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**7.** The number of cakes, $X$, bought by customers at a particular shop has probability distribution

| $x$ | 1 | 2 | 3 | 4 | 5 | 6 | >6 |
|---|---|---|---|---|---|---|---|
| $P(X = x)$ | 0.35 | $a$ | $a$ | 0.15 | $b$ | $b$ | 0 |

where $a$ and $b$ are constants.

Given that $E(X) = 2.5$

(a) (i) show that $a = 0.2$

(ii) find the value of $b$

**(5)**

(b) Calculate $\text{Var}(4X + 3)$

**(4)**

The cost to produce each cake is 20 cents and the shopkeeper sells each cake for 80 cents.

(c) Find the expected profit made by the shopkeeper for a randomly selected customer buying cakes.

**(2)**

The shopkeeper decides to run a promotion where she gives 1 free cake to all customers who buy 4 or more cakes. During the promotion the number of cakes, $Y$, taken away by a customer buying cakes has the following probability distribution

| $y$ | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| $P(Y = y)$ | $\frac{3}{40}$ | $\frac{4}{40}$ | $\frac{3}{40}$ | 0 | $\frac{22}{40}$ | $\frac{8}{40}$ |

(d) Find the expected profit made by the shopkeeper for a randomly selected customer buying cakes during the promotion.

**(4)**

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**Q7**

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**TOTAL FOR PAPER: 75 MARKS**

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