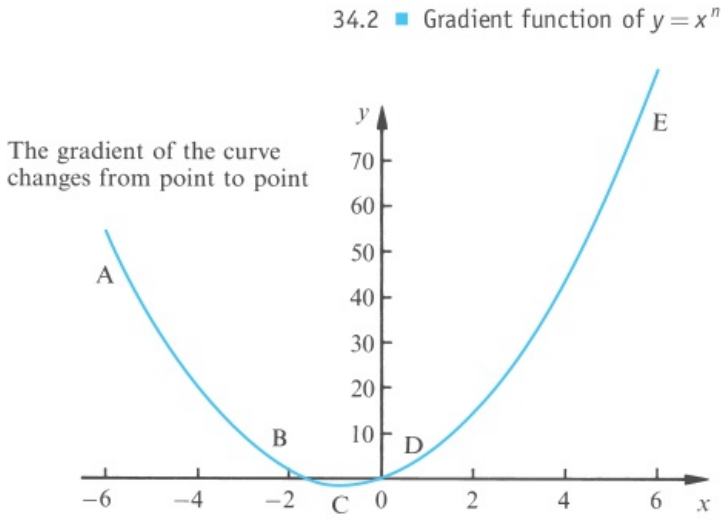
Cheatsheet - Gradients of Curves & Differentiation

Fabio Lama – fabio.lama@pm.me

1. Gradient Function

The **gradient** (or "slope") of a graph tells us something about the rate of change and "steepness" of a function. Given a function $y = f(x)$ we denote its gradient function by $\frac{dy}{dx}$ or simply by y'.

TODO: What is *d*?



The gradient function is also called **(first) derivative**. The process of obtaining this is also known as **differentiation**. Saying to differentiate $y = x^5$ means to find its gradient function y. *Differential calculus* studies this more in depth.

1.1. Gradient function of $y = x^n$

For any function of the form $y = x^n$ the gradient function is found from the following formula:

$$y = x^n \quad \text{then} \quad y' = nx^{n-1}$$

When we substitute *x* and the result is negative, the curve is falling. If the result is positive, the curve is rising. We write $y'(x = 2)$ or simply $y'(2)$ to denote the value of the gradient function when $x = 2$.

TODO: Add some examples.

2. Rules for Finding Gradient Functions

Rule 1: To find the gradient function of a sum of two functions we can simply find the two gradient functions separately and those together.

$$y = f(x) + g(x) \quad \text{then} \quad y' = f'(x) + g'(x)$$

Rule 2: Extension of the first rule.

$$y = f(x) - g(x) \quad \text{then} \quad y' = f'(x) - g'(x)$$

Rule 3:

$$y = kf(x) \quad \text{then} \quad y' = kf'(x)$$

where *k* is a number.

3. Higher Derivatives

To find the derivative of the derivative itself, known as the **second derivative** and denoted as y'', we define:

$$y'' = \frac{d^2y}{dx^2}$$

y'' is found by differentiating y'.

TODO: Add example.

TODO...