

Note: “(3 sfs)” means “answer which rounds to ... to 3 sfs”. If correct ans seen to ≥ 3 sfs, ISW for later rounding
 Penalise 2 sfs only once in paper.

1(i)	Negative, because (grad or coeff of x in 1 st equn or x -value or reg coeff or B or -0.6) is negative	B1	1	Neg because x incr & y decr
(ii)	$x = -1.6 \times 7.0 + 21$ $x = 9.8$	M1 A1	2	Sub $y=7.0$ in 2 nd eqn. Allow 1 sign error If sub in both must choose 2nd
(iii)	$y = -0.6(-1.6y + 21) + 13$ or similar $\bar{x} = 5, \bar{y} = 10$	M1 A1A1	3	Obtain correct eqn in 1 variable. Allow 1 num'l error Allow without bars
Total			6	
In qus 2 & 3 “prod” means “product of two probabilities”				
2(i)	$^4/7$ or 0.571 (3 sfs)	B1	1	
(ii)	$^5/8 \times ^4/7 + ^3/8 \times ^5/8$ $= ^{265}/_{448}$ or 0.592 (3 sfs)	M1M1 A1	3	M1: one correct prod or add any two prods M1: all correct
(iii)	$^3/8 \times ^5/8 + ^5/8 \times ^3/7$ $= ^{225}/_{448}$ or 0.502 (3 sfs)	M1M1 A1	3	M1: one correct prod or add any two prods M1: all correct
Total			7	
3(i)	$\frac{7!}{3! \times 2!}$ $= 420$	M1M1 A1	3	M1: $7!$ /(a factorial); or $\dots \div (3! \times 2!)$ M1: all correct
(ii)	$\frac{5!}{2!}$ $= 60$	M1 A1	2	M1: $5!$ seen (not part of a C) or $5 \times 4!$ or 120 seen or $\dots \div 2!$ alone
(iii)	$1 - ^4/7 \times ^3/6$ or $1 - ^4C_2 / ^7C_2$ or $1 - ^4P_2 / ^7P_2$ or $^3/7 \times ^2/6 + ^3/7 \times ^4/6 + ^4/7 \times ^3/6$ oe or $^3C_2 / ^7C_2 + ^3C_1 \times ^4C_1 / ^7C_2$ $= ^5/7$ or 0.714 (3 sfs)	M1M1 A1	3	M1: $1 - \text{prod}$ or $1 - \dots / ^7C_2$ or $1 - ^4C_2 / ..$ (or Ps) or add 3 prods or add 2 correct prods or $^3C_2 / ^7C_2$ or $^3C_1 \times ^4C_1 / ^7C_2$ or add ≥ 5 out of 7 correct prods M1: all correct
Total			8	

4(i)	0.4207 or 0.421 (3 sfs) or $0.8^{25} + 25 \times 0.8^{24} \times 0.2 + \dots + {}^{25}C_4 \times 0.4^{21} \times 0.2^4$ 0.579(3)	B1 B1	2	or $1 - 0.6167$ or 0.3833 (3 sfs) or $1 - (6 \text{ correct terms, } 0 \text{ to } 5)$
(ii)	${}^{10}C_3 \times (1-0.27)^7 \times 0.27^3$ = 0.261 (3 sfs)	M1 A1	2	
(iii)	$0.73^9 = 0.059$ $0.73^{10} = 0.043$ $n = 10$	Allow “=” thro’out $1 - 0.73^n > 0.95$ or $0.73^n < 0.05$ $n \log 0.73 < \log 0.05$ oe M1 M1 A1	3	or $1 - {}^nC_0 \times 0.27^0 \times 0.73^n > 0.95$ oe allow incorrect sign M1 must be correct ft $(1 - 0.27)$ from (ii) for M1M1 10 with incorrect sign in wking: SCB2 10 with just $0.73^9 = 0.059$: M1M1A1
Total			7	
5(i)	$\frac{1}{3} + \frac{1}{4} + p + q = 1$ oe $0 \times \frac{1}{3} + 1 \times \frac{1}{4} + 2p + 3q = 1\frac{1}{4}$ oe equalize coeffs, eg mult eqn (i) by 2 or 3 Or make p or q subject of (i) or (ii) $p = \frac{1}{4}, q = \frac{1}{6}$ oe	B1 B1 M1 A1A1	5	allow one error. ft their eqns subst or subtr not nec’y
(ii)	$\sum x^2 p$ (not $\frac{1}{4}$ or $\frac{1}{3}$ etc) $(= 2\frac{3}{4})$ $-(\frac{1}{4})^2$ $= 1.1875$ or $1\frac{3}{16}$ oe sd = $\sqrt{(\text{their } 1.1875)} = 1.09$ (3 sfs)	M1 M1 A1 B1f	4	≥ 2 non-zero terms correct. dep +ve result indep if +ve result or $\square x - 1\frac{1}{4})^2 p$ $(\geq 2 \text{ (non-0) terms correct): M2}$ ft (i) ($0 \leq p, q < 1$) or letters p, q both M1s cao dep 1st M1 & $\sqrt{(\text{+ve no.})}$ eg $\sqrt{2.75} = 1.66$
Total			9	

