## 4766 Statistics 1

Mode = 1B1 CAO(ii) $\int_{0}^{1} \int_{0}^{1} \int_{0$	Q1 (i)	Median = 2	B1 CAO	2
(ii)S1 labelled linear scales on both axes H1 heights2(iii)PositiveB11(iii)PositiveB11(iii) $\begin{pmatrix} 25\\5 \end{pmatrix}$ different teams = 53130M1 for $\begin{pmatrix} 25\\5 \end{pmatrix}$ 		Mode = 1	B1 CAO	
(iii)PositiveB11 $(1i)$ $(25) \\ 5$ different teams = 53130M1 for $(25) \\ 5$ 2(ii) $(14) \\ 3$ $\times$ $(11) \\ 2$ $= 364 \times 55 = 20020$ M1 for either combination M1 for product of both A1 CAO3(iii) $(14) \\ 3$ $\times$ $(11) \\ 2$ $= 364 \times 55 = 20020$ M1 for reither combination M1 for product of both A1 CAO3(iii) $(14) \\ 3$ $\times$ $(12) \\ 12 = 364 \times 55 = 20020$ B1 for mean3(iii)Mean = $\frac{126}{12} = 10.5$ B1 for mean3 $Sxx = 1582 - \frac{126^2}{12} = 259$ M1 for attempt at Sxx3 $s = \sqrt{\frac{259}{11}} = 4.85$ M1 for attempt at Sxx3(iii)New mean = 500 + 100 × 10.5 = 1550B1 ANSWER GIVEN3New s = $100 \times 4.85 = 485$ M1A1FT3(iii)On average Marlene sells more cars than Dwayne.E1 E1FT2(iiii)On average Marlene sells more cars than Dwayne.E1 E1FT2(iiii)On average Marlene sells more cars than Dwayne.TOTAL8	(11)	60 60 60 60 60 60 60 60 60 60	S1 labelled linear scales on both axes H1 heights	2
Q2 (i)TOTAL5Q2 (i) $\begin{pmatrix} 25\\ 5 \end{pmatrix}$ different teams = 53130M1 for $\begin{pmatrix} 25\\ 5 \end{pmatrix}$ A1 CAO2(ii) $\begin{pmatrix} 14\\ 3 \end{pmatrix} \times \begin{pmatrix} 11\\ 2 \end{pmatrix} = 364 \times 55 = 20020$ M1 for either combination M1 for product of both A1 CAO3Q3 (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 CAO3(ii)New mean = 500 + 100 × 10.5 = 1550 New s = $100 \times 4.85 = 485$ B1 <u>ANSWER GIVEN</u> M1A1FT3(iii)On average Marlene sells more cars than Dwayne. Marlene has less variation in monthly sales than Dwayne.E1 E1FT2(iii)On average Marlene sells more cars than Dwayne.E1 E1FT2	(iii)	Positive	B1	1
$\begin{array}{c} \mathbf{Q2}\\ (\mathbf{i})\\ \mathbf{i}\\ (\mathbf{i})\\ \mathbf{i}\\ (\mathbf{i})\\ \mathbf{i}\\ (\mathbf{i})\\ \mathbf{i}\\ (\mathbf{i})\\ \mathbf{i}\\ $			TOTAL	5
(ii) $\begin{pmatrix} 14\\3 \end{pmatrix} \times \begin{pmatrix} 11\\2 \end{pmatrix} = 364 \times 55 = 20020$ M1 for either combination M1 for product of both A1 CAO3Q3 (i)Mean $= \frac{126}{12} = 10.5$ B1 for mean3Q3 (i)Mean $= \frac{126^2}{12} = 259$ M1 for attempt at $Sxx$ 3 $s = \sqrt{\frac{259}{11}} = 4.85$ M1 for attempt at $Sxx$ 3(ii)New mean $= 500 + 100 \times 10.5 = 1550$ New $s = 100 \times 4.85 = 485$ B1 ANSWER GIVEN M1A1FT3(iii)On average Marlene sells more cars than Dwayne. Marlene has less variation in monthly sales than Dwayne.E1 E1FT2(iii)On average Marlene sells more than Dwayne.E1 E1FT2(iii)On average Marlene sells more than Dwayne.E1 E1FT2	Q2 (i)	$\begin{pmatrix} 25\\5 \end{pmatrix}$ different teams = 53130	M1 for $\begin{pmatrix} 25\\5 \end{pmatrix}$ A1 CAO	2
Q3 (i)Mean $= \frac{126}{12} = 10.5$ B1 for mean5Sxx $= 1582 - \frac{126^2}{12} = 259$ M1 for attempt at Sxx3 $s = \sqrt{\frac{259}{11}} = 4.85$ A1 CAO3(ii)New mean $= 500 + 100 \times 10.5 = 1550$ New $s = 100 \times 4.85 = 485$ B1 <u>ANSWER GIVEN</u> M1A1FT3(iii)On average Marlene sells more cars than Dwayne. Marlene has less variation in monthly sales than Dwayne.E1 E1FT2Image: Comparison of the case of	(ii)	$\binom{14}{3} \times \binom{11}{2} = 364 \times 55 = 20020$	M1 for either combination M1 for product of both A1 CAO	3
Q3 (i)Mean $= \frac{126}{12} = 10.5$ B1 for meanB1 for meanSxx $= 1582 - \frac{126^2}{12} = 259$ M1 for attempt at Sxx3 $s = \sqrt{\frac{259}{11}} = 4.85$ A1 CAOA1 CAO(ii)New mean $= 500 + 100 \times 10.5 = 1550$ New $s = 100 \times 4.85 = 485$ B1 ANSWER GIVEN M1A1FT3(iii)On average Marlene sells more cars than Dwayne. Marlene has less variation in monthly sales than Dwayne.E1 E1FT2Image: Constraint of the self of			TOTAL	5
Sxx = $1582 - \frac{126^2}{12} = 259$ M1 for attempt at Sxx3 $s = \sqrt{\frac{259}{11}} = 4.85$ A1 CAOA1 CAO(ii)New mean = 500 + 100 × 10.5 = 1550 New s = 100 × 4.85 = 485B1 ANSWER GIVEN M1A1FT3(iii)On average Marlene sells more cars than Dwayne. Marlene has less variation in monthly sales than Dwayne.E1 E1FT2Image: Comparison of the self o	Q3 (i)	Mean = $\frac{126}{12}$ = 10.5	B1 for mean	
(ii)New mean = $500 + 100 \times 10.5 = 1550$ New s = $100 \times 4.85 = 485$ B1 <u>ANSWER GIVEN</u> M1A1FT3(iii)On average Marlene sells more cars than Dwayne. Marlene has less variation in monthly sales than Dwayne.E1 		Sxx = $1582 - \frac{126^2}{12} = 259$ s = $\sqrt{\frac{259}{11}} = 4.85$	M1 for attempt at <i>Sxx</i> A1 CAO	3
New s = 100 × 4.85 = 485 M1A1FT 3   (iii) On average Marlene sells more cars than Dwayne. E1 2   Marlene has less variation in monthly sales than Dwayne. TOTAL 8	(ii)	New mean = 500 + 100 ×10.5 = 1550	B1 ANSWER GIVEN	
(iii)On average Marlene sells more cars than Dwayne.E1 E1FT2Marlene has less variation in monthly sales than Dwayne.TOTAL8		New s = 100 ×4.85 = 485	M1A1FT	3
Marlene has less variation in monthly sales than Dwayne. E1FT 2   TOTAL 8	(iii)	On average Marlene sells more cars than Dwayne.	E1	
TOTAL 8		Marlene has less variation in monthly sales than Dwayne.	E1FT	2
			TOTAL	8

