

2(a)	One mark per mark point (Max 2) MP1 Correct mantissa MP2 Correct exponent Mantissa <table><tr><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td></tr></table> Exponent <table><tr><td>1</td><td>0</td><td>0</td><td>1</td></tr></table>	0	1	1	1	0	1	0	1	1	0	1	0	1	0	0	1
0	1	1	1	0	1	0	1	1	0	1	0						
1	0	0	1														
2(b)	One mark per mark point (Max 4) MP1 correct method to find the binary number MP2 additional working towards binary number MP3 correct use of exponent MP4 correct answer in the space provided Two from: e.g. 76.1875 = 64+8+4+0.125+0.0625 (0)1001100.0011 −76.1875 = −128+32+16+2+1+0.5+0.25+0.0625 10110011.11 01 One mark movement of binary point by 7 places // 1.011001111 01 x 2⁷ One mark Mantissa <table><tr><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td></tr></table> Exponent <table><tr><td>0</td><td>1</td><td>1</td><td>1</td></tr></table>	1	0	1	1	0	0	1	1	1	1	0	1	0	1	1	1
1	0	1	1	0	0	1	1	1	1	0	1						
0	1	1	1														

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0	1	1	0	1	0	1	1	1	0								
1	1	1	0	1	0												
2(b)	One mark per mark point for working (Max 2) - number converted to binary e.g., positive binary version of 25.3125 = (0)11001.0101 - two's complement version bits flipped and 1 added = 100110.1011 -32 + 4 + 2 + 0.5 + 0.125 // -32 + 4 + 2 + 1/2 + 1/8 + 1/16 - movement of binary point seen (5 places) One mark per mark point - correct mantissa - correct exponent Mantissa <table><tr><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td></tr></table> Exponent <table><tr><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td></tr></table>	1	0	0	1	1	0	1	0	1	1	0	0	0	1	0	1
1	0	0	1	1	0	1	0	1	1								
0	0	0	1	0	1												

2(a)	Two marks for working • number converted to binary (0)1111100.0111 • use of exponent = 7 // Moving binary point the correct number (7) of places One mark for correct answer Mantissa <table><tr><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td></tr></table> Exponent <table><tr><td>0</td><td>1</td><td>1</td><td>1</td></tr></table>	0	1	1	1	1	1	0	0	0	1	1	1	0	1	1	1
0	1	1	1	1	1	0	0	0	1	1	1						
0	1	1	1														
2(b)	Two marks for working • correct use of exponent seen • correct conversion method from binary to denary One mark for correct answer Working: 1010001.01011 // moving bp 6 places to right Evaluation of two's complement $-64 + 16 + 1 + 0.25 + 0.0625 + 0.03125$ // $-64 + 16 + 1 + 1/4 + 1/16 + 1/32$ // Converting two's complement back and evaluating positive binary number $32 + 8 + 4 + 2 + 0.5 + 0.125 + 0.03125$ // $32 + 8 + 4 + 2 + 1/2 + 1/8 + 1/32$ Fractions methods - award both working marks for either $(-2048 + 512 + 32 + 8 + 2 + 1) / 2048 \times 2^6 = -1493 / 32$ OR $-1 + 1/4 + 1/64 + 1/256 + 1/1024 + 1/2048 \times 2^6 = -1493 / 32$ Answer: -46.65625 // $-46^{21}/_{32}$																

1(a)	One mark per mark point (Max 1) - correct answer - statement regarding number losing precision/rounding error One mark per mark point for working (Max 2) - number converted to binary $201.125 = 11001001.001$ // $128 + 64 + 8 + 1 + 0.125 / \frac{1}{8}$ seen - use of the exponent e.g. moving the binary point 8 places / $\times 2^8$. <table><tr><th colspan="10">Mantissa</th><th colspan="6">Exponent</th></tr><tr><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td></tr></table>	Mantissa										Exponent						0	1	1	0	0	1	0	0	1	0	0	0	1	0	0	0
Mantissa										Exponent																							
0	1	1	0	0	1	0	0	1	0	0	0	1	0	0	0																		
1(b)	One mark per mark point (Max 2) - application of exponent to go from 1.010110011 to 101011.0011 // $\times 2^5$ // movement of binary point 5 places seen $-32 + 8 + 2 + 1 + .125 + .0625$ // $-32 + 8 + 2 + 1 + \frac{1}{8} + \frac{1}{16}$ seen // $-1 + \frac{1}{4} + \frac{1}{16} + \frac{1}{32} + \frac{1}{256} + \frac{1}{512}$ // $-1 + \frac{179}{512}$ // $-\frac{333}{512}$ One mark for correct answer (Max 1) -20.8125 // -20^{13}_{16}																																

4(a)	One mark for working - application of exponent to mantissa to go from 0.10001110111 to 01000111.0111 // moving the binary point 7 places // multiplying by $2^7/128$ in the fractions method // $64 + 4 + 2 + 1 + .25 + .125 + .0625$ seen One mark for correct answer 71.4375 // $71\frac{7}{16}$																
4(b)	One mark per mark point (Max 2) - correct mantissa – exact answer only - correct exponent – exact answer only Mantissa <table><tr><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td></tr></table> Exponent <table><tr><td>0</td><td>1</td><td>1</td><td>0</td></tr></table> One mark per mark point for working (Max 2) - number converted to binary e.g., positive binary version of 49.1875 = 0110001.0011 // two's complement version bits flipped and 1 added = 1001110.1101 // $-64 + 8 + 4 + 2 + .5 + .25 + .0625$ // $-64 + 14.8125$ - use of the exponent e.g. moving the binary point 6 places / $\times 2^6$.	1	0	0	1	1	1	0	1	1	0	1	0	0	1	1	0
1	0	0	1	1	1	0	1	1	0	1	0						
0	1	1	0														