

# NCEA Level 3 Calculus (Differentiation)

## 14. Differentiation Revision (Homework)

### Reading

Go and watch...

<https://www.youtube.com/watch?v=i5bH-EwTLAU>

### Questions

1. Find  $f'$  in each case:

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

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

3. A cone-shaped paper drinking cup is to be made to hold  $27 \text{ cm}^3$  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)  $(3, 1)$ .