NCEA Level 3 Calculus (Differentiation)
14. Differentiation Revision (Homework)

Reading

> **Go and watch...**
>
> `https://www.youtube.com/watch?v=fIaupXkpB00`

Questions

1. Find f' in each case:

   (a) $f(x) = 3x^{2017} + \frac{1}{x^{19}} + \sqrt[2017]{x+2}$

   (b) $f(h) = \pi r^2 h$

   (c) $f(\theta) = \frac{\mu mg}{\mu \sin \theta + \cos \theta}$

   (d) $f(g) = \frac{\sin g}{g^2 + \ln g}$

   (e) $3x \cdot f(x) + [f(x)]^2 = \frac{x}{3+f(x)}$

2. A kite $50\,\mathrm{m}$ above the ground moves horizontally at a speed of $2\,\mathrm{m\,s^{-1}}$. At what rate is the angle between the string and the horizontal decreasing when $100\,\mathrm{m}$ of string has been let out?

3. A cone-shaped paper drinking cup is to be made to hold $27\,\mathrm{cm}^3$ of water (or other liquid beverage). Find the height and radius of the cup that will use the smallest amount of paper.

4. Find the closest point on the hyperbola $x^2 - 2x - y^2 = 2$ to the following points. You may find it useful to complete the square and parameterise the hyperbola (it's easier than dealing with solving the hyperbola equation for x or y).

   (a) $(2, 1)$.

   (b) $(3, 1)$.