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Q4 (i)	E(X) = 25 because the distribution is symmetrical.	E1 ANSWER GIVEN	1
	Allow correct calculation of Σrp		
(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 <sup>2</sup> = 105	M1 for $\Sigma r^2 p$ (at least 3 terms correct) M1dep for – 25 <sup>2</sup> A1 CAO	3
		TOTAL	4
Q5 (i)	Distance freq width f dens 0- 360 50 7.200 50- 400 50 8.000 100- 307 100 3.070 200-400 133 200 0.665	M1 for fds A1 CAO Accept any suitable unit for fd such as eg freq per 50 miles. L1 linear scales on both axes and label W1 width of bars H1 height of bars	5
(ii)	Median = 600th distance Estimate = $50 + \frac{240}{400} \times 50 = 50 + 30 = 80$	B1 for 600 <sup>th</sup> M1 for attempt to interpolate A1 CAO	3
		TOTAL	8
Q6 (i)	(A) P(at most one) $=\frac{83}{100}=0.83$	B1 aef	1
	(B) P(exactly two) = $\frac{10+2+1}{100} = \frac{13}{100} = 0.13$	M1 for (10+2+1)/100 A1 aef	2
(ii)	P(all at least one) = $\frac{53}{100} \times \frac{52}{99} \times \frac{51}{98} = \frac{140556}{970200} = 0.145$	M1 for $\frac{53}{100}$ × M1 <i>dep</i> for product of next 2 correct fractions A1 CAO	3
		TOTAL	6

