**Berufskolleg der Stadt Bochum**
**Technische Berufliche Schule 1**

# Formelsammlung

## Binomische Formeln

$(a+b)^2 = a^2 + 2ab + b^2$ $\quad$ $(a-b)^2 = a^2 - 2ab + b^2$ $\quad$ $(a+b)(a-b) = a^2 - b^2$

$(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$

## Potenzen

$a^0 = 1$ $\quad$ $a^{-k} = \frac{1}{a^k}$ $\quad$ $\sqrt[p]{a^k} = a^{\frac{k}{p}}$ $\quad$ $a^k \cdot a^p = a^{k+p}$

$(a^k)^p = a^{k \cdot p}$ $\quad$ $\frac{a^k}{a^p} = a^{k-p}$ $\quad$ $a^k \cdot b^k = (a \cdot b)^k$ $\quad$ $\frac{a^k}{b^k} = \left(\frac{a}{b}\right)^k$

## Logarithmen

$a^k = b \Leftrightarrow k = \log_a(b) = \frac{\lg(b)}{\lg(a)} = \frac{\ln(b)}{\ln(a)}$ $\quad$ $\lg(b) = \log_{10}(b)$ $\quad$ $\ln(b) = \log_e(b)$

$\lg(b \cdot c) = \lg(b) + \lg(c)$ $\quad$ $\lg\left(\frac{b}{c}\right) = \lg(b) - \lg(c)$ $\quad$ $\lg(b)^k = k \cdot \lg(b)$

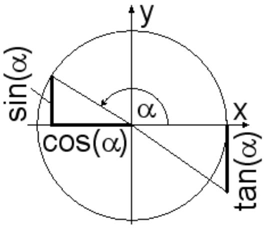
## Satz von VIETA (pq-Formel)

$x^2 + px + q = 0 \Leftrightarrow x_{1,2} = -\frac{p}{2} \pm \sqrt{\left(\frac{p}{2}\right)^2 - q}$ $\quad$ mit $x_1 + x_2 = -p$ und $x_1 \cdot x_2 = q$

$x^2 + px + q = (x - x_1) \cdot (x - x_2) = 0$

## Winkelfunktionen Trigonometrie

$\sin(\alpha) = \frac{\text{Gegenkathete}}{\text{Hypothenuse}}$ $\quad$ $\cos(\alpha) = \frac{\text{Ankathete}}{\text{Hypothenuse}}$




$\tan(\alpha) = \frac{\text{Gegenkathete}}{\text{Ankathete}} = \frac{\sin(\alpha)}{\cos(\alpha)}$

$\sin(\alpha) = k \Rightarrow \alpha = \arcsin(k)$; *[TR: $\sin^{-1}(k)$]*

$(\sin(\alpha))^2 + (\cos(\alpha))^2 = 1$

Bogenmaß $\quad 1\,\text{rad} = \frac{360°}{2\pi}$ $\qquad$ Gradmaß $\quad 1° = \frac{2\pi\,\text{rad}}{360°}$

Stand: 03. 2014

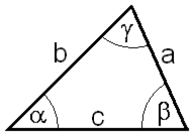
## Formelsammlung

Sinussatz: $\frac{a}{\sin(\alpha)} = \frac{b}{\sin(\beta)} = \frac{c}{\sin(\gamma)}$

Kosinussatz: $a^2 = b^2 + c^2 - 2bc\cos(\alpha);$

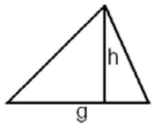
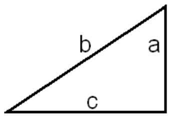
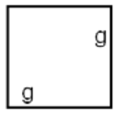
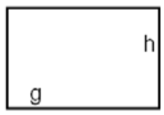
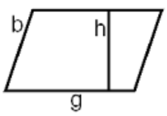
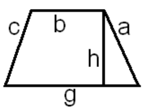
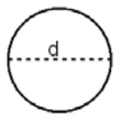
$b^2 = a^2 + c^2 - 2ac\cos(\beta);$

$c^2 = a^2 + b^2 - 2ab\cos(\gamma)$



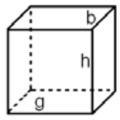
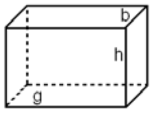
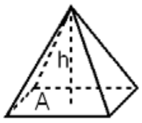
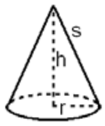
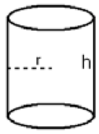
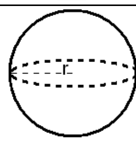

### Geometrie in der Ebene

A: Fläche U: Umfang g: Grundseite h: Höhe d: Durchmesser r: Radius

| | | | |
|---|---|---|---|
| Dreieck (beliebig) | $A = \frac{g \cdot h}{2}$ | $U = a + b + c$ |   |
| Dreieck (rechtwinklig) | $b^2 = a^2 + c^2$ | |   |
| Quadrat | $A = g^2$ | $U = 4\,g$ |   |
| Rechteck | $A = g \cdot h$ | $U = 2\,g + 2\,h$ |   |
| Parallelogramm | $A = g \cdot h$ | $U = 2\,g + 2\,b$ |   |
| Trapez | $A = \frac{g + b}{2} \cdot h$ | $U = g + a + b + c$ |   |
| Kreis | $A = \pi \cdot r^2 = \pi \frac{d^2}{4}$ | $U = 2\,\pi\,r = \pi\,d$ $d = 2r$ |   |

