Question	Scheme	Marks
3. (i)(a)	Middle Right Pivot 28 18 50 27 48 8 25 12 56 31 33 42 25 18 8 12 **25** 28 50 27 48 56 31 33 42 8, 56 **8** 18 12 **25** 28 50 27 48 31 33 42 **56** 12, 48 **8** **12** 18 **25** 28 27 31 33 42 **48** 50 **56** (18), 31, (50) **8** **12** **18** **25** 28 27 **31** 33 42 **48** **50** **56** 27, 42 **8** **12** **18** **25** **27** 28 **31** 33 **42** **48** **50** **56** Middle Left Pivot 28 18 50 27 48 8 25 12 56 31 33 42 8 **8** 28 18 50 27 48 25 12 56 31 33 42 25 **8** 18 12 **25** 28 50 27 48 56 31 33 42 18, 48 **8** 12 **18** **25** 28 27 31 33 42 **48** 50 56 (12), 31, 50 **8** **12** **18** **25** 28 27 **31** 33 42 **48** **50** 56 28, 33, (56) **8** **12** **18** **25** 27 **28** **31** **33** 42 **48** **50** **56**	**M1** **A1** **A1ft** **A1**
		(4)

(i)(b)	8 12 18 25 27 28 **31** 33 42 48 50 56 Pivot 31 31 < 40 so discard 31 and below 33 42 **48** 50 56 Pivot 48 48 > 40 so discard 48 and above 33 **42** Pivot 42 42 > 40 so discard 42 **33** 33 ≠ 40 so 40 is not in the list	**M1** **A1** **A1**
	Alternatively 56 50 48 42 33 31 **28** 27 25 18 12 8 Pivot 28 28 < 40 so discard 28 and below 56 50 48 **42** 33 31 Pivot 42 42 > 40 so discard 42 and above 33 **31** Pivot 31 31 < 40 so discard 31 33 33 ≠ 40 so 40 is not in the list	
		(3)
(ii)	$x > 15$ or $x < 19$ o.e. $x > 15$ and $x < 19$ leading to $15 < x < 19$ or $16 \leqslant x \leqslant 18$ o.e.	**B1** **B1**
		(2)
		(9 marks)

Notes	
ia1M1	Quick sort using all 12 numbers (condone one item error or omission), pivot, p, chosen (must be choosing middle left or right – choosing first/last item as the pivot is M0). After the first pass the list must read (values less than the pivot), pivot, (values greater than the pivot). **If only choosing one pivot per iteration then M1 only**
ia1A1	First and second passes correct, but not choice of pivots for 3rd pass
ia2A1ft	Third and fourth passes correct following through from their second pass and choice of pivots for the third pass. The pivots for the third, and fourth passes must be consistent (so all MR or all ML)
ia3A1	CSO (correct solution only – all previous marks in this part **must** have been awarded) including a fifth pass (with both 27 and 42 chosen as pivots MR or both 28 and 33 chosen as pivots ML)
	Special Case for (a) If the candidate sorts into descending order they can score M1 as per the main scheme (but with the values either side of the pivot reversed), A1 for a fully correct sort then A0 A0 even if the list is reversed at the end (so 2 marks max.). See below
ib1M1	Correct choice of pivot (**must be using MR**) (31 ascending or 28 descending) and discards 8 to 31 or 28 (must be using the sorted list, but could be sorted into either ascending or descending order) It must be clear which values are being discarded or the reduced list must be shown. If pivots are retained, this will score M1 only. Candidates may either compare with the actual values or the positions of items in a correctly sorted list. The actual rejections may be shown as values from the list or the positions in the list. (If they do not not have the correct 12 numbers in their sorted list in (a) they can score M1 only for using their sorted list here)
ib1A1	2nd and 3rd pass correct choice of pivots and discards (if pivot not discarded A0)
ib2A1	CSO - Final pass correct, compares with 33 and concludes 40 is not in list
ii1B1	One inequality correct – if a list of inequalities is seen, they must clearly select from this list otherwise B0
ii2B1	Both inequalities correct and combined to give a range of values (accept either form or list of values 16, 17, 18) (SC if just 16, 17, 18 seen accept this for both marks) (accept interval notation either (15, 19) or [16, 18])

Special Case Descending Max M1 A1 A0 A0
Middle Right

												Pivot
28	18	50	27	48	8	25	12	56	31	33	42	25
28	50	27	48	56	31	33	42	**25**	18	8	12	56, 8
56	28	50	27	48	31	33	42	**25**	18	12	**8**	48, 12
56	50	**48**	28	27	31	33	42	**25**	18	**12**	**8**	(50), 31, (18)
56	**50**	**48**	33	42	**31**	28	27	**25**	**18**	**12**	**8**	42, 27
56	50	48	42	33	31	28	27	25	18	12	8	

Middle Left

												Pivot
28	18	50	27	48	8	25	12	56	31	33	42	8
28	18	50	27	48	25	12	56	31	33	42	**8**	25
28	50	27	48	56	31	33	42	**25**	18	12	**8**	48, 18
50	56	**48**	28	27	31	33	42	**25**	**18**	12	**8**	50, 31, (12)
56	**50**	**48**	33	42	**31**	28	27	**25**	**18**	**12**	**8**	33, 28
56	50	48	42	33	31	28	27	25	18	12	8	