4732 Probability & Statistics 1

1			Q1: if consistent "0.8" incorrect or $^1/_8$, $^7/_8$ or 0.02 allow M marks in ii , iii & 1st M1 in i
i	Binomial stated 0.9437 – 0.7969 or $^8C_3\times0.2^3\times0.8^5$ = 0.147 (3 sfs)	M1 M1 A1 3	or implied by use of tables or $^8C_3$ or $0.2^a\times0.8^b$ $(a+b = 8)$
ii	1– 0.7969 = 0.203 (3 sf)	M1 A1 2	allow 1– 0.9437 or 0.056(3) or equiv using formula
iii	8 × 0.2 oe 1.6	M1 A1 2	8 × 0.2 = 2 M1A0 1.6 ÷ 8 or $^1/_{1.6}$ M0A0
Total		**7**	
2	first two d's = ±1 Σd^2 attempted (= 2) $1-\frac{6\times\text{"2"}}{7(7^2-1)}$ = $^{27}/_{28}$ or 0.964 (3 sfs)	B1 M1 M1dep A1	S_{xx} or S_{yy} = 28 B1 S_{xy} = 27 B1 $S_{xy}/\sqrt{(S_{xx}S_{yy})}$ M1 dep B1 1234567 & 1276543 (ans $^2/_7$): MR, lose A1
Total		**4**	
3 i	x independent or controlled or changed Value of y was measured for each x x not dependent	B1 1	Allow Water affects yield, or yield is dependent or yield not control water supply Not just y is dependent Not x goes up in equal intervals Not x is fixed
ii	(line given by) minimum sum of squs	B1 B1 2	B1 for "minimum" or "least squares" with inadequate or no explanation
iii	S_{xx} = 17.5 or 2.92 S_{yy} = 41.3 or 6.89 S_{xy} = 25 or 4.17 $r=\frac{S_{xy}}{\sqrt{(S_{xx}S_{yy})}}$ = 0.930 (3 sf)	 B1 M1 A1 3	or $91-21^2/_6$ or $394-46^2/_6$ B1 for any one or $186-{}^{21\times46}/_6$ dep B1 0.929 or 0.93 with or without wking B1M1A0 **SC** incorrect n: max B1M1A0
iv	Near 1 or lg, high, strong, good corr'n or relnship oe Close to st line or line good fit	B1ft B1 2	$\|r\|$ small: allow little (or no) corr'n oe Not line accurate. Not fits trend
Total		**8**	

4			Q4: if consistent "0.7" incorrect or $^1/_3$, $^2/_3$ or 0.03 allow M marks in ii , iii & 1st M1 in i
i	Geo stated $0.7^3 \times 0.3$ alone $^{1029}/_{10000}$ or 0.103 (3 sf)	M1 M1 A1 3	or implied by $q^n \times p$ alone ($n > 1$) $0.7^3 - 0.7^4$
ii	0.7^4 alone $= {}^{2401}/_{10000}$ or 0.240 (3 sf)	M1 A1 2	$1 - (0.3 + 0.7\times0.3 + 0.7^2\times0.3 + 0.7^3\times0.3)$ NB $1 - 0.7^4$: M0
iii	$1 - 0.7^5$ = 0.832 (3 sfs)	M2 A1 3	or $0.3 + 0.7\times0.3 + + \ldots + 0.7^4\times0.3$ M2 M1 for one term extra or omitted or wrong or for 1– (above) M1 for $1 - 0.7^6$ or 0.7^5 NB Beware: $1 - 0.7^6 = 0.882$
		8	
5i	$^{25}/_{10}$ = 2.5	M1 A1 2	Allow $^{25}/_{(9to10)}$ or 2.78: M1
ii	(19.5, 25) (9.5, 0)	B1 B1 2	 Allow (24.5, 47) Both reversed: SC B1 If three given, ignore (24.5, 47)
iii	Don't know exact or specific values of x (or min or max or quartiles or median or whiskers). oe Can only estimate (min or max or quartiles or median or whiskers) oe Can't work out (…..) oe Data is grouped oe	 B1 1	Exact data not known Allow because data is rounded
Total		**5**	

