Chapter 13 / **Example 7**

Average and instantaneous velocity

A diver jumps from a platform at time $t = 0$ seconds. The distance of the diver above the water level at time t seconds is given by $s(t) = -4.9t^2 + 4.9t + 10$, where s is in metres.

a Find the average velocity of the diver during the dive.

b Find the velocity of the diver at the instant the diver hits the water.

c Explain why the answer to part b is negative.

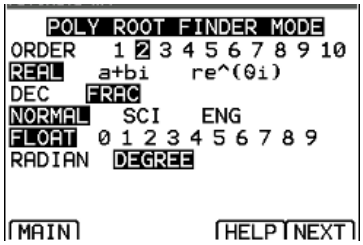
d Find the speed of the diver at the instant the diver hits the water.

Solve $s(t) = 0$ where $t \geq 0$

Press [APPS] :PlySmlt2

Press [enter] [enter] [enter]

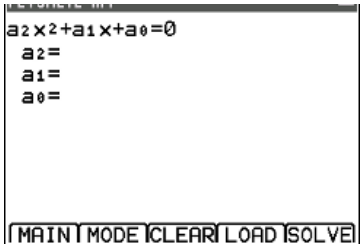
You are solving a quadratic (degree 2) with real roots so press [f5] NEXT.



Enter to coefficients into the template. Press [tab] to navigate through the template.

$a_2 = -4.9$, $a_1 = 4.9$ and $a_0 = 10$

[f5] SOLVE.



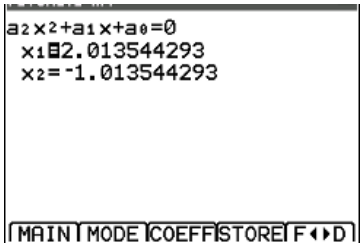
To be able to use the most accurate value of t in the following calculations store this value of t.

Press [f4] STORE and choose STORE ROOTS TO LIST.

Press [enter] and choose the list L_1 by pressing [2nd] [1] ([L1]).

Press [enter], [f1] MAIN and 6:QUIT APP

The positive value x1 will be stored as $L_1(1)$



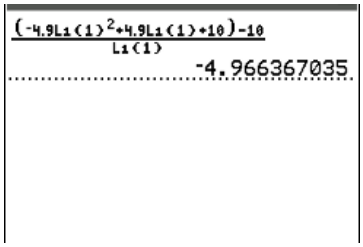
Find the average velocity over the interval [0, 2.01354] using the formula $\frac{s(t) - s(0)}{t - 0}$

Clearly $s(0) = 10$

Press [ALPHA] [f1] 1:n/d to select the fraction template.

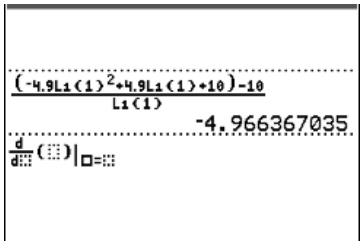
Type (– 4.9 $L_1(1)$ [x^2] + 4.9 $L_1(1)$ + 10) – 10 in the numerator and $L_1(1)$ in the denominator.

Average velocity = -4.97 ms^{-2}.



Chapter 13 / **Example 7**

Average and instantaneous velocity

To calculate the instantaneous velocity when diver hits the water find $s'(t)$ when t = 2.01… To calculate the instantaneous rate of change press alpha [f2] 3:nDeriv The template has spaces for the variable, x, the function and the value that it is evaluated at.	
Although the function is expressed in terms of t, the variable used on the GDC will be x. Enter X in the denominator and type in the function $-4.9x^2 + 4.9x + 10$. Enter $L_1(1)$ as the value of x. Press enter. The instantaneous velocity when the diver hits water is -14.8 ms^{-1}.