Single Sample and Paired Sample Sign Tests (From OCR 4735)

Q1, (Jun 2008, Q2)

(i)	Wilcoxon test requires a symmetric distribution not supported by the diagram	B1	**1**		Or equivalent
(ii)	H_0: $m = 1.80$, H_1: $m > 1.80$		B1		Needs "population median" if words
	Use sign test	M1			
	Number exceeding 1.8 = 20	A1			
	Use B(30,0.5), P(≥20) Or P(≤10)	M1			
	0.0494	A1			
	Compare with 0.05 correctly	M1			OR: 1.645 if N(15,7.5) , z =1.643, 1.816, 2.008
	Conclude there is significant evidence that the median time exceeds 1.80 sec	A1√	**7**	**(8)**	used; OR CR ($X \geq 20$) ft p or z

Q2, (Jun 2009, Q2)

(i)	Non-parametric test used when the distribution of the variable in question is unknown	B1	**1**	
(ii)	H_0: $m_{V-A} = 0$, H_1: $m_{V-A} \neq 0$ where m_{V-A} is the median of the population differences	B1		Allow $m_V = m_A$ etc
	Difference and rank, bottom up	M1		
	$P = 65$ $Q = 13$	A1		Allow $P > Q$ stated
	$T = 13$	B1		
	Critical region: $T \leq 13$	M1		
	13 is inside the CR so reject H_0 and accept that there is sufficient evidence at the 5% significance level that the medians differ	A1		Penalise over-assertive conclusions once only.
	Use B(12, 0.5)	M1		
	P(≤ 4) = 0.1938 or CR = {0,1,2,10,11,12}	A1		
	> 0.025, accept that there is insufficient evidence, etc CWO	A1	**9**	Or 4 not in CR
(iii)	Wilcoxon test is more powerful than the sign test	B1	**1** **{11}**	Use more information, more likely to reject NH

Q3, (Jun 2012, Q5)

(i)	For $n = 4$ P(X = 0) or P($X = 4$) = $2^{-4} = 0.0625$ 0.0625 > 0.05 so H_0 cannot be rejected	M1 A1 **[2]**	or 0.9375<0.95	
(ii)	Sample of times considered random	B1	Allow 'data above or below median'	
	$H_0: m = 30$, $H_1: m < 30$	B1	Both hypotheses, median or m	
	Use sign test	M1	May be implied	
	$X \sim B(72, ½)$	M1		No , or wrong ,CC (27.5 or 44.5) -1.886 or -2.003 M0
	P($X \leq 28$) = (from N(36,18)	M1		Any other CC M0
	Φ (28.5or 43.5 – 36)/$18^{1/2}$	M1	=(-)1.767	
	= 0.0385 or 0.0386	A1	or CV=(-)1.645	0.0297 or 0.0227 A1
	Or from B(72, ½) = 0.0382	A2	Using calculator procedure	0.03818457
	Compare with 0.05 and reject H_0	M1	or -1.767<-1.645	No, or wrong, CC M1A1ft
	There is sufficient evidence to accept that the median time for Elena's swims is less than 30s	A1ft **[9]**	not over-assertive	

Q4, (Jun 2016, Q1)

(i)		$H_0: p = ½$, $H_1: p > ½$	B1	For both. Allow any sensible hypotheses.	
		Find signs of differences	M1	+++-++-++- or vv	
		Obtain 7+, 3-	A1	or vv	
		Attempt P($X \geq 7$) or P($X \leq 3$)	M1ft		Attempt to find CR. M1 (not ft)
		0.1719	A1ft	Allow 0.172 (0.0547 from 8+)	$X \geq 9$ or $X \leq 1$ A1 (not ft)
		"0.1719" > 0.05, so do not reject H_0	M1	Ft candidate's p.	"7" (or "3") not in CR, so d.n.r. H_0 ft
		Insuff. evidence that type P is better.	A1 **[7]**	In context, not over-assertive. Cwo.	NOT "suff evidence that there is no difference between the bows."
(ii)		Magnitude of differences taken into account.	B1 **[1]**	Uses more information. More powerful.	