Question 6 **(25 marks)**

A local sports club is planning to run a weekly lotto. To win the Jackpot of €1000, contestants must match one letter chosen from the 26 letters in the alphabet and two numbers chosen, in the correct order, from the numbers 0 to 9. In this lotto, repetition of numbers is allowed (e.g. M, 3, 3 is an outcome).

(a) Calculate the probability that M, 3, 3 would be the winning outcome in a particular week.

(b) If a contestant matches the letter only, or the letter and one number (but not both numbers), they will win €50. Using the table below, or otherwise, find how much the club should expect to make or lose on each play, correct to the nearest cent, if they charge €2 per play.

Event	**Payout** (x) €	**Probability** (P(x))	x.P(x)
Win Jackpot			
Match letter and first number only			
Match letter and second number only			
Match letter and neither number			
Fail to win			

(c) The club estimates that the average number of plays per week will be 845. If the club wants to make an average profit of €600 per week from the lotto, how much should the club charge per play, correct to the nearest cent?

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<table>
<tr><th>Q6</th><th>Model Solution – 25 Marks</th><th>Marking Notes</th></tr>
<tr><td>(a)</td><td>$$P(M,3,3)=\frac{1}{26}\times\frac{1}{10}\times\frac{1}{10}=\frac{1}{2600}$$</td><td>Scale 10C (0, 3, 7, 10)
Low Partial Credit
• any correct relevant probability

High Partial credit
• correct probabilities but not expressed as single fraction or equivalent

Note: Accept correct answer without supporting work</td></tr>
<tr><td>(b)</td><td>
<table>
<tr><th>Event</th><th>Payout</th><th>Prob (P(x))</th><th>x.P(x)</th></tr>
<tr><td>Win</td><td>1000</td><td>$\frac{1}{2600}$</td><td>$\frac{1000}{2600}$</td></tr>
<tr><td>letter 1 No.</td><td>50</td><td>$\frac{9}{2600}$</td><td>$\frac{450}{2600}$</td></tr>
<tr><td>letter 2nd No</td><td>50</td><td>$\frac{9}{2600}$</td><td>$\frac{450}{2600}$</td></tr>
<tr><td>letter only</td><td>50</td><td>$\frac{81}{2600}$</td><td>$\frac{4050}{2600}$</td></tr>
<tr><td>Fail to win</td><td>0</td><td></td><td>0</td></tr>
</table>
$$\sum x.P(x)=\frac{5950}{2600}=2{\cdot}29$$
Club loses 29 cent per play

Or
<table>
<tr><th>Event</th><th>Pay out</th><th>Prob (P(x)</th><th>x.P(x)</th></tr>
<tr><td>Win</td><td>-998</td><td>$^{1}/_{2600}$</td><td>$^{-998}/_{2600}$</td></tr>
<tr><td>letter + 1st No.</td><td>-48</td><td>$^{9}/_{2600}$</td><td>$^{-432}/_{2600}$</td></tr>
<tr><td>Letter + 2nd No</td><td>-48</td><td>$^{9}/_{2600}$</td><td>$^{-432}/_{2600}$</td></tr>
<tr><td>letter only</td><td>-48</td><td>$^{81}/_{2600}$</td><td>$^{-3888}/_{2600}$</td></tr>
<tr><td>Fail to Win</td><td>$+2$</td><td>$^{2500}/_{2600}$</td><td>$^{5000}/_{2600}$</td></tr>
</table>
$$\sum x.P(x)=-\frac{750}{2600}=-29 \text{ cent}$$
</td><td>Scale 10C (0, 3, 7, 10)
Low Partial Credit
• 1 correct entry to table
High Partial Credit
• all entries correct but fails to finish or finishes incorrectly
• no conclusion</td></tr>
</table>

(c)	Profit = Revenue – Pay-out $600 = 845(x - 2{\cdot}29)$ $x = \frac{600 + 845(2{\cdot}29)}{845}$ $x = 3$ **or** $\frac{600}{845} = 0{\cdot}71$ $0{\cdot}71 + 2{\cdot}29 = 3$	Scale 5C (0, 2, 4, 5) *Low Partial Credit* • links profit, revenue and payout *High partial Credit* • formula fully substituted