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Calculus

Calculus – In search of the gradient of the tangent

In this lesson we continue trying to determine the co-ordinates of the turning point of the function that describes the volume of the box whose volume we are trying to maximise.

Lesson Outcomes

By the end of this lesson, you should be able to:

- describe the challenge of Differential Calculus as determining the gradient of a tangent to a curve.

Curriculum Links

LO 2: Functions and Algebra

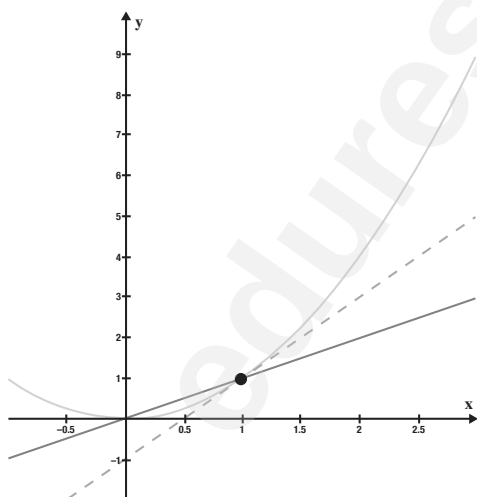
12.2.7 (a) Investigate and use instantaneous rate of change of a variable when interpreting models of situations:

- demonstrating an intuitive understanding of the limit concept in the context of approximating the rate of change or gradient of a function at point; (Linked to task)

Lesson Notes

To solve the box problem:

- We need to find the co-ordinates of the turning point of the graph.
- In order to do this we must find the point where the gradient of the tangent to the graph is zero.
- A more general problem is to find the gradient of the tangent to the graph at any point on the graph.



In order to determine a method for determining the gradient of the tangent to the graph at any point on the graph we will work with the function $y = x^2$ and determine the gradient of the tangent at the point (1;1). The graph is shown above and the tangent through the point is shown by the dotted line.

We need two points in order to find the gradient of a line. Since we don't have another point we will simply choose another point. To start with let the other point be (0;0). The gradient of the line pass through (0;0) and (1;0) is equal to 1.

This is a very rough approximation for the gradient of the tangent. To improve on this approximation we must choose a point closer to (1;1). As a next attempt we choose the point $(\frac{1}{2}; f(\frac{1}{2}))$ and calculate the gradient again.

This gradient is a better approximation of the gradient of the tangent. To get an even better approximation we must choose a point even closer to (1;1).

Task

Given the function $y = f(x) = x^2$. Determine the gradients of the lines through:

- (0,5; $f(0,5)$) and (1;1)
- (0,75; $f(0,75)$) and (1;1)