1		total ways ${}^{10}C_5 = 252$ MW together e.g. (MW)*** in ${}^{8}C_3$ ways = 56 MW not together = 252 – 56 = 196 ways **OR 1** $2\ {}^{8}C_4 + {}^{8}C_5$ $2\ {}^{8}C_4 = 2x70=140$; ${}^{8}C_5 = 56$ $2\ {}^{8}C_4 + {}^{8}C_5 = 196$ **OR 2** $2\ {}^{9}C_5 - {}^{8}C_5$ $2\ {}^{9}C_5 = 2 \times 126 = 252$; ${}^{8}C_5 = 56$ $2\ {}^{9}C_5 - {}^{8}C_5 = 196$	**M1** **B1** **A1** **M1** **B1** **A1** **M1** **B1** **A1**	[3]	${}^{10}C_5 - \ldots$ or $252 - \ldots$ 252 and 56 seen, may be unsimplified $2\ {}^{n}C_4 + {}^{n}C_5$ 140 and 56 seen may be unsimplified $2\ {}^{9}C_5 - ..$ 252 and 56 seen, may be unsimplified
2	**(i)**	$p = 1/3$ $P(\geqslant 2) = 1 - P(0, 1) = 1 - (2/3)^4 - {}^{4}C_1(1/3)(2/3)^3$ or $P(2,3,4) = {}^{4}C_2(1/3)^2(2/3)^2 + {}^{4}C_3(1/3)^3(2/3) + (1/3)^4$ $= \frac{11}{27}$, 0.407	 **M1** **M1** **A1**	 [3]	 Bin term ${}^{4}C_x p^x (1-p)^{4-x}$ $0 < p < 1$ Correct unsimplified answer
	(ii)	P(sum is 5) = P(1, 1, 1, 2) ×4 $= (1/3)^4 \times 4$ $= \frac{4}{81}$, 0.0494	**M1** **M1** **A1**	 [3]	1, 1, 1, 2 seen or 4 options Mult by $(1/3)^4$
3	**(i)**	e.g. **5 in ${}^{3}P_2$ ways = 6 **7 in ${}^{3}P_2 = 6$ Total 12 AG **OR** listing 457, 547, 467, 647, 567, 657, 475, 745 465, 645, 675, 765 Total 12 AG	**M1** **M1** **A1** **M1** **M1** **A1**	 [3]	Recognising ends in 5 or 7, can be implied Summing ends in 5 + ends in 7 oe Correct answer following legit working Listing at least 5 different numbers ending in 5 Listing at least 5 different numbers ending in 7
	(ii)	1 digit in 2 ways 2 digits in *5 or *7 = ${}^{3}P_1 \times 2 = 6$ 4 digits in ***5 or ***7 = ${}^{3}P_3 \times 2 = 12$ Total ways = 32	**M1** **A1** **A1**	 [3]	Consider at least 3 options with different number of digits. If no working, must be 3 or 4 from 2, 6, 12, 12 One option correct from 1, 2 or 4 digits
4	**(i)**	64/250, 0.256	**B1**	[1]	oe
	(ii)	190/250, 0.76(0)	**B1**	[1]	oe

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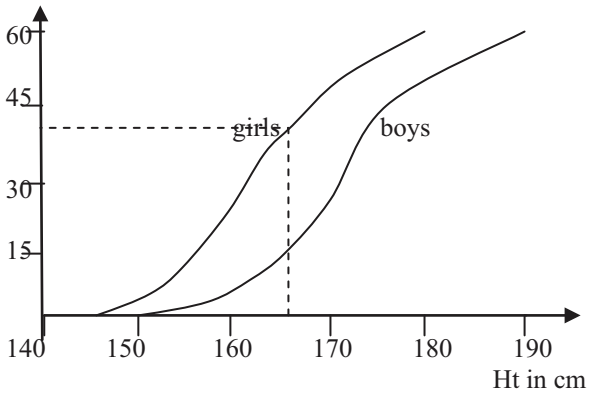
(iii)	P(X) = 80/250 = 8/25	**M1**		attempt at P(X)
	P(Y) = 100/250 = 2/5	**M1**		attempt at P(Y)
	P ($X \cap Y$) = 32/250 = 16/125	**B1**		oe
	$P(X) \times P(Y) = \frac{8}{25} \times \frac{2}{5} = \frac{16}{125}$	**M1**		comparing P(X) × P(Y) and P($X \cap Y$) so long as independence has not been assumed
	Since P(X) × P(Y) = P ($X \cap Y$) therefore independent	**A1**	**[**5]	correct answer with all working correct
5 (i)	cf  	**B1** **B1** **B1** **B1**	 [4]	Horizontal axis from min of 140 to 190 and vertical axis from 0 to minimum of 60 and two CF graphs on the same set of axes. Labels: CF; height (ht) in cm; girls; boys in correct places CF graph going through (150, 0) , (160, 20), (170, 43), (180, 55) and (190, 60) CF graph going through (140, 0), (150, 12), (160,33), (170,50), (180, 60) [and (190, 60)]
(ii)	42 (± 1) shorter than 165. (18(± 1))/60×100 = 30% (± 1.7%)	**M1** **M1** **A1**	 **[**3]	Line or reading from 165 on their cf graph oe subtracting from 60
(iii)	can see which is taller; see which of boys or girls is more spread out	**B1**	[1]	any sensible comment in context
6 (i)	$P(\text{small}) = P\left(z < \frac{95-150}{50}\right)$ = P(z < –1.1) = 1 – 0.8643 = 0.136	**M1** **M1** **A1**	 **[**3]	± standardising using 95, no cc, no sq, no sq rt 1 – Φ (in final answer)
(ii)	z = 1.282 $1.282 = \frac{x-150}{50}$ x = 214 g	**B1** **M1** **A1**	 [3]	± rounding to 1.28 Standardised eqn in their z allow cc
(iii)	P(small) = 0.1357, P(large) = 0.1357 symmetry P(medium) = 1 – 0.1357×2 = 0.7286 **AG**	**B1**	[1]	Correct answer legit obtained
(b)	Expected cost per banana = 0.1357×10 + 0.1357×25 + 0.7286×20 = 19.3215 cents Total cost of 100 bananas = 1930 (cents) ($19.30)	***M1** **DM1** **A1**	 [3]	Attempt at multiplying each 'prob' by a price and summing Mult by 100

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7 (i)	$P(2) = {}^7C_2(0.1)^2(0.9)^5$ $= 0.124$	**M1** **A1**	[2]	Bin term ${}^7C_2p^2(1-p)^5 \quad 0 < p < 1$
(ii)	$(0.15)^1(0.1)^2(0.75)^2 \times 5!/2!2!$ $= 0.0253$ or $81/3200$	**M1** **M1** **A1**	[3]	Mult probs for options, $(0.15)^a(0.1)^b(0.75)^c$ where a + b + c sum to 5 Mult by 5!/2!2! oe
(iii)	mean = 365×0.15 (= 54.75 or 219/4) Var = $365\times 0.15\times0.85$ (= 46.5375 or 3723/80) $P(x > 44) = P\left(z > \frac{44.5 - 54.75}{\sqrt{46.5375}}\right)$ $= P(z > -1.5025)$ $= 0.933$	**B1** **M1** **M1** **M1** **A1**	[5]	Correct unsimplified mean **and** var, oe ± Standardising need sq rt cc either 44.5 (or 43.5) Φ Correct answer accept 0.934

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