1	**(i)**	(A) P X = 10) = P(5 then 5) = 0.4×0.25 = 0.1	B1 **ANSWER GIVEN**	**[1]**
		(B) P X = 30) = P(10 and 20) = 0.4×0.25 + 0.2×0.5 = 0.2	M1 for full calculation A1 **ANSWER GIVEN**	**[2]**
	(ii)	E(X) = $10\times0.1+15\times0.4+20\times0.1+25\times0.2+30\times0.2=20$ E(X^2) = $100\times0.1+225\times0.4+400\times0.1+625\times0.2+900\times0.2=445$ Var(X) = 445 – 20^2 = 45	M1 for Σrp (at least 3 terms correct) A1 CAO M1 for Σr^2p (at least 3 terms correct) M1 dep for – their E (X)² A1 FT their E(X) provided Var(X) > **TOTAL**	**[5]** **[8]**

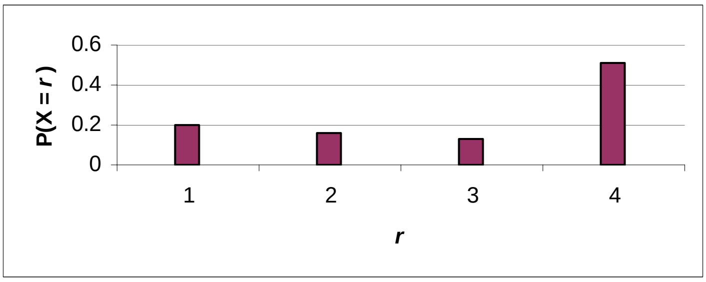
2 (i)	Mean = $\frac{126}{12}$ = 10.5 Sxx = $1582-\frac{126^2}{12}$ = 259 s = $\sqrt{\frac{259}{11}}$ = 4.85	B1 for mean M1 for attempt at *Sxx* A1 CAO	**3**
(ii)	New mean = 500 + 100 × 10.5 = 1550 New s = 100 × 4.85 = 485	B1 <u>ANSWER GIVEN</u> M1A1FT	**3**
(iii)	On average Marlene sells more cars than Dwayne. Marlene has less variation in monthly sales than Dwayne.	E1 E1FT	**2**
		TOTAL	**8**

3 (i)	E(X) = 25 because the distribution is symmetrical. Allow correct calculation of Σrp	E1 <u>ANSWER GIVEN</u>	**1**
(ii)	$E(X^2) = 10^2 \times 0.2 + 20^2 \times 0.3 + 30^2 \times 0.3 + 40^2 \times 0.2 = 730$ $Var(X) = 730 - 25^2 = 105$	M1 for $\Sigma r^2 p$ (at least 3 terms correct) M1dep for -25^2 A1 CAO	**3**
		TOTAL	

4 (i)	$p = 0.55$	B1 cao	**1**
(ii)	E(X) = $0 \times 0.55 + 1 \times 0.1 + 2 \times 0.05 + 3 \times 0.05 + 4 \times 0.25 = 1.35$ $E(X^2) = 0 \times 0.55 + 1 \times 0.1 + 4 \times 0.05 + 9 \times 0.05 + 16 \times 0.25$ $= 0 + 0.1 + 0.2 + 0.45 + 4$ $= (4.75)$ Var(X) = 'their' $4.75 - 1.35^2 = 2.9275$ awfw (2.9275 – 2.93)	M1 for Σrp (at least 3 non zero terms correct) A1 CAO(no 'n' or 'n-1' divisors) M1 for $\Sigma r^2 p$ (at least 3 non zero terms correct) M1dep for – their $E(X)^2$ provided $Var(X) > 0$ A1 cao (no 'n' or 'n-1' divisors)	**5**
(iii)	P(At least 2 both times) = $(0.05+0.05+0.25)^2 = 0.1225$ o.e.	M1 for $(0.05+0.05+0.25)^2$ or 0.35^2 seen A1cao: awfw (0.1225 - 0.123) or 49/400	**2**
		TOTAL	**8**

5 (i)	$X \sim B(50, 0.03)$ (*A*) $P(X = 1) = \binom{50}{1} \times 0.03 \times 0.97^{49} = 0.3372$ (*B*) $P(X = 0) = 0.97^{50} = 0.2181$ $P(X > 1) = 1 - 0.2181 - 0.3372 = 0.4447$	M1 0.03×0.97^{49} or 0.0067(4)…. M1 $\binom{50}{1} \times pq^{49}$ (p+q =1) A1 CAO **(awfw 0. 337 to 0. 3372) or 0.34(2s.f.) or 0.34(2d.p.) but not just 0.34** B1 for 0.97^{50} or 0.2181 (awfw 0.218 to 0.2181) M1 for 1 – ('their' p (X = 0) + 'their' p(X = 1)) must have both probabilities A1 CAO (awfw 0.4447 to 0.445)	**3** **3**
(ii)	Expected number = *np* = 240 × 0.3372 = 80.88 – 80.93 = (81) *Condone 240 × 0.34 = 81.6 = (82) but for M1 A1f.t.*	M1 for 240 × prob (A) A1FT	**2**
		TOTAL	**8**

6 (i)	Mean = 7.35 (or better) Standard deviation: 3.69 – 3.70 (awfw) Allow s^2 = 13.62 to 13.68 Allow rmsd = 3.64 – 3.66 (awfw) **After B0, B0 scored** then if at least 4 correct mid-points seen or used.**{1.5, 4, 6, 8.5, 15}** Attempt of their mean = $\frac{\sum fx}{\mathbf{44}}$, with $301 \le$ fx ≤ 346 and fx strictly from mid-points not class widths or top/lower boundaries.	B2cao $\sum fx = 323.5$ B2cao $\sum fx^2 = 2964.25$ (B1) for variance s.o.i.o (B1) for rmsd (B1) mid-points (B1) $6.84 \le$ mean ≤ 7.86	**4**
(ii)	Upper limit = 7.35 + 2 × 3.69 = 14.73 or 'their sensible mean' + 2 × 'their sensible s.d.' So there could be one or more outliers	M1 (with s.d. < mean) E1**dep** on B2, B2 earned and comment	**2**
		TOTAL	**6**

7 **(i)**	E(X) = $1\times0.2+2\times0.16+3\times0.128+4\times0.512=2.952$ Division by 4 or other spurious value at end loses A mark E(X^2) = $1\times0.2+4\times0.16+9\times0.128+16\times0.512=10.184$ Var(X) = $10.184 - 2.952^2 = 1.47$ (to 3 s.f.)	M1 for Σ *rp* (at least 3 terms correct) A1 cao M1 for Σ x^2p *at least 3 terms correct* M1 for E(X^2) – E(X)^2 Provided ans > 0 A1 FT their E(X) but not a wrong E(X^2)	**5**
(ii)	Expected cost = 2.952 × £45000 = £133000 (3sf)	B1 FT (no extra multiples / divisors introduced at this stage)	**1**
(iii)	 	G1 labelled linear scales G1 height of lines	**2**
		TOTAL	**8**