Averages and Spread

Q1, (Edexcel 6683, Jan 2008, Q2)

(a)	mean is $\frac{2757}{12}, = 229.75$	AWRT 230	**M1, A1**
	sd is $\sqrt{\frac{724961}{12} - (229.75)^2}, = 87.34045$	AWRT 87.3	**M1, A1**
		[Accept s = AWRT 91.2]	
			(4)
(b)	Ordered list is: 125, 160, 169, 171, 175, 186, 210, 243, 250, 258, 390, 420		
	$Q_2 = \frac{1}{2}(186+210) = 198$		**B1**
	$Q_1 = \frac{1}{2}(169+171) = 170$		**B1**
	$Q_3 = \frac{1}{2}(250+258) = 254$		**B1**
			(3)
(c)	$Q_3 + 1.5(Q_3 - Q_1) = 254 + 1.5(254-170), = 380$	Accept AWRT (370-392)	**M1, A1**
	Patients F (420) and B (390) are outliers.		**B1ft B1ft**
			(4)

Q2, (AQA SS1B, Jan 2007, Q1)

(a)	Mean $(\bar{x})$ = 39.3 to 39.4	B1		AWFW (39.35)
	Standard Deviation (s_n, s_{n-1}) = 12.3 to 12.7	B2	3	AWFW (12.358 or 12.679)
	If **neither** correct **but** working shown, then			$\sum x = 787$ $\sum x^2 = 34023$
	Mean $(\bar{x}) = \frac{\sum x}{20}$	(M1)		Used
(b)	Median = 42	B2		CAO
	Median = 41.5 or 39 or 40	(B1)		CAO
	Interquartile Range = 55 – 31 = 24	B2	4	CAO; allow B1 for identification of 31 and 55; B0 if method shown is incorrect
	Interquartile Range = 21 to 27	(B1)		AWFW
(c)(i)	**Mode:** eg Does not exist If exists, must be > 60 or 58 All / too many different values Sparse data	B1		OE
(ii)	**Range:** eg **Maximum value** is unknown / > 60 or 58	B1	2	OE; accept 'slowest' but not 'smallest'
		Total	**9**	

Q3, (Edexcel 6683, Jan 2012, Q4)

(a)	60		B1
			(1)
(b)	$Q_1 = 46$		B1
	$Q_2 = 56$		B1
	$Q_3 = 64$		B1
			(3)
(c)	mean = 55.48…. or $\frac{2497}{45}$	awrt 55.5	B1
	$sd = \sqrt{\frac{143369}{45} - \left(\frac{2497}{45}\right)^2}$		M1
	= 10.342… (s = 10.459..)	anything which rounds to 10.3 (or s = 10.5)	A1
			(3)

Q4, (OCR 4732, Jun 2006, Q7)

7(i)				Correct (149.5)	With 150	Tot = 2000
	Midpoints attempted ≥ 2 classes	M1				
	$\sum xf$ / 100 or $\sum xf$ / $\sum f$ attempted ≥ 2 terms	M1				
	x within class, not class width			2720.5/100	2725/100	Allow Ms
	Mean = 27.2 (to 3 sfs) (not 27.25)					
	art 27.2 from fully correct wking	A1				
	$\sum x^2 f$ or $\sum x - \bar{x})^2 f$ ≥ 2 terms	M1				& poss As
	$\sqrt{(\sum x^2 f/100 - \bar{x}^2)}$ or $\sqrt{((\sum x - \bar{x})^2 f/100)}$ or $/\sum f$	M1				
	fully corr method, not √neg			27.2	27.25	
		A1	**6**	240702.25	242050	
	= 40.5 to 41.1 (3 sfs)			40.82	40.96	
				allow class widths for 2nd M1 only		
(ii)	Recog LQ in 1st class & UQ in 3rd class	B1				
	Graph: Interp:					
	Attempt 25(.25)th value LQ = 3.0 to 4.3					
	Attempt 75(.75)th value UQ =27 to 29	M1		both nec'y		
	Subtract	M1		dep B1or M1		
	IQR = 23 or 24 or 25	A1	**4**	integer. dep M2		
(iii)(a)	Increase	B1	**1**			
(b)	Increase	B1	**1**	Ignore "probably" etc		
(c)	No change	B1	**1**			
Total		**13**				

Q5, (AQA SS1B, Jan 2008, Q6a-bi)

(a)(i)	x: 0 1 2 3 4 5 6 7 8 9 F: 30 109 208 276 336 360 371 377 379 380			
	Median ($\approx 190.5^{th}$) = 2	B2		CAO; B0 if shown method incorrect
	Interquartile range ($\approx 285.75^{th} - \approx 95.25^{th}$) = 4 – 1 = 3	B2	4	CAO; B0 if shown method incorrect B1 for identification of 4 and 1
	If neither is correct but F attempted	(M1)		Allow for median = $1+\frac{x}{99}$
	and matched correctly with ≥ 5 x-values	(A1)		
(ii)	Mean $(\bar{x})$ = 2.56 to 2.57	B2		AWFW (2.56316)
	(2.5 to 2.6)	(B1)		AWFW $\sum fx = 974$ and $\sum fx^2 = 3546$
	Standard Deviation (s_n, s_{n-1}) = 1.66 to 1.67	B2	4	AWFW (1.66187)
	(1.6 to 1.7)	(B1)		AWFW (1.66406)
	If neither is correct but $\sum fx$ attempted	(M1)		
	and result divided by 380	(M1)		
(b)(i)	Average: Same/similar/greater in 2004/05	B1 dep		OE; dep on 2 and 2.5 to 2.6
	Spread: Similar/greater in 2004/05	B1 dep	2	OE; dep on 3 and 1.6 to 1.7

Q6, (AQA SS1B, Jun 2011, Q1)

(a)(i)	Mode = **253**	B1	1	CAO
(ii)	Median = **252**	B1		CAO
	Upper quartile = **253**	B1		CAO; either May be implied by IQR = 3
	Lower quartile = **250**			
	Interquartile range = **3**	B1	3	CAO; do not award if **seen** to be not based on 253 and 250
(b)(i)	Range = 271 – 227 = **44**	B1	1	CAO; do not award if **seen** to be not based on 271 and 227
(ii)	Mean, $\bar{x}$ = **251 to 251.4** *Award B1 if divisor **seen** not to be 85 but answer in range* **Note:** If B0 then can award M1 for attempt at $\sum fx \div 85$ **seen**	B2		AWFW $\sum fx$ = 21352 $\bar{x}$ = 251.2 *Ignore notation and condone incorrect midpoints (eg upper or lower limits used)*
	Standard deviation, s or σ = **4.21 to 4.28** *Award B1 if divisor **seen** not to be 84 or 85 but answer in range*	B2	4	AWFW $\sum fx^2$ = 5365134 σ = 4.217 s = 4.242
(c)	Interquartile range (IQR)	B1		Named
	Not affected by unknown/large/small/extreme/ outlying/227 & 271 values	Bdep1	2	Or equivalent Dependent on previous B1 Only negative comments on other measures ⇒ Bdep0
	OR			*More than one named ⇒ B0 Bdep0* *Range ⇒ B0 Bdep0*
	Standard deviation (s or σ)	(B1)		Named
	Uses all data values	(Bdep1)		Or equivalent Dependent on previous (B1) Only negative comments on other measures ⇒ Bdep0
	Total		**11**	