

Chapter 13 / **Example 7****Average and instantaneous velocity**

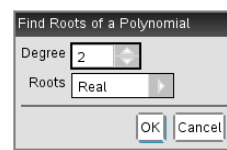
A diver jumps from a platform at time $t = 0$ seconds. The distance of the diver above the water level at time t seconds is given by $s(t) = -4.9t^2 + 4.9t + 10$, where s is in metres.

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

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

Press **menu** 3:Algebra | 3:Polynomial Tools | 1:Find Roots of Polynomial...

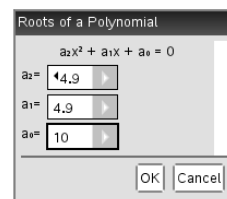
You are solving a quadratic (degree 2) with real roots so press **enter**.



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

$$a_2 = -4.9, a_1 = 4.9 \text{ and } a_0 = 10$$

Press **enter**.



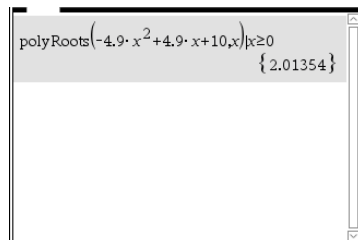
The GDC displays the function that solves the quadratic equation.

Since you only want positive solutions add the condition $x \geq 0$.

Enter **ctrl** **=** (**|#>**) and select the vertical bar (|), type X, enter **ctrl** **=** (**|#>**) and select \geq and type 0.

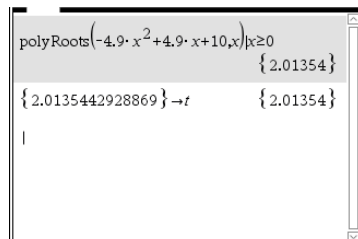
Press **enter**.

The positive solution is 2.01...



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

Press **ctrl** **var** **sto** **T** and press **enter** to store this value as a variable t .



Chapter 13 / **Example 7****Average and instantaneous velocity**

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

Press $\boxed{\text{ctrl}}$ $\boxed{\frac{\square}{\square}}$ to enter a fraction template.

Type $(-4.9 \text{ T } \boxed{x^2} + 4.9 \text{ T } + 10) - (-4.9 \boxed{x} 0 \boxed{x^2} + 4.9 \boxed{x} 0 + 10)$ in the numerator and $T - 0$ in the denominator.

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

To calculate the instantaneous velocity when diver hits the water find $s'(t)$ when $t = 2.01\dots$

Press $\boxed{\frac{d}{dx}}$ and select $\frac{d}{dx}$



Enter X in the denominator and the function $-4.9x^2 + 4.9x + 10$

Press \blacktriangleright to exit the parentheses.

Enter $\boxed{\text{ctrl}}$ $\boxed{=}$ ($\boxed{\neq}$) and select the vertical bar ($|$)

Type $X = T$ and press $\boxed{\text{enter}}$.

The instantaneous velocity when the diver hits water is -14.8 ms^{-1} .