6i	$\Sigma x \div 11$ 70 Σx^2 attempted $\sqrt{\frac{\Sigma x^2}{11} - \bar{x}^2}$ $= \sqrt{({}^{54210}/_{11} - 70^2)}$ or $\sqrt{28.18}$ or 5.309 (= 5.31) **AG**	M1 A1 M1 A1 4	$\geq$ 5 terms, or $\Sigma(x-\bar{x})^2$ or $\sqrt{\frac{\Sigma(x-\bar{x})^2}{11}}$ $= \sqrt{{}^{310}/_{11}}$ or $\sqrt{28.18}$ ie correct substn or result If $\times {}^{11}/_{10}$: M1A1M1A0
ii	Attempt arrange in order med = 67 74 and 66 IQR = 8	M1 A1 M1 A1 4	or (72.5 – 76.5) – (65.5 – 66.5) incl must be from 74 – 66
			iii, iv & v: ignore extras
iii	no (or fewer) extremes this year oe sd takes account of all values sd affected by extremes less spread tho' middle 50% same less spread tho' 3rd & 9th same or same gap	B1 1	fewer high &/or low scores highest score(s) less than last year Not less spread or more consistent Not range less
iv	sd measures spread or variation or consistency oe	B1 1	sd less means spread is less oe or marks are closer together oe
v	more consistent, more similar, closer together, nearer to mean less spread	B1 1	allow less variance Not range less Not highest & lowest closer
Total		**11**	
7i	${}^8C_3$ = 56	M1 A1 2	
ii	${}^7C_2$ or or ${}^7P_2$ / ${}^8P_3$ ÷(${}^8C_3$ or "56") only = ${}^3/_8$	${}^1/_8$ not from incorrect × 3 only or ${}^1/_8+{}^7/_8\times{}^1/_7+{}^7/_8\times{}^6/_7\times{}^1/_6$	M1 M1 A1 3	${}^8C_1+{}^7C_1+{}^6C_1$ or 21 or 8×7×6 or ¨/$_8$×¨/$_7$×¨/$_6$ indep, dep ans < 1	${}^7/_8 \times {}^6/_7 \times {}^5/_6$ 1 – prod 3 probs
iii	${}^8P_3$ or 8×7×6 or ${}^8C_1\times{}^7C_1\times{}^6C_1$ or 336 1 ÷ ${}^8P_3$ only = ${}^1/_{336}$ or 0.00298 (3 sf)	M1 M1 A1 3	${}^1/_8 \times {}^1/_7 \times {}^1/_6$ only M2 If × or ÷: M1 $({}^1/_8)^3$ M1	
Total		**8**	

8ia	$^{18}/_{19}$ or $^{1}/_{19}$ seen $^{17}/_{18}$ or $^{1/}{}_{18}$ seen structure correct ie 6 branches all correct incl. probs and W & R	B1 B1 B1 B1 4	 regardless of probs & labels (or 14 branches with correct 0s & 1s)
b	$^{1}/_{20} + {}^{19}/_{20} \times {}^{1}/_{19} + {}^{19}/_{20} \times {}^{18}/_{19} \times {}^{1}/_{18}$ $= {}^{3}/_{20}$	M2 A1 3	M1 any 2 correct terms added $^{19}/_{20}\times{}^{18}/_{19}\times{}^{17}/_{18}$ $1 - {}^{19}/_{20}\times{}^{18}/_{19}\times{}^{17}/_{18}$
iia	$^{19}/_{20} \times {}^{18}/_{19}$ $= {}^{9}/_{10}$ oe	M1 A1 2	$^{19}/_{20}\times{}^{18}/_{19}\times{}^{1}/_{18}+{}^{19}/_{20}\times{}^{18}/_{19}\times{}^{17}/_{18}$ or $^{1}/_{20}+{}^{17}/_{20}$
b	(P(X = 1) = $^{1}/_{20}$) $^{19}/_{20} \times {}^{1}/_{19}$ $= {}^{1}/_{20}$ Σxp $= {}^{57}/_{20}$ or 2.85	 M1 A1 M1 A1 4	 or $1 - ({}^{1}/_{20} + {}^{9}/_{10})$ or 2 probs of $^{1}/_{20}$ M1A1 $\geq$ 2 terms, ft their p's if $\Sigma p = 1$ NB: $^{19}/_{20}\times 3 = 2.85$ no mks
			With replacement:
ia			Original scheme
ib			$^{1}/_{20} + {}^{19}/_{20} \times {}^{1}/_{20} + ({}^{19}/_{20})^2 \times {}^{1}/_{20}$ or $1 - ({}^{19}/_{20})^2$ M1
iia			$({}^{19}/_{20})^2$ or $({}^{19}/_{20})^2\times{}^{1}/_{20} + ({}^{19}/_{20})^2\times{}^{19}/_{20}$ M1
b			Original scheme But NB ans 2.85(25…) M1A0M1A0
Total		**13**	

9i	$(1 - 0.12)^n$ $\underline{\log 0.05}$ $\log 0.88$ $n = 24$	 or $0.88^{23} = 0.052...$ or $0.88^{24} = 0.046...$ 	M1 M1 A1 3	Can be implied by 2nd M1 allow $n - 1$ or $\log_{0.88}0.05$ or 23.4(…) Ignore incorrect inequ or equals signs
ii	${}^6C_2 \times 0.88^4 \times 0.12^2$ $\times 0.12$ $= 0.0155$	(= 0.1295…)	M3 M1 A1 5	or $0.88^4 \times 0.12^2$ M2 or ${}^6C_2 \times 0.88^4 \times 0.12^2$ + extra M2 or 2 successes in 6 trials implied or ${}^6C_2$ M1 dep $\geq$ M1 $0.88^4 \times 0.12^2 \times 0.12$: M2M1 $0.88^4 \times 0.12^3$ M0M0A0 unless clear P(2 success in 6 trials) × 0.12 in which case M2M1A0
Total			**8**	

Total 72 marks