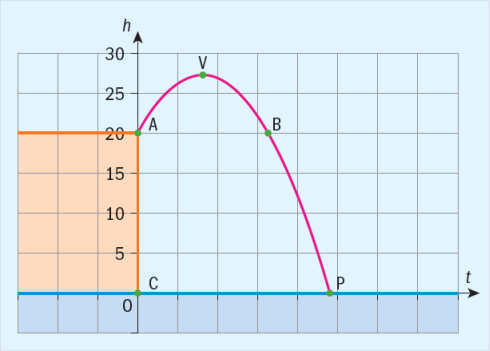
Chapter 6 / **Example 5**

Quadratic modelling

There are two methods you can use to do this.

A student wants to model the path of a rock with respect to time.
He is standing at the top of a vertical cliff at a height of 20 m and throws a rock upwards as shown in the diagram.
He starts counting time at the instant he throws the rock, at point A.
He measures that the time at which the rock is again at eye level, at point B, is $t = 3.26$ s.



He finally measures that the time at which the rock falls into the sea, at point P, is $t = 4.8$ s.
The function that will model the height of the rock with respect to time is a quadratic function of the form $h(t) = at^2 + bt + c$.

Find the equation of the function that will model the height h of the ball at time t.

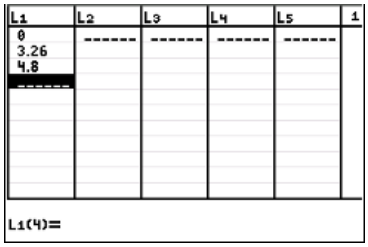
Method 1: Using **Quadratic regression**

You need to identify three clear points on the curve. Known points are A(0, 20), B(3.26, 20) and P(4.8, 0).

Press [STAT] 1:Edit and press [ENTER]

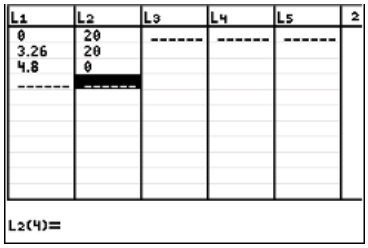
Enter the x-coordinates in the first column.

Press [ENTER] or [▼] after each number to move to the next cell.



Press [▶] to move to the next column.

Enter the y-coordinates in the second column.



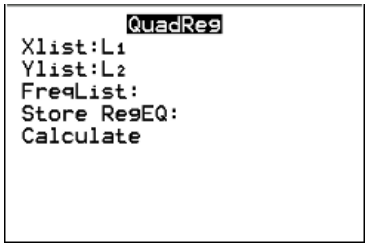
To calculate the equation of quadratic regression

Press [STAT] and [▶] to access the CALC menu.

Select 5:QuadReg and press [ENTER].

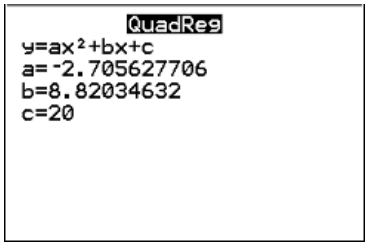
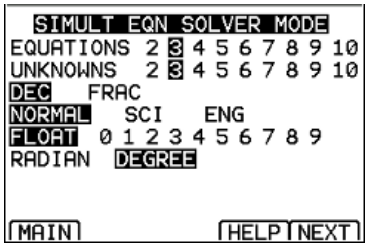
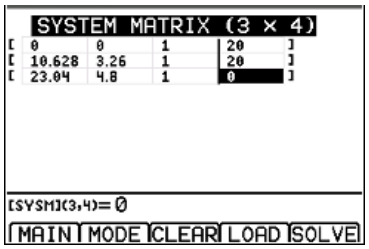
Leave the X List as L_1 and the Y List as L_2.

Navigate down to Calculate and press [ENTER].



Chapter 6 / **Example 5**

Quadratic modelling

The parabola is given by the equation $h(t) = -2.71t^2 + 8.82t + 20$.	
Method 2: Using **Simultaneous equation solver**. Curve passes through (0, 20), (3.26, 20) and (4.8, 0) as above. Substituting these points into the general equation of a parabola, $y = ax^2 + bx + c$. $a(0)^2 + b(0) + c = 20$ $a(3.26)^2 + b(3.26) + c = 20$ $a(4.8)^2 + b(4.8) + c = 0$	
Press APPS :PlySmlt2 Press ENTER 2:SIMULTANEOUS EQN SOLVER Select 3 equations with 3 unknowns and DEC. Press F5 NEXT.	
Enter the three equations into the system matrix. Press F5 SOLVE. Enter 3.26^2 and 4.8^2 directly, the solver APP will calculate these for you.	
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