# applications of differentiation

## Year 11-12 - Mathematical Methods

### Australian Curriculum learning objectives[[1]](#footnote-1)

ACMMM108 - Understand the concept of the second derivative as the rate of change of the first derivative function

ACMMM109 - Recognise acceleration as the second derivative of position with respect to time

## Resources required

* [Newton, Leibnitz and Usain Bolt](http://www.youtube.com/watch?v=EKvHQc3QEow)[[2]](#footnote-2) captioned online video and projection facilities. (Duration: 9 minutes)
* [Usain Bolt wins 100m/200m Gold](http://www.youtube.com/watch?v=F14EaVEDyUs)[[3]](#footnote-3) online video (Duration: 4 minutes)
* Active Review and Investigation × class set

Lesson outcome: students learn how differential calculus is helpful in finding instantaneous rates of change

## Lesson outline

1. Setting the scene: How amazingly fast is this human being Usain Bolt? Introduce the video [Usain Bolt wins 100m/200m Gold](http://www.youtube.com/watch?v=F14EaVEDyUs). (This video has no dialogue and only sound effects not integral to the message. It is not captioned.)
2. Conduct a class discussion on the concepts of distance, speed and acceleration, and how they are connected through rates of change.
3. Emphasise the fact that Usain Bolt does not travel at a constant speed. To help us find his speed at any instant we can turn to differential calculus.
4. Introduce the video [Newton, Leibnitz and Usain Bolt](http://www.youtube.com/watch?v=EKvHQc3QEow)
5. Students now complete the first page of the Active Review and Investigation worksheet. Certain sections of the video may need to be replayed for students to complete this task.

## Homework/extension

Investigation into Usain Bolt’s 100m sprint in the Olympics. Use the second page of the Active Review and Investigation worksheet for this task.

1. <http://bit.ly/SgdSHd> [↑](#footnote-ref-1)
2. <http://www.youtube.com/watch?v=xyAuNHPsq-g> [↑](#footnote-ref-2)
3. <http://www.youtube.com/watch?v=F14EaVEDyUs> [↑](#footnote-ref-3)