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Q7 (i)	$a = 0.8, \ b = 0.85, \ c = 0.9.$	B1 for any one B1 for the other two	2
(ii)	P(Not delayed) = $0.8 \times 0.85 \times 0.9 = 0.612$	M1 for product	
	P(Delayed) = 1 − 0.8 × 0.85 × 0.9 = 1 − 0.612 = 0.388	M1 for 1 – P(delayed) A1FT	4
(iii)	P(just one problem)		
	= 0.2×0.85×0.9 + 0.8×0.15×0.9 + 0.8×0.85×0.1	B1 one product correct	
	= 0.153 + 0.108 + 0.068 = 0.329	M1 sum of 3 products A1 CAO	4
(iv)	P(Just one problem   delay)	M1 for numerator	
	$= \frac{P(Just one problem and delay)}{P(Delay)} = \frac{0.329}{0.388} = 0.848$	M1 for denominator A1FT	3
(v)	P(Delayed   No technical problems)	M1 for 0.15 +	
	<i>Either</i> = $0.15 + 0.85 \times 0.1 = 0.235$	M1 for second term	
	$Or = 1 - 0.9 \times 0.85 = 1 - 0.765 = 0.235$	M1 for product M1 for 1 – product A1CAO	
	$Or = 0.15 \times 0.1 + 0.15 \times 0.9 + 0.85 \times 0.1 = 0.235$	M1 for all 3 products M1 for sum of all 3 products A1CAO	
	Or (using conditional probability formula)		3
	P(Delayed and no technical problems)		
	P(NO technical problems) 0 8×0 15×0 1+0 8×0 15×0 9+0 8×0 85×0 1	M1 for numerator	
	=0.00000000000000000000000000000000000	will for denominator	
	$=\frac{0.188}{0.8}=0.235$	A1CAO	
(vi)	Expected number = $110 \times 0.388 = 42.7$	M1 for product	2
		TOTAL	18

Mark Scheme

Q8	X ~ B(15, 0.2)		
(i)	(1) $P(Y = 0)$ $(15)$ $0.03$ $0.012$ $0.0201$	M1 $0.2^3 \times 0.8^{12}$	
	(A) $P(X = 3) = \begin{pmatrix} 3 \\ 3 \end{pmatrix} \times 0.2^{5} \times 0.8^{5} = 0.2501$	M1 $\binom{15}{3} \times p^3 q^{12}$	
		A1 CAO	3
	OR from tables $0.6482 - 0.3980 = 0.2502$	OR: M2 for 0.6482 – 0.3980 A1 CAO	
	$(B)  P(X \ge 3) = 1 - 0.3980 = 0.6020$	M1 P( <i>X</i> ≤2)	3
		M1 1-P(X≤2) A1 CAO	2
	(C) $E(X) = np = 15 \times 0.2 = 3.0$	M1 for product A1 CAO	
(ii)	(A)Let $p$ = probability of a randomly selected child eating at least 5 a day $H_0$ : $p$ = 0.2 $H_1$ : $p$ > 0.2(B) $H_1$ has this form as the proportion who eat at least 5	B1 for definition of $p$ in context B1 for H <sub>0</sub> B1 for H <sub>1</sub> E1	4
	a day is expected to <u>increase</u> .		
(iii)	Let $X \sim B(15, 0.2)$ $P(X \ge 5) = 1 - P(X \le 4) = 1 - 0.8358 = 0.1642 > 10\%$ $P(X \ge 6) = 1 - P(X \le 5) = 1 - 0.9389 = 0.0611 < 10\%$ So critical region is {6,7,8,9,10,11,12,13,14,15}	B1 for 0.1642 B1 for 0.0611 M1 for at least one comparison with 10% A1 CAO for critical region <i>dep</i> on M1 and at least one B1	6
	7 lies in the critical region, so we reject null hypothesis and we conclude that there is evidence to suggest that the proportion who eat at least five a day has increased.	M1 <i>dep</i> for comparison A1 <i>dep</i> for decision and conclusion <b>in</b> <b>context</b>	
		TOTAL	18