QUESTION 3 (25 MARKS)

Question 3 (a)

Number of arrangements of n objects, p alike of one kind, q alike of another kind $= \dfrac{n!}{p!q!}$

In order to win €8 playing Game A four times, John would have hit the following segments: €0, €0, €3 and €5, but not necessarily in that order.

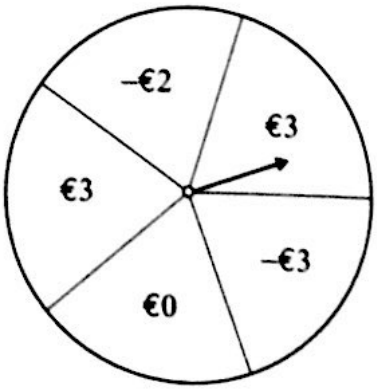
How many arrangements can be made of 4 objects, 2 of which are alike?

Number of ways John could win €8 $= \dfrac{4!}{2!} = \dfrac{4\times3\times2\times1}{2\times1} = 12$

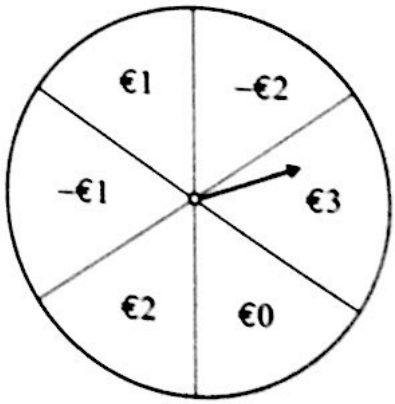
MARKING SCHEME NOTES
Question 3 (a) [Scale 10C (0, 3, 7, 10)]
3: • Some reference to €3 and €5
7: • Listing with not more than five omitted

Question 3 (b)

The spinners are redrawn and the values represent the amount the charity would gain for each spin.



Game A



Game B

Calculate the expected earnings $E(x)$ for each €3 bet placed.

Game A: $E(x) = \frac{1}{5}(3) - \frac{1}{5}(2) + \frac{1}{5}(3) + \frac{1}{5}(0) - \frac{1}{5}(3) = \frac{3}{5} = €0\cdot60$

Game B: $E(x) = \frac{1}{6}(3) - \frac{1}{6}(2) + \frac{1}{6}(1) - \frac{1}{6}(1) + \frac{1}{6}(2) + \frac{1}{6}(0) = \frac{3}{6} = €0\cdot50$

EXPECTED VALUE $E(x)$
$E(x) = \sum xP(x)$

Game B would be more successful at earning money for the charity as its expected earnings are higher per spin.

Marking Scheme Notes
Question 3 (b) [Scale 5C (0, 2, 3, 5)]
2: • One partially accurate statement
• Expected outcome formula
3: • Correct answer but inaccurate/only partially correct supporting evidence
• Expected outcome of both Game *A* and Game *B* calculated but incorrect or no conclusion.

Question 3 (c)

$p = P(4) = \frac{1}{6}$, $q = P(\text{Not } 4) = \frac{5}{6}$

$n = 6$, $r = 2$, $p = \frac{1}{6}$, $q = \frac{5}{6}$

$P(2 \text{ successes}) = {}^6C_2 (\frac{1}{6})^2 (\frac{5}{6})^4 = \frac{3125}{15552} = 0 \cdot 2$

Bernoulli Trials
$P(r \text{ successes}) = {}^nC_r \, p^r q^{n-r}$

Marking Scheme Notes
Question 3 (c) [Scale 10C (0, 3, 7, 10)]
3: • Establishes probability of stopping on €4 sector once
• Establishes probability of not stopping on €4 sector once
• Effort to express a relevant binomial expansion
7: • Omits $\binom{6}{2}$
• Indices incorrectly assigned