**10A Roots within Intervals**

1. The diagram shows a sketch of the curve $y=f\left(x\right),$ where $f\left(x\right)=x^{3}-4x^{2}+3x+1$
2. Explain how the graph shows that $f(x)$ has a root between $x=2$ and $x=3$.



1. Show that $f(x)$ has a root between $x=1.4$ and $x=1.5$
2. The graph of the function

 $f\left(x\right)=54x^{3}-225x^{2}+309x-140$

 is shown in the diagram.

A student observes that $f(1.1)$ and $f(1.6)$ are both negative and states that $f\left(x\right)$ has no roots in the interval $\left[1.1,1.6\right]$

1. Explain, referring to the diagram, why the student is incorrect



1. Calculate $f(1.3)$, $f(1.5)$ and $f(1.7)$ and use your answer to explain why there are at least 3 roots in the interval $1.1<x<1.7$.
2. Using the same axes, sketch the graphs of $y=lnx$ and $y=\frac{1}{x}$. Explain how your diagram shows that the function $f\left(x\right)=lnx-\frac{1}{x}$ has only one root



1. Show that this root lies in the interval $1.7<x<1.8$
2. Given that the root of $f\left(x\right)=α$, show that $α=1.763$ correct to 3 decimal places