$,

(a) show that $2p - q + 7 = 0$

(5)

Given that $q = 11$ and that the mass of A is 2 kg, and that $\mathbf{F}_1$ and $\mathbf{F}_2$ are the only forces acting on A,

(b) find the magnitude of the acceleration of A.

(5)

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1. Three forces $\mathbf{F}_1$, $\mathbf{F}_2$ and $\mathbf{F}_3$ act on a particle P.

$\mathbf{F}_1 = (2\mathbf{i} + 3a\mathbf{j})$ N; $\mathbf{F}_2 = (2a\mathbf{i} + b\mathbf{j})$ N; $\mathbf{F}_3 = (b\mathbf{i} + 4\mathbf{j})$ N.

The particle P is in equilibrium under the action of these forces.

Find the value of a and the value of b.

(6)

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4. Two forces $\mathbf{F}_1$ and $\mathbf{F}_2$ act on a particle. The force $\mathbf{F}_1$ has magnitude 8 N and acts due east. The resultant of $\mathbf{F}_1$ and $\mathbf{F}_2$ is a force of magnitude 14 N acting in a direction whose bearing is 120°.

Find

(i) the magnitude of $\mathbf{F}_2$,

(4)

(ii) the direction of $\mathbf{F}_2$, giving your answer as a bearing to the nearest degree.

(5)

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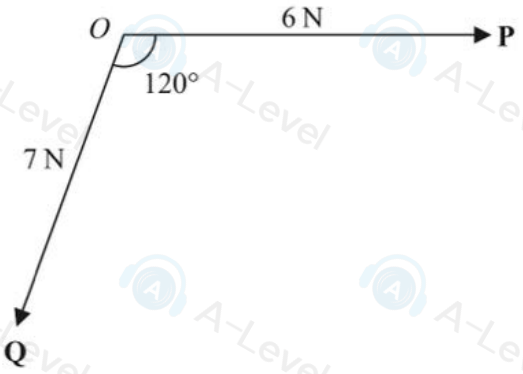

Figure 1

Two forces **P** and **Q** act on a particle at a point O. Force **P** has magnitude 6 N and force **Q** has magnitude 7 N. The angle between the line of action of **P** and the line of action of **Q** is 120°, as shown in Figure 1.

The resultant of **P** and **Q** is **R**.

Find

(i) the magnitude of **R**,

(ii) the angle between the line of action of **R** and the line of action of **P**.

(8)

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