



## **A-LEVEL MATHS QUESTIONS**

**Mechanics and Statistics - Day 2**

**COMPLETE ALL QUESTIONS**



1. Whilst training, a penalty shootout is played in such a way that as soon as three penalties are scored, the shootout ends. Given that each shot is independent and there is a 70% of scoring, calculate the probability of exactly six shots being required.

2. A machine produces sprockets<sup>TM</sup>. Their mass is thought to be normally distributed, with a mean of  $10\text{kg}$  and variance  $0.09\text{kg}^2$ . A sample of 20 sprockets is found to have a mean mass of  $10.1\text{kg}$ . Test at a 5% level whether there is evidence that the sprocket mass has increased.

3. Two particles, of mass  $1\text{kg}$  and  $2\text{kg}$  travel towards each other with speeds of  $3\text{m/s}$  and  $2\text{m/s}$  respectively. After they collide, the  $2\text{kg}$  particle reverses direction, and has a new speed of  $1.5\text{m/s}$ . Determine the velocity of the other particle.

4. A block is initially at rest, on an inclined plane, at an angle of  $15$  degrees to the horizontal. The block has a mass of  $3\text{kg}$ , the coefficient of friction is  $0.1$ . Determine the velocity of the block after it has travelled along the plane for  $2\text{metres}$ .

5. The random variable  $X$  has distribution  $X \sim B(10, p)$ . Given that

$$P(X = 1) = \frac{1}{2}P(X = 2)$$

find the value of  $p$