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.

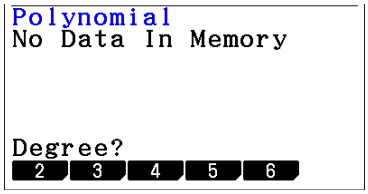
a Find the average velocity of the diver during the dive.
b Find the velocity of the diver at the instant the diver hits the water.
c Explain why the answer to part b is negative.
d Find the speed of the diver at the instant the diver hits the water.

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

Press MENU A EQUA to enter equation mode.

Press F2 Polynomial

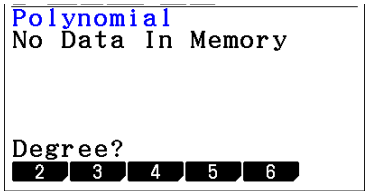
You are solving a quadratic (degree 2) so press F1 2.



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

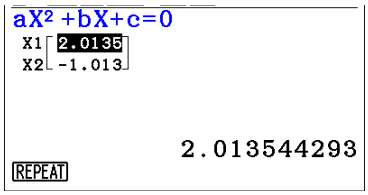
$a = -4.9$, $b = 4.9$ and $c = 10$

Press F1 SOLVE.



Press S⇔D to display the results as decimals.

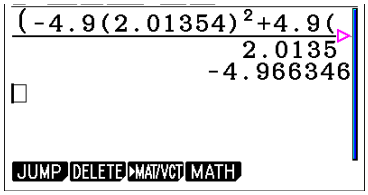
To be able to use the most accurate value of t you will want to use an accurate value of t for the remainder of the question. Use $t = 2.01354$.



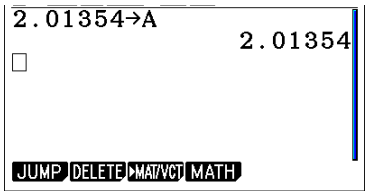
Find the average velocity over the interval [0, 2.01354] using the formula $\frac{s(t) - s(0)}{t - 0}$

Clearly $s(0) = 10$

Press MENU 1 RUN·MAT to display the Run-Matrix screen for arithmetical calculations.

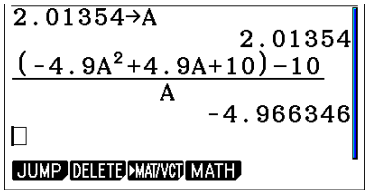
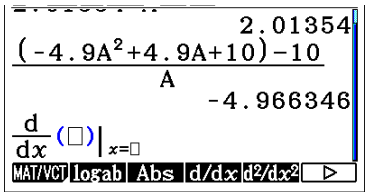


Type 2.01354 → ALPHA X,θ,T (A) to store the value of t as a variable A.



Chapter 13 / **Example 7**

Average and instantaneous velocity

Press ▦ to select the fraction template. Type (− 4.9 ALPHA A x^2 + 4.9 ALPHA A + 10) − 10 in the numerator and ALPHA A in the denominator. Press EXE. Average velocity = -4.97 ms^{-2}.	
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 F4 MATH F4 d/dx The template has spaces for 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 A as the value of x. Press EXE. The instantaneous velocity when the diver hits water is -14.8 ms^{-1}.