



First Principles - Derivatives

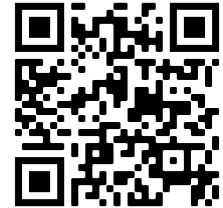
Each of the questions included here can be solved using either the TI-nspire CX or CX CAS.

Scan the QR code or use the link: bit.ly/FirstPrinciplesDerivative

Question: 1.

Determine the gradient of the secant connecting $x = 2$ and $x = 3$ on the function:

$f(x) = x^2 + 3$ and compare the result to that obtained in the video for the same x values.



Question: 2.

Use first principles to calculate the approximate gradient to the function: $f(x) = x^3$ at the point $x = 4$ for $h = 0.1$

Question: 3.

Use first principles to calculate the gradient of the function $f(x) = (x - 3)^2$ at the point $x = 2$ for $h = 0.1$

Question: 4.

Use first principles to calculate the gradient of the function $f(x) = x^2 - 6x$ at the point $x = 2$ for $h = 0.1$ and compare with the answer with that obtained for Question 3.

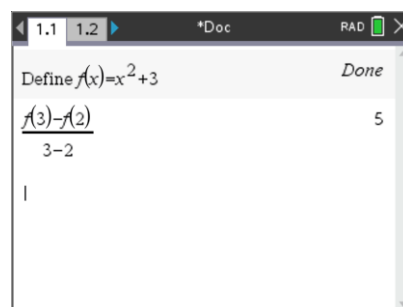
Question: 5.

Use first principles to determine the gradient of the function $f(x) = x^3$.

Answers

Question 1

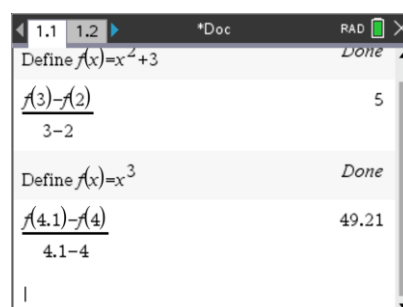
Since $f(3) = 12$ and $f(2) = 7$ then the gradient of the secant is 5.



A screenshot of the TI-nspire CAS interface. The top bar shows '1.1 1.2' and '*Doc'. The main area contains the following text: 'Define $f(x)=x^2+3$ Done', ' $\frac{f(3)-f(2)}{3-2}$ 5', and a cursor '|'.

Question 2

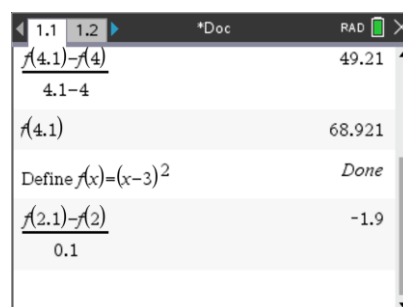
Since $f(4) = 64$ and $f(4.1) = 68.921$ then the gradient of the secant will be: $4.921 \div 0.1 = 49.21$.



A screenshot of the TI-nspire CAS interface. The top bar shows '1.1 1.2' and '*Doc'. The main area contains the following text: 'Define $f(x)=x^2+3$ Done', ' $\frac{f(3)-f(2)}{3-2}$ 5', 'Define $f(x)=x^3$ Done', ' $\frac{f(4.1)-f(4)}{4.1-4}$ 49.21', and a cursor '|'.

Question 3

Since $f(2) = 1$ and $f(2.1) = 0.81$ the gradient of the secant is -1.9.

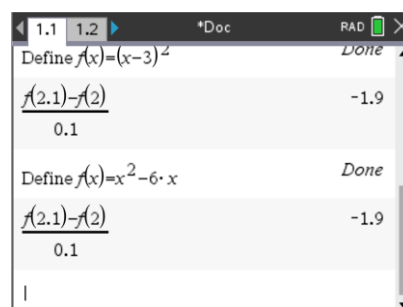


A screenshot of the TI-nspire CAS interface. The top bar shows '1.1 1.2' and '*Doc'. The main area contains the following text: ' $\frac{f(4.1)-f(4)}{4.1-4}$ 49.21', ' $f(4.1)$ 68.921', 'Define $f(x)=(x-3)^2$ Done', ' $\frac{f(2.1)-f(2)}{0.1}$ -1.9', and a cursor '|'.

Question 4

Since $f(2) = 1$ and $f(2.1) = 0.81$ the gradient of the secant is -1.9.

The answers are the same since $(x-3)^2 = x^2 - 6x + 9$ which is a simple 'vertical' translation of the function: $x^2 - 6x$, therefore it makes sense that the same x values would generate the same gradient.

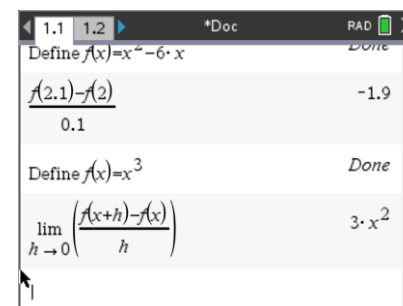


A screenshot of the TI-nspire CAS interface. The top bar shows '1.1 1.2' and '*Doc'. The main area contains the following text: 'Define $f(x)=(x-3)^2$ Done', ' $\frac{f(2.1)-f(2)}{0.1}$ -1.9', 'Define $f(x)=x^2-6 \cdot x$ Done', ' $\frac{f(2.1)-f(2)}{0.1}$ -1.9', and a cursor '|'.

Question 5

On the TI-nspire CX CAS series, it is possible to simply use the limit command.

TI-nspire CX requires the calculations be done by hand.



A screenshot of the TI-nspire CAS interface. The top bar shows '1.1 1.2' and '*Doc'. The main area contains the following text: 'Define $f(x)=x^2-6 \cdot x$ Done', ' $\frac{f(2.1)-f(2)}{0.1}$ -1.9', 'Define $f(x)=x^3$ Done', and ' $\lim_{h \rightarrow 0} \left(\frac{f(x+h)-f(x)}{h} \right)$ $3 \cdot x^2$ '. A cursor is visible at the bottom left.