MA0003 Cheatsheet

Kristoffer Dalby

1 Domain and Range

Domain is the acceptable x-values and Range is the acceptable y-values.

1.1 Domain

$f(x) = \frac{6}{2-x}$
$2 - x \neq 0 \quad \rightarrow \quad x \neq 2$
$D = (-\infty, 2) \cup (2, \infty)$ or
$D = \{x | x \neq 2\}$

2 Slope and y-intercept

Problem: $y - 3x = 6$
Solve for y: $y = 3x + 6$
slope $\rightarrow 3x$ y-int $\rightarrow 6$
slope $= m = 3$

3 Derivative

3.1 Critical points

The function:
$f(x) = y = x^2 - 6x + 5$
The derivative:
$f'(x) = y' = 2x - 6$
Set y' to zero to find x
$y' = 0 \Rightarrow 0 = 2x - 6 \Rightarrow x = 3$
Solve for x
$y = (3^2) - (6 \cdot 3) + 5 \Rightarrow 9 - 18 + 5 = -4$
The critical point is -4

3.2 Inflection points

Find the second derivative of the function
$y'' = 2$
Set y'' to zero
$y'' = 0 \neq 2 \rightarrow$ No inflection points

3.3 Practical rules

$\frac{d}{dx}(x^n) = nx^{n-1}$

$\frac{d}{dx}(f(x))^n) = n(f(x))^{n-1} \cdot f'(x)$

$\frac{d}{dx}(\sin x) = \cos x$

$\frac{d}{dx}(\sin f(x)) = \cos(f(x)) \cdot f'(x)$

$\frac{d}{dx}(\cos x) = -\sin x$

$\frac{d}{dx}(\cos f(x)) = -\sin(f(x)) \cdot f'(x)$

$\frac{d}{dx}(\tan x) = \frac{1}{\cos^2 x} = \sec^2 x$

$\frac{d}{dx}(\tan f(x)) = \frac{1}{\cos^2(f(x))}$

$\frac{d}{dx}(a^x) = a^x \cdot \ln a$

$\frac{d}{dx}(a^{f(x)}) = a^{f(x)} \cdot \ln a \cdot f'(x)$

$\frac{d}{dx}(\log_a x) = \frac{1}{\ln a \cdot x}$

$\frac{d}{dx}(\log_a f(x)) = \frac{1}{\ln a \cdot x} \cdot f'(x)$

4 Integration

4.1 Power rule

Example: $\int x^3 dx$
The rule: $\int x^n dx = \frac{x^{n+1}}{n+1} + C$
Result: $\int x^3 dx = \frac{x^4}{4} + C$

4.2 Multiplication by constant

Example: $\int 6x^2 dx$
The rule: $\int nx^n dx = n \int x^n dx$
Result: $\int 6x^2 dx = 6 \int x^2 dx = 6\frac{x^3}{3} + C$

4.3 Sum rule

Example: $\int \cos x + x dx$
Result: $\int \cos x + x dx = \int \cos x dx + \int x dx$

4.4 Difference rule

Example: $\int \cos x - x dx$
Result: $\int \cos x - x dx = \int \cos x dx - \int x dx$

4.5 Integration by Parts

The rule: $\int uv dx = u \int v dx - \int u'(\int v dx) dx$