Question Number	Scheme	Marks
4 (a)	$a + a^2 + 0.26 + 0.34 + 0.16 = 1$	M1
	$a^2 + a - 0.24 = 0 \Rightarrow (a - 0.2)(a + 1.2) = 0 \Rightarrow a = ...$	dM1
	$a = 0.2$ as e.g. a cannot be negative *	A1*
		(3)
(b)	$\mathrm{E}(X) = 1\times0.2 + 2\times0.2^2 + 3\times0.26 + 4\times0.34 + 5\times0.16 \left[= 3.22 = \frac{161}{50}\right]$	M1
	$\mathrm{E}(2X + 4) = 2\mathrm{E}(X) + 4 = 2\times'3.22' + 4$	M1
	= 10.44 awrt 10.4	A1
		(3)
Alt(b)	$Y = 2X + 4$ so y = 6, 8, 10, 12, 14	M1
	$\mathrm{E}(Y) = 6\times0.2 + 8\times0.2^2 + 10\times0.26 + 12\times0.34 + 14\times0.16$ [= 10.44]	M1
	= 10.44 awrt 10.4	A1
		(3)
(c)	$\mathrm{E}(X^2) = 1^2\times0.2 + 2^2\times0.2^2 + 3^2\times0.26 + 4^2\times0.34 + 5^2\times0.16 \left[= 12.14 = \frac{607}{50}\right]$	M1
	$\mathrm{Var}(X) = '12.14' - '3.22'^2$ [= 1.7716]	M1
	$\mathrm{Var}(2X + 4) = 4\mathrm{Var}(X) = 4\times'1.7716'$	M1
	= 7.0864 awrt 7.09	A1
		(4)
Alt(c)	$Y = 2X + 4$ so y^2 = 36, 64, 100, 144, 196	M1
	$\mathrm{E}(Y^2) = 36\times0.2 + 64\times0.2^2 + 100\times0.26 + 144\times0.34 + 196\times0.16$ [= 116.08]	M1
	$\mathrm{Var}(Y) = '116.08' - '10.44'^2$ [= 7.0864]	M1
	= 7.0864 awrt 7.09	A1
		(4)
(d)	awrt "7.09"	B1ft
		(1)

	Notes		Total 11
(a)	**M1**	for use of $\sum \mathrm{P}(X = x) = 1$ which may be implied by a correct 3TQ	
	dM1	dep on 1st M for a 3TQ in a and attempts to solve the 3TQ by factorising, completing the square or quadratic formula proceeding to at least one value. If they state the roots without working (e.g. solving directly from a calculator) they must state **both** 0.2 and -1.2 oe. Correct roots from a correct 3TQ scores M1dM1 Condone when factorising if their factors are for the equivalent quadratic equation $\times 25$ e.g. $a^2 + a - 0.24 = 0 \Rightarrow (5a - 1)(5a + 6) = 0 \Rightarrow a = 0.2$	
	A1*	for achieving the given answer and a reason for selecting 0.2 following a correct quadratic. They either need to explain why they are rejecting the other root e.g. -1.2 is negative or probs are between 0 and 1 (or it is not a probability) or they need to explain why they are selecting 0.2 e.g. a must be greater than (or equal to) 0 Do not accept vague reasons e.g. -1.2 is not possible SC verification scores M1M0A0.	

Mark (b) and (c) together Look for values by the table for evidence of method or by the question		
(b)	**M1**	for use of $\sum xP(X=x)$ (with at least 3 correct products or terms with intention to add) but division by 5 is M0. May see 0.2+ 0.08+0.78+1.36+0.8 - **cannot be implied by 3.22 alone.** Look out for attempts at $2X$ which can score this mark. e.g. $2\times0.2+4\times0.04+6\times0.26+8\times0.34+10\times0.16$ (with at least 3 correct products or terms with intention to add) but division by 5 is M0
	M1	for use of $2E(X)+4$ ft their E(X) In the attempt at $2X$ for the first M they would need to add 4 for this mark
	A1	awrt 10.4 (provided all previous marks scored) Accept $\frac{261}{25}$
Alt(b)	**M1**	for y = 6, 8, 10, 12, 14 (May be seen in part (c)). They do not have to be evaluated. May be implied by the values 1.2, 0.32, 2.6, 4.08, 2.24
	M1	for use of $\sum yP(Y=y)$ (with at least 3 correct products or terms with intention to add) but division by 5 is M0. May see 1.2+0.32+2.6+4.08+2.24 which can imply the first two M marks - **cannot be implied by awrt 10.4 alone**
	A1	awrt 10.4 (provided all previous marks scored) Accept $\frac{261}{25}$
(c)	**M1**	for use of $\sum x^2P(X=x)$ (with at least 3 correct products or terms with intention to add) but division by 5 is M0. May see 0.2+0.16+2.34+5.44+4 **Cannot be implied by 12.14 alone.** Condone if labelled as Var(X)
	M1	for use of $E(X^2)-E(X)^2$ ft their values for $E(X^2)$ and $E(X)$
	M1	for use of $4\text{Var}(X)$ ft their **positive** Var(X) – it cannot be for e.g. $4E(X^2)$ i.e. it must be a changed value from $E(X^2)$ even if it is labelled as Var(X)
	A1	awrt 7.09 (provided all previous marks scored)
Alt(c)	**M1**	for y = 36, 64, 100, 144, 196. They do not need to be evaluated. May see 7.2+2.56+26+48.96+31.36 **Cannot be implied by 116.08 alone.** Condone if labelled as Var(X) If they attempt $2X$ the values 4, 16, 36, 64, 100 oe can score this mark (note they do not need to add 4 for the Var(X))
	M1	for use of $\sum y^2P(Y=y)$ (with at least 3 correct products or terms with intention to add) or may attempt for just $2X$ (e.g. $4\times0.2+16\times0.04+36\times0.26+64\times0.34+100\times0.16$ oe) but division by 5 is M0
	M1	for use of $E(Y^2)-E(Y)^2$ ft their values for $E(Y^2)$ and $E(Y)$. May use the equivalent formula for $2X$
	A1	awrt 7.09 (provided all previous marks scored)
(d)	**B1ft**	awrt 7.09 or ft their **positive** answer in (c). Condone if their answer to (c) has subsequently been rounded to 3sf or better