

D1 Pseudo code

Challenge 1

(a) Trace the following algorithm.



```
Line 1    A = 1
Line 2    LABEL X
Line 3    B = A * A * A
Line 4    IF B > 100 THEN GOTO Y
Line 5    PRINT A, B
Line 6    A = A + 1
Line 7    GOTO X
Line 8    LABEL Y
Line 9    STOP
```

(3 marks)

(b) Explain how your trace table would change if lines 1 and 2 were interchanged. (2 marks)

Challenge 2

The following algorithm is to be used on different sets of numbers.

```
Line 10  INPUT  $X, Y$ 
Line 20  LET  $A = Y$ 
Line 30  LET  $B = 0$ 
Line 40  LET  $A = A - X$ 
Line 50  LET  $B = B + 1$ 
Line 60  IF  $A \geq X$  THEN GOTO Line 40
Line 70  PRINT  $A, B$ 
Line 80  STOP
```



- (a) Trace the algorithm:
- (i) in the case when $X = 5$ and $Y = 20$; *(2 marks)*
 - (ii) in the case when $X = 7$ and $Y = 29$. *(3 marks)*
- (b) State the purpose of the algorithm. *(2 marks)*

Challenge 3

The algorithm below is used to generate a sequence of numbers.

```
LINE 10  INPUT A, B
LINE 20  PRINT A, B
LINE 30  LET C = A + B
LINE 40  PRINT C
LINE 50  LET A = B
LINE 60  LET B = C
LINE 70  IF C < 10 THEN GOTO LINE 30
LINE 80  END
```



(a) Trace the algorithm when $A = 1$ and $B = 1$. (4 marks)

(b) Suppose that LINE 70 is changed to

IF $C < 50$ THEN GOTO LINE 30.

Write down the extra values that C now takes. (2 marks)

(c) A student mistypes LINE 60 as LET $C = B$.

Find the values of A , B and C that the student would get using the amended algorithm. (4 marks)

Final Challenge

A student is using the algorithm below to find the real roots of a quadratic equation.

```
LINE 10      INPUT A, B, C
LINE 20       $D = B^2 - 4 * A * C$ 
LINE 30       $X_1 = (-B + \sqrt{D}) / (2 * A)$ 
LINE 40       $X_2 = (-B - \sqrt{D}) / (2 * A)$ 
LINE 50      IF  $X_1 = X_2$  THEN GOTO L
LINE 60      PRINT "DIFFERENT ROOTS",  $X_1$ ,  $X_2$ 
LINE 70      GOTO M
LINE 80      LABEL L
LINE 90      PRINT "EQUAL ROOTS",  $X_1$ 
LINE 100     LABEL M
LINE 110     END
```



(a) Trace the algorithm

(i) if $A = 1$, $B = -4$, $C = 4$,

(2 marks)

(ii) if $A = 2$, $B = 9$, $C = 9$.

(2 marks)

(b) (i) Find a set of values of A , B and C for which the algorithm would fail.

(2 marks)

(ii) Write down additional lines to ensure that the algorithm would not fail for **any** values of A , B and C that may be input.

(4 marks)