

## Stærðfræðigreining I/IA:

### I.1. Tölur og föll

$$\begin{aligned}\sin^2(x) + \cos^2(x) &= 1 \\ \sin(x \pm y) &= \sin(x)\cos(y) \pm \cos(x)\sin(y) \\ \cos(x \pm y) &= \cos(x)\cos(y) \mp \sin(x)\sin(y) \\ \tan(x \pm y) &= \frac{\tan(x) \pm \tan(y)}{1 \mp \tan(x)\tan(y)}\end{aligned}$$

$$\begin{aligned}\sin(-x) &= -\sin(x) & \cos(-x) &= \cos(x) \\ \sin(\pi - x) &= \sin(x) & \cos(\pi - x) &= -\cos(x) \\ \sin(\pi/2 - x) &= \cos(x) & \cos(\pi/2 - x) &= \sin(x) \\ \sin^2(x) &= \frac{1-\cos(2x)}{2} & \cos^2(x) &= \frac{1+\cos(2x)}{2} \\ \sin(2x) &= 2\sin(x)\cos(x) & \cos(2x) &= 2\cos^2(x) - 1\end{aligned}$$

### I.3. Afleiður

Taylormargliða:

$$P_n(x) = f(a) + f'(a)(x-a) + \frac{f''(a)}{2}(x-a)^2 + \frac{f'''(a)}{3!}(x-a)^3 + \cdots + \frac{f^{(n)}(a)}{n!}(x-a)^n.$$

Skekjkjumat:  $E_n(x) = \frac{f^{(n+1)}(X)}{(n+1)!}(x-a)^{n+1}.$

### I.4. Torræð föll

Andhverfur hornafalla

$$\frac{d}{dx} \arcsin(x) = \frac{1}{\sqrt{1-x^2}} \quad \frac{d}{dx} \arccos(x) = \frac{-1}{\sqrt{1-x^2}} \quad \frac{d}{dx} \arctan(x) = \frac{1}{1+x^2}$$

Breiðbogaföll

$$\sinh(x) = \frac{e^x - e^{-x}}{2} \quad \cosh(x) = \frac{e^x + e^{-x}}{2} \quad \tanh(x) = \frac{\sinh(x)}{\cosh(x)}$$

$$\text{arsinh}(x) = \ln\left(x + \sqrt{x^2 + 1}\right) \quad \text{arcosh}(x) = \ln\left(x + \sqrt{x^2 - 1}\right) \quad \text{artanh}(x) = \frac{1}{2} \ln\left(\frac{1+x}{1-x}\right)$$

### I.6. Heildun

$$\text{Innsetning: } \int f(g(x))g'(x)dx = \int f(u)du \quad \text{Hluth.: } \int u'(x)v(x)dx = u(x)v(x) - \int u(x)v'(x)dx$$

### I.7. Rúmmál, massi og massamiðja

Kúla:  $V = \frac{4}{3}\pi r^3$ ,  $S = 4\pi r^2$ .

Sívalningur:  $V = \pi r^2 h$ ,  $S = 2\pi r h$ .

Keila með grunnflöt  $A$ :  $V = \frac{1}{3}Ah$ .

### Snúðar

Snúið um  $x$ -ás:

$$V = \pi \int_a^b f(x)^2 dx, \quad S = 2\pi \int_a^b |f(x)| \sqrt{1 + (f'(x))^2} dx.$$

Snúið um  $y$ -ás:

$$V = 2\pi \int_a^b x f(x) dx, \quad S = 2\pi \int_a^b |x| \sqrt{1 + (f'(x))^2} dx.$$

Lengd grafs:  $s = \int_a^b \sqrt{1 + (f'(x))^2} dx$ .

## Massamiðja plötu

$$\bar{x} = \frac{M_{x=0}}{m} = \frac{\int_a^b x\delta(x)f(x) dx}{\int_a^b \delta(x)f(x) dx} \quad \bar{y} = \frac{M_{y=0}}{m} = \frac{\frac{1}{2}\int_a^b \delta(x)f(x)^2 dx}{\int_a^b \delta(x)f(x) dx}.$$

## I.8. Diffurjöfnur

Línulegar fyrsta stigs diffurjöfnur,  $y' + p(x)y = q(x)$

$$y(x) = e^{-\mu(x)} \int e^{\mu(x)} q(x) dx, \quad \mu(x) = \int p(x) dx.$$

Línuleg annars stigs diffurjafna með fastastuðla,  $ay'' + by' + cy = 0$

Tilvik I:  $y(x) = Ae^{r_1 x} + Be^{r_2 x}$  ef kennijafnan hefur tvær ólíkar rauntölulausnir  $r_1$  og  $r_2$ .

Tilvik II:  $y(x) = Ae^{kx} + Bxe^{kx}$  ef kennijafnan hefur eina tvöfalda rauntölulausn  $k = -\frac{b}{2a}$ .

Tilvik III:  $y(x) = Ae^{kx} \cos(\omega x) + Be^{kx} \sin(\omega x)$  ef kennijafnan hefur engar rauntölulausnir, bara tvinntölulausnir  $r_1 = k + i\omega$  og  $r_2 = k - i\omega$  þar sem  $k = -\frac{b}{2a}$  og  $\omega = \frac{\sqrt{4ac-b^2}}{2a}$ .

## I.9. Runur og raðir

$$\sum_{n=1}^{\infty} \frac{1}{n(n+1)} = 1$$

## I.10. Veldaraðir

$$\text{Kvótapróf: } \frac{1}{R} = L = \lim_{n \rightarrow \infty} \left| \frac{a_{n+1}}{a_n} \right| \quad \text{Rótarpróf: } \frac{1}{R} = L = \lim_{n \rightarrow \infty} \sqrt[n]{|a_n|}$$

$$e^x = \sum_{n=0}^{\infty} \frac{x^n}{n!} = 1 + x + \frac{x^2}{2} + \frac{x^3}{3!} + \dots \quad \text{fyrir öll } x$$

$$\sin x = \sum_{n=0}^{\infty} \frac{(-1)^n}{(2n+1)!} x^{2n+1} = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \dots \quad \text{fyrir öll } x$$

$$\cos x = \sum_{n=0}^{\infty} \frac{(-1)^n}{(2n)!} x^{2n} = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \dots \quad \text{fyrir öll } x$$

$$\frac{1}{1-x} = \sum_{n=0}^{\infty} x^n = 1 + x + x^2 + x^3 + \dots \quad \text{fyrir } -1 < x < 1$$

$$\frac{1}{(1-x)^2} = \sum_{n=1}^{\infty} nx^{n-1} = 1 + 2x + 3x^2 + 4x^3 + \dots \quad \text{fyrir } -1 < x < 1$$

$$\ln(1+x) = \sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{n} x^n = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \dots \quad \text{fyrir } -1 < x \leq 1$$

$$\tan^{-1} x = \sum_{n=0}^{\infty} \frac{(-1)^n}{2n+1} x^{2n+1} = x - \frac{x^3}{3} + \frac{x^5}{5} - \frac{x^7}{7} + \dots \quad \text{fyrir } -1 \leq x \leq 1$$

$$\sinh x = \sum_{n=0}^{\infty} \frac{x^{2n+1}}{(2n+1)!} = x + \frac{x^3}{3!} + \frac{x^5}{5!} + \frac{x^7}{7!} + \dots \quad \text{fyrir öll } x$$

$$\cosh x = \sum_{n=0}^{\infty} \frac{x^{2n}}{(2n)!} = 1 + \frac{x^2}{2!} + \frac{x^4}{4!} + \frac{x^6}{6!} + \dots \quad \text{fyrir öll } x$$