6(i)(a)	<p>Ranks: 2 4 7 5 3 1 6 6 4 1 3 5 7 2 7 1 6 3 2 5 4 1 7 2 5 6 3 4</p> <p>Σd^2 (= 60)</p> <p>$r_s = 1 - \frac{6 \times 60}{7 \times 48}$</p> <p>= $-1/14$ or -0.071 (3 dps)</p> <p>(b) Little (or no) connection (agreement, rel'nship) between dist and commission Allow disagreement</p> <p>(c) Unchanged. No change in rank</p>	<p>M1 A1 M1 M1 A1</p> <p>5 1 2</p>	<p>≥ 5 ranks correct in each set all correct dep ranks attempted even if opp orders, allow arith errors Correct formula with $n = 7$, dep 2nd M1 calc r for ranks: $S_{xx} = S_{yy} = 140 - 28^2/7$. $S_{xy} = 110 - 28^2/7$ (= 28) (= -2) corr subst in one corr S (any version): M1 corr subst in $r = S_{xy} / \sqrt{(S_{xx}S_{yy})}$: M1 -0.07 without wking: M1A1M2A0 No mks unless $r_s \leq 1$ ft their r_s Must refer to context. Not “little corr’n between dist and com” not “strong disagreement” Ignore other comment</p>
(ii)(a)	= -1	B1	1 indep
(b)	Close to -1 or, eg ≈ -0.9	B1	cao not referring to “corr’n” rather than r allow “neg”, not neg corr’n or neg skew
Total		10	

7(i)	<p>Midpoints attempted ≥ 2 classes $\sum xf / 100$ or $\sum xf / \sum f$ attempted ≥ 2 terms x within class, not class width Mean = 27.2 (to 3 sfs) (not 27.25) art 27.2 from fully correct wking</p> <p>$\sum x^2 f$ or $\sum (x - \bar{x})^2 f \geq 2$ terms $\sqrt{(\sum x^2 f / 100 - \bar{x}^2)}$ or $\sqrt{((\sum x - \bar{x})^2 f / 100)}$ or $1 / \sum f$ fully corr method, not $\sqrt{\text{neg}}$ = 40.5 to 41.1 (3 sfs)</p>	<p>M1 M1 A1 M1 M1 A1</p>	<p>Correct (149.5) 2720.5/100 27.2 240702.25 40.82</p>	<p>With 150 2725/100 27.25 242050 40.96</p>	<p>Tot = 2000 Allow Ms & poss As</p>
(ii)	<p>Recog LQ in 1st class & UQ in 3rd class</p> <p><u>Graph</u>: Attempt 25(.25)th value Attempt 75(.75)th value</p> <p><u>Interp</u>: LQ = 3.0 to 4.3 UQ = 27 to 29</p> <p>Subtract IQR = 23 or 24 or 25</p>	<p>B1 M1 M1 A1</p>	<p>6 6</p>	<p>both nec'y dep B1 or M1 integer. dep M2</p>	
(iii)(a)	Increase	B1	1		
(b)	Increase	B1	1		
(c)	No change	B1	1		Ignore "probably" etc
Total			13		
8(i)	<p>Geometric. Each attempt (or result or try) indep</p>	<p>B1 B1</p>	<p>2</p>	<p>In context. Not "events, trials, outcomes". Ignore extra</p>	
(ii)(a)	<p>$(\frac{2}{3})^3 \times \frac{1}{3}$ = $\frac{8}{81}$ or 0.0988 (3 sfs)</p>	<p>M2 A1</p>	<p>3</p>	<p>$(\frac{2}{3})^2 \times \frac{1}{3}$ or $(\frac{2}{3})^4 \times \frac{1}{3}$: allow other numerical "p" (0 < p < 1):M1</p>	
(b)	<p>$(\frac{2}{3})^3$ $1 - (\frac{2}{3})^3$ = $\frac{19}{27}$ or 0.704 (3sfs)</p>	<p>M1 M1 A1</p>	<p>3</p>	<p>not $(\frac{2}{3})^3 \times \dots$ or $\frac{1}{3} + \frac{2}{3} \times \frac{1}{3} + (\frac{2}{3})^2 \times \frac{1}{3}$ M2 or $1 - (\frac{2}{3})^4$ or $1 - ("q")^4$ M1 or 3 terms, with 2 correct M1 or 3 correct terms + 1 extra M1 or "p" + "qp" + "q²p" M1 or 1 - sum of 3 correct terms M1 "p" means num value, not $\frac{1}{3}$</p>	
(iii)	3	B1f	1		or $\frac{1}{p}$
(iv)	<p>$1 - \frac{19}{27}$ $(1 - 0.7037)$ or 0.2963 $(\frac{8}{27})^2 \times \frac{19}{27}$ $0.2963^2 \times 0.7037$ = $\frac{1216}{19683}$ = 0.0618 (3 sfs)</p>	<p>M1 M1 A1</p>	<p>3</p>	<p>ft (b) for M1M1 must see method if ft Allow figs rounded to 2 sfs for M1M1 cao. allow art 0.0618 or 0.0617</p>	
Total			12		

Total 72 marks