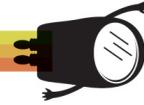




A-LEVEL MATHS QUESTIONS

**Mechanics and Statistics - Day 1
Diagnostics Assessment**

COMPLETE ALL QUESTIONS



1. Let the random variable X have distribution $X \sim N(10, 5)$

1. Explain what is meant by $X \sim N(10, 5)$
2. Find $P(X > 15)$
3. Find $P(9 < X < 14)$

2. Let the random variable Y have distribution $Y \sim B(10, 0.4)$

1. Explain, with reference to a Bernoulli trial, what is meant by the statement $Y \sim B(10, 0.4)$
2. Find $P(Y = 7)$
3. Find $P(Y \geq 8)$

3. Athletes are to be randomly drugs tested for a particular competition; the following data is obtained

	Male	Female
40 or over	28	20
Under 40	15	7

- i If two competitors are chosen at random (without replacement), what is the probability that they are both over 40 and male?
- ii If two competitors are chosen at random (without replacement), what is the probability that the second is male given that the first competitor was female?
- iii Given that three competitors under the age of 40 are chosen, what is the probability that all three are have the same gender.



4. A block of mass 2kg is placed on a slope, with an angle of 15 degrees to the horizontal. The block is held stationary by a rope with tension T .

- i If the coefficient of friction, μ is zero, what is the value of T ?
- ii If the coefficient of friction, $\mu = 0.1$, what is the value of T ?
- iii What is the minimum value of μ such that $T = 0$

5. A particle has position vector $\underline{r}(t)$ at time t , find $\underline{v}(t)$ and $\underline{a}(t)$, the velocity and acceleration vectors, given that

$$\underline{r}(t) = \begin{pmatrix} t^2 + t \\ 2t - t^3 \\ 3t \end{pmatrix}$$

When $t = 3$, determine the **speed** of the particle.

6. A cannonball is fired at an angle of 30 degrees to the horizontal. The initial speed of the cannonball is 200m/s

- i If the cannonball first lands in a position such that its vertical displacement is zero, how long, in seconds, was its flight and what is its horizontal displacement?
- ii At what times did the cannonball have a vertical displacement of 50m?
- iii What was the maximum height of the cannonball?