## Grade Grabber 3

Applied Mathematics Revision

## Question 1

A non-uniform $\log , A B$, of mass 140 kg and length 6 m rests on a support at its midpoint, $C$. A mass of 40 kg placed at a point $D$, which is 1 m from $B$, causes the $\log$ to be in equilibrium.

(i) Find the magnitude of the reaction force at $C$.
(ii) Find the distance of the log's centre of mass from $A$.

## Question 2

( a ) Complete the following contingency table,

|  | $A$ | $A^{\prime}$ |  |
| :---: | :---: | :---: | :---: |
| $B$ |  | 0.4 |  |
| $B^{\prime}$ | 0.1 |  | 0.4 |

[ 2 marks ]
(b) Using the values given in the contingency table, calculate,
(i) $p(A)$
(ii) $p(A \cup B)$
[ 1, 2 marks]
( iii ) $p(A \mid B) \quad$ (iv) $p\left(A \mid B^{\prime}\right)$
[ 2, 2 marks ]
( c) Are events $A$ and $B$ statistically independent?
Justify your answer.
[ 2 marks ]

## Question 3

Joe and Chris are tiling the bathroom. They have decided on a random pattern of white and green tiles with about five times as many white as green. To achieve this, before Chris lays each tile, Joe rolls a die. If it shows a six, green is chosen, otherwise white.
Given that the top row has twenty tiles in all, calculate the probability that,
(i) exactly four tiles are green
( ii ) less than four tiles are green
( iii ) more than four tiles are green
(iv) What is the probability that exactly four tiles are green and that those four tiles are all adjacent ?

## Question 4

An aeroplane is ascending in a straight line over flat grasslands.
It's speed is $175 \mathrm{~m} / \mathrm{s}$ and the angle of elevation is $14^{\circ}$
An aid package is released from the aeroplane and travels a horizontal distance of 2.38 km before hitting the ground.
(i) How long after being released, will the package hit the ground?
( ii ) What was the height of the aeroplane above the ground at the moment the package was released?
[ 2 marks ]
( iii ) With what speed did the package hit the ground ?
(iv) State two modelling assumptions made in answering the question.

## Question 5

A poorly designed NUCLEAR POWER STATION has ten electrical circuits in its control system, each with a $\frac{1}{15}$ independent probability of failing when the power station is started up. If none of the ten circuits fail, the station will function safely. If one fails it has a $10 \%$ probability of EXPLODING but if more than one fails it has a $50 \%$ probability of EXPLODING.
(i) Using a tree diagram, or otherwise, calculate the probability of the station EXPLODING when it is started up.

## [ 8 marks ]

The safety mechanism consists of two elements; a RED ALERT which sounds if one or more of the electric circuits fail, and a PINK EMERGENCY BUTTON which switches all control to the back-up circuits. If these back-up circuits are used, the probability of the station EXPLODING is $20 \%$. The station is started up and the RED ALERT sounds.
( ii ) Should the operator press the PINK EMERGENCY BUTTON ?