## Geometrie im Raum

V: Volumen O: Oberfläche A: Grundfläche M: Mantelfläche

| | | |
|---|---|---|
| Würfel | $V = g^3$ $O = 6g^2$ $g = b = h$ |  |
| Quader | $V = g \cdot h \cdot b$ $O = 2(gh + hb + gb)$ |  |
| Pyramide | $V = \frac{A \cdot h}{3}$ $O = A + M$ |  |
| Kegel | $V = \frac{A \cdot h}{3} = \frac{\pi r^2 h}{3}$ $O = A + M = \pi r^2 + \pi r s$ $M = \pi r s$ |  |
| Zylinder | $V = \pi r^2 h$ $O = 2 \pi r^2 + 2 \pi r h$ $M = 2 \pi r h$ |  |
| Kugel | $V = \frac{4}{3} \pi r^3$ $O = 4 \pi r^2$ $r = \frac{d}{2}$ |  |

## Analysis

Kriterien für:

Extrempunkte: $f'(x_E) = 0$ und $f''(x_E) > 0 \Rightarrow P(x_E / f(x_E))$ ist Minimum
$f'(x_E) = 0$ und $f''(x_E) < 0 \Rightarrow P(x_E / f(x_E))$ ist Maximum

Wendepunkte: $f''(x_W) = 0$ und $f'''(x_W) \neq 0 \Rightarrow P(x_W / f(x_W))$ ist Wendepunkt

Sattelpunkte: $f'(x_W) = 0$ und $f''(x_W) = 0$ und $f'''(x_W) \neq 0$
$\Rightarrow P(x_W / f(x_W))$ ist Sattelpunkt

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TBS1

## Formelsammlung

| F(x) | f(x) | f ' (x) |
|---|---|---|
| a x | a | 0 |
| $\frac{x^{k+1}}{k+1}$, $k \neq -1$ | $x^k$ | $k \cdot x^{k-1}$ |
| – cos(x) | sin(x) | cos(x) |

| F(x) | f(x) | f ' (x) |
|---|---|---|
| sin(x) | cos(x) | – cos(x) |
| $e^x$ | $e^x$ | $e^x$ |
| $x \cdot \ln(x) - x$ | ln(x) | $x^{-1}$ |

Produktregel: $(f' \cdot g') = f' \cdot g + f \cdot g'$

Quotientenregel: $\left(\frac{f}{g}\right)' = \frac{f' \cdot g - f \cdot g'}{g^2}$

Kettenregel: „***äußere***“ Ableitung mal „***innere***“ Ableitung

Unbestimmtes Integral: $F(x) = \int f(x)\,dx + C$

Bestimmtes Integral: $\int_a^b f(x)\,dx = F(b) - F(a)$

### Vektorrechnung

Vektor $\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA} = \vec{r}_B - \vec{r}_A$

Abstand der Punkte A und B: $|\overrightarrow{AB}| = |\vec{a}| = \sqrt{(b_x - a_x)^2 + (b_y - a_y)^2 + (b_z - a_z)^2}$

Mittelpunkt M der Strecke AB $\overrightarrow{OM} = \frac{1}{2}\left(\overrightarrow{OA} + \overrightarrow{OB}\right)$

Skalares Produkt $\vec{a} \bullet \vec{b} = |\vec{a}| \cdot |\vec{b}| \cos(\vec{a}, \vec{b}) = a_x b_x + a_y b_y + a_z b_z = \lambda,\ \lambda \in \mathbb{R}$

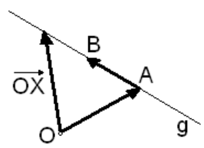
Orthogonalität $\vec{a} \perp \vec{b} \Leftrightarrow \vec{a} \bullet \vec{b} = 0$

Parallelität $\vec{a} \parallel \vec{b} \Rightarrow \vec{a} \times \vec{b} = \vec{0}$

Vektorprodukt $\vec{a} \times \vec{b} = \vec{c} = \begin{pmatrix} a_y b_z - a_z b_y \\ a_z b_x - a_x b_z \\ a_x b_y - a_y b_x \end{pmatrix}$; $A = |\vec{a} \times \vec{b}| = |\vec{a}| \cdot |\vec{b}| \sin(\vec{a}, \vec{b})$

Parameterdarstellung einer Geraden

g: $\overrightarrow{OX} = \overrightarrow{OA} + \lambda \cdot \overrightarrow{AB}$, $\lambda \in \mathbb{R}$ oder g: $\overrightarrow{OX} = \overrightarrow{OA} + r \cdot \vec{a}$, $r \in \mathbb{R}$




Parameterdarstellung einer Ebene

E: $\overrightarrow{OX} = \overrightarrow{OA} + \lambda \cdot \vec{a} + \nu \cdot \vec{b}$, $\lambda, \nu \in \mathbb{R}$ oder

E: $\overrightarrow{OX} = \overrightarrow{OA} + r \cdot \vec{a} + s \cdot \vec{b}$, $r, s \in \mathbb{R}$