AQA – Forces and Newton's laws – A2 Mathematics P2

1. June/2020/Paper_2/No.11

A number of forces act on a particle such that the resultant force is $\begin{pmatrix} 6 \\ -3 \end{pmatrix}$ N

One of the forces acting on the particle is $\begin{pmatrix} 8 \\ -5 \end{pmatrix}$ N

Calculate the total of the other forces acting on the particle.

Circle your answer.

[1 mark]

$\begin{pmatrix} 2 \\ -2 \end{pmatrix}$ N $\begin{pmatrix} 14 \\ -8 \end{pmatrix}$ N $\begin{pmatrix} -2 \\ 2 \end{pmatrix}$ N $\begin{pmatrix} -14 \\ 8 \end{pmatrix}$ N

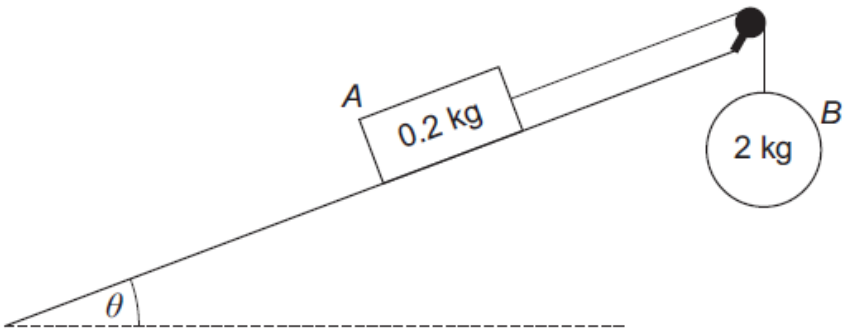
2. June/2020/Paper_2/No.18

Block A, of mass 0.2 kg, lies at rest on a rough plane.

The plane is inclined at an angle θ to the horizontal, such that $\tan\theta = \frac{7}{24}$

A light inextensible string is attached to A and runs parallel to the line of greatest slope until it passes over a smooth fixed pulley at the top of the slope.

The other end of this string is attached to particle B, of mass 2 kg, which is held at rest so that the string is taut, as shown in the diagram below.



(a) B is released from rest so that it begins to move vertically downwards with an acceleration of $\frac{543}{625}g\,\text{m s}^{-2}$

Show that the coefficient of friction between A and the surface of the inclined plane is 0.17

[8 marks]

(b) **In this question use $g = 9.81\,\text{m s}^{-2}$**

When A reaches a speed of $0.5\,\text{m s}^{-1}$ the string breaks.

(b) (i) Find the distance travelled by A after the string breaks until first coming to rest.

[4 marks]

(b) (ii) State an assumption that could affect the validity of your answer to part **(b)(i)**.

[1 mark]

3. June/2019/Paper_2/No.11

A wooden crate rests on a rough horizontal surface.

The coefficient of friction between the crate and the surface is 0.6

A forward force acts on the crate, parallel to the surface.

When this force is 600 N, the crate is on the point of moving.

Find the weight of the crate.

Circle your answer.

[1 mark]

1000 N 100 kg 360 N 36 kg

4. June/2019/Paper_2/No.12

A particle, under the action of two constant forces, is moving across a perfectly smooth horizontal surface at a constant speed of $10\,\text{m}\,\text{s}^{-1}$

The first force acting on the particle is $(400\mathbf{i} + 180\mathbf{j})$ N.

The second force acting on the particle is $(p\mathbf{i} - 180\mathbf{j})$ N.

Find the value of p.

Circle your answer.

[1 mark]

-400 -390 390 400

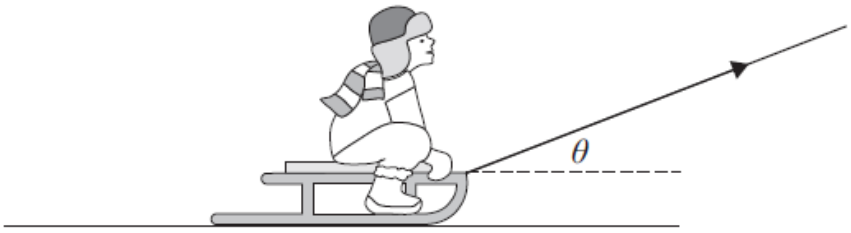
5. June/2019/Paper_2/No.17

Lizzie is sat securely on a wooden sledge.

The combined mass of Lizzie and the sledge is M kilograms.

The sledge is being pulled forward in a straight line along a horizontal surface by means of a light inextensible rope, which is attached to the front of the sledge.

This rope stays inclined at an acute angle θ above the horizontal and remains taut as the sledge moves forward.



The sledge remains in contact with the surface throughout.

The coefficient of friction between the sledge and the surface is μ and there are no other resistance forces.

Lizzie and the sledge move forward with constant acceleration, $a\,\text{m s}^{-2}$

The tension in the rope is a constant T Newtons.

(a) Show that

$$T = \frac{M(a + \mu g)}{\cos\theta + \mu \sin\theta}$$

[7 marks]

(b) It is known that when $M = 30$, $\theta = 30°$, and $T = 40$, the sledge remains at rest.

Lizzie uses these values with the relationship formed in part **(a)** to find the value for μ

Explain why her value for μ may be incorrect.

[2 marks]