

**Algorithms 1B**

1 a

$a$	$b$	$c$	$d$	$d < 0?$	$d = 0?$	$x$
4	-12	9	0	No	Yes	1.5

Equal roots  $x = 1.5$

b

$a$	$b$	$c$	$d$	$d < 0?$	$d = 0?$	$x_1$	$x_2$
-6	13	5	289	No	No	$-\frac{1}{3}$	$\frac{5}{2}$

Roots are  $-\frac{1}{3}$  and  $\frac{5}{2}$

c

$a$	$b$	$c$	$d$	$d < 0?$
3	-8	11	-68	Yes

No real roots.

2 a i

	$n$	$A$	$T$	$T < A?$	$n < 5?$
box 1	1	28			
box 2	2				
box 3			26		
box 4				Yes	
box 5		26			
box 6					Yes
box 2	3				
box 3			23		
box 4				Yes	
box 5		23			
box 6					Yes
box 2	4				
box 3			25		
box 4				No	
box 6					Yes
box 2	5				
box 3			21		
box 4				Yes	
box 5		21			
box 6					No
box 7	Output is 21				

2 a ii

	$n$	$A$	$T$	$T < A?$	$n < 5?$
box 1	1	11			
box 2	2				
box 3			8		
box 4				Yes	
box 5		8			
box 6					Yes
box 2	3				
box 3			9		
box 4				No	
box 6					Yes
box 2	4				
box 3			8		
box 4				No	
box 6					Yes
box 2	5				
box 3			5		
box 4				Yes	
box 5		5			
box 6					No
box 7	Output is 5				

b It will find the largest number in the list.

c box 6 – changed to ‘Is  $n < 8$ ?’

3 a

$a$	$b$	$ a - b $	$ a - b  < 0.001?$
2	1.7652	0.2348	No
1.7652	1.8112	0.046	No
1.8112	1.8029	0.0083	No
1.8029	1.8044	0.0015	No
1.8044	1.8041	0.0003	Yes

Output 1.8041 (4 d.p.)

b

$a$	$b$	$ a - b $	$ a - b  < 0.001?$
20	-5.7740	25.774	No
-5.7740	-2.0931	3.6809	No
-2.0931	1.7446	3.8377	No
1.7446	1.8149	0.0703	No
1.8149	1.8022	0.0127	No
1.8022	1.8045	0.0023	No
1.8045	1.8041	0.0004	Yes

Output 1.8041 (4 d.p.)

The sequence produced in part **b** is initially quite different to the sequence produced in part **a** but both sequences converge to the same root.

4 a i

$a$	$b$	$p$	$q$	$r$	$r = 0?$
507	52				
		9			
			468		
				39	
					No
52	39				
		1			
			39		
				13	
					No
39	13				
		3			
			39		
				0	
					Yes

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a ii

$a$	$b$	$p$	$q$	$r$	$r = 0?$
884	85				
		10			
			850		
				34	
					No
85	34				
		2			
			68		
				17	
					No
34	17				
		2			
			34		
				0	
					Yes

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4 a iii

$a$	$b$	$p$	$q$	$r$	$r = 0?$
4845	3795				
		1			
			3795		
				1050	
					No
3795	1050				
		3			
			3150		
				645	
					No
1050	645				
		1			
			645		
				405	
					No
645	405				
		1			
			405		
				240	
					No
405	240				
		1			
			240		
				165	
					No
240	165				
		1			
			165		
				75	
					No
165	75				
		2			
			150		
				15	
					No
75	15				
		5			
			75		
				0	
					Yes

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b Euclid's algorithm finds the HCF.

5 a

$A$	$B$	$A < B?$	Output
18	7	No	
11	7	No	
4	7	Yes	4

- b** The flow diagram calculates the remainder when  $A$  is divisible by  $B$ .
- c** The output is 0.  $A$  is completely divisible by  $B$  for some positive integer  $k$ .