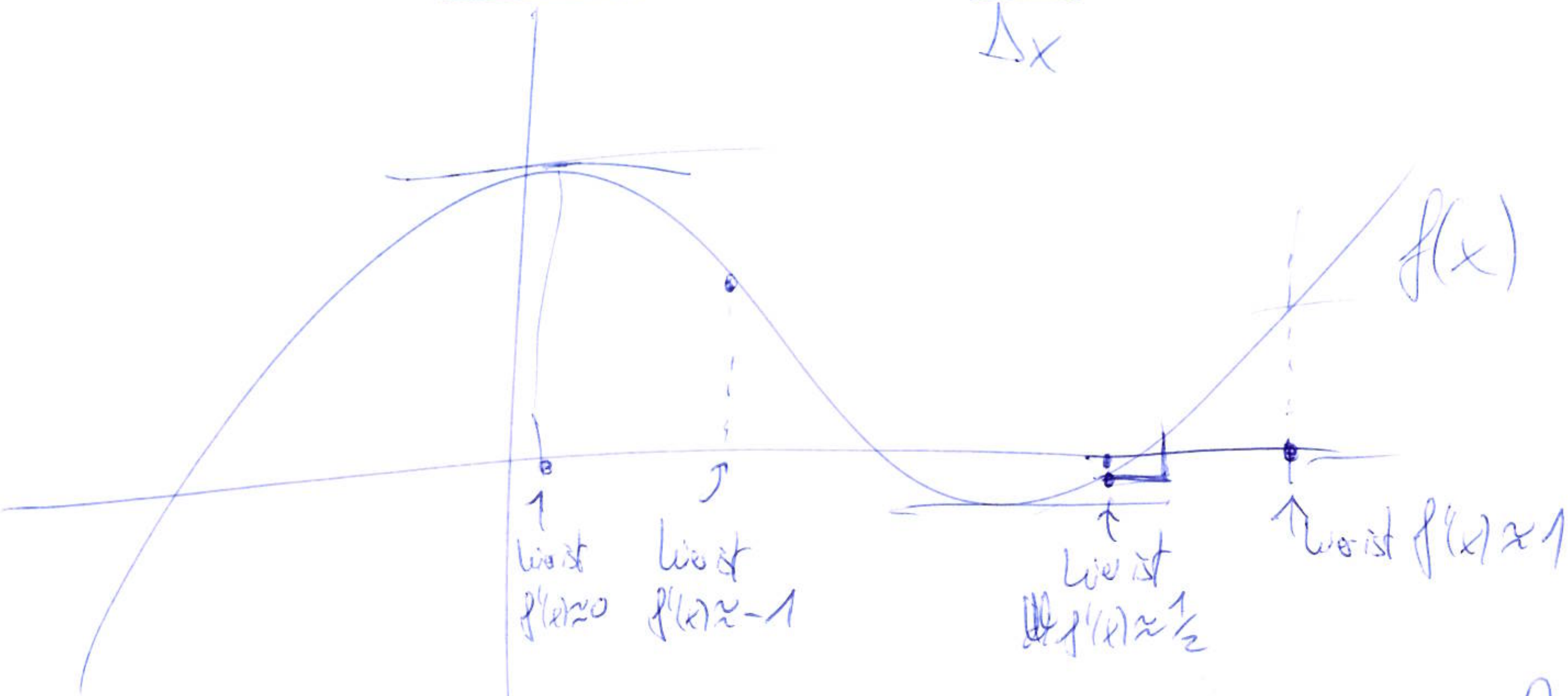
Ableitung

$$\frac{\Delta y}{\Delta x}$$



$f'(x)$ = die Steigung von f an der Stelle x

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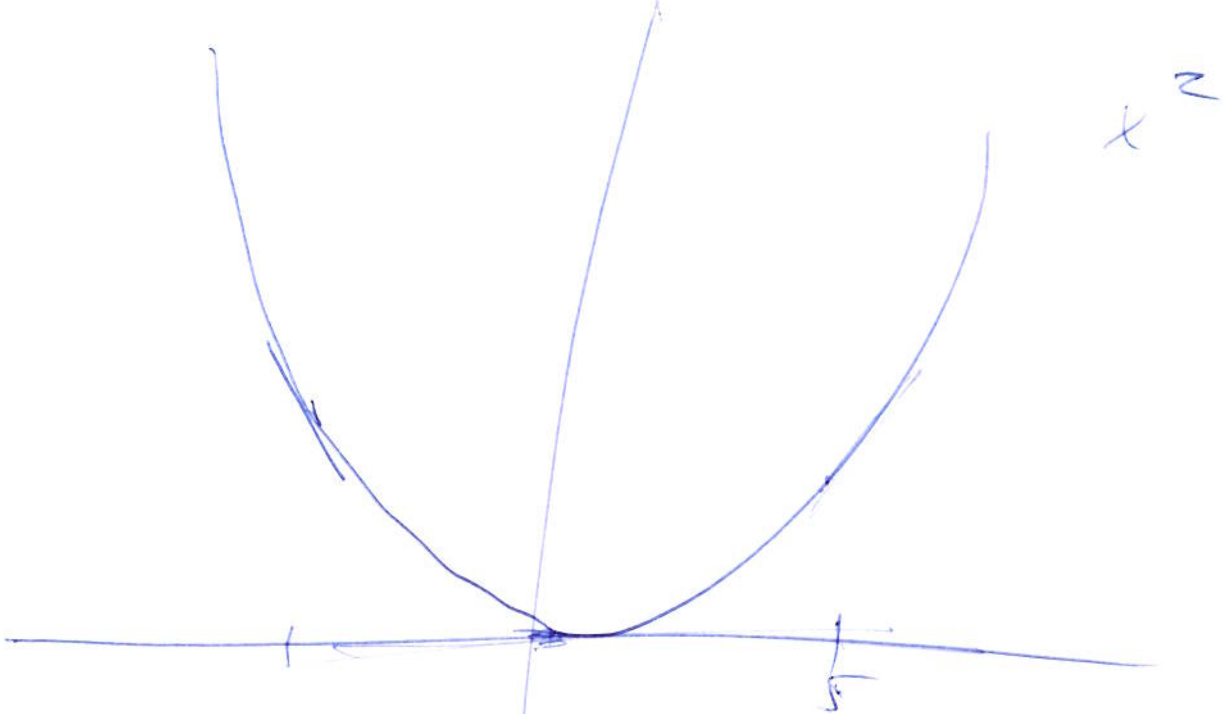
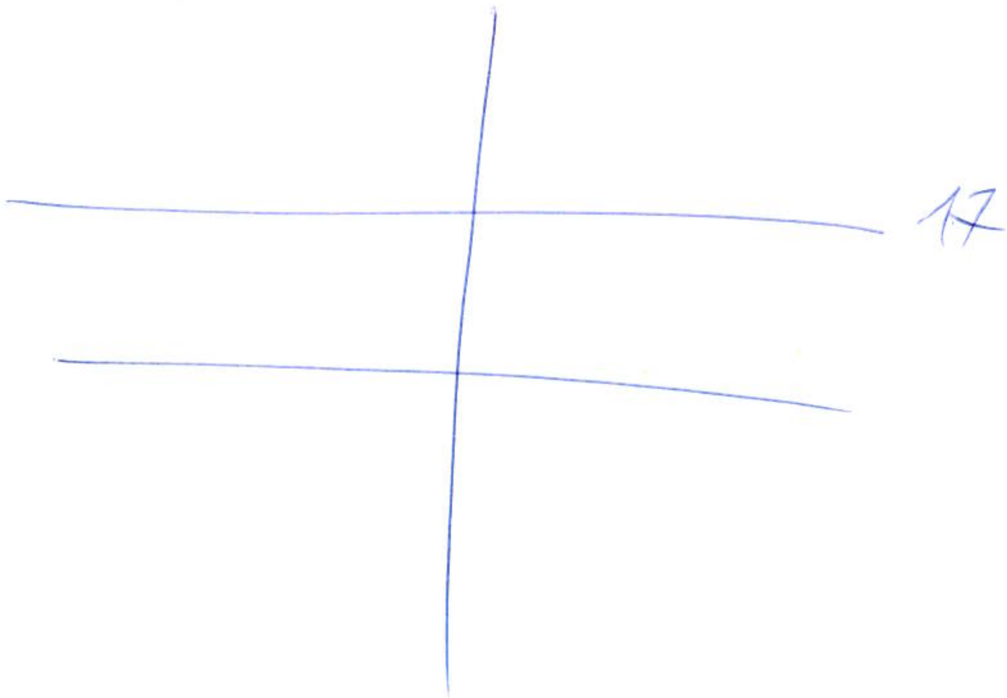
$f(x)$	$f'(x)$
17	0
x^2	$2x$
x^3	$3x^2$
x^4	$4x^3$
x^5	$5x^4$
e^x	e^x
$\frac{1}{x}$	$-\frac{1}{x^2}$
$\sqrt{x}$	$\frac{1}{2\sqrt{x}}$
sin	cos

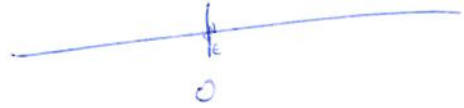
$e \approx 2{,}717$

sin	cos
cos	−sin


x^2
5


17

Duale Zahlen



neue Zahl: ε $\boxed{\varepsilon^2 = 0}$ $(\varepsilon \neq 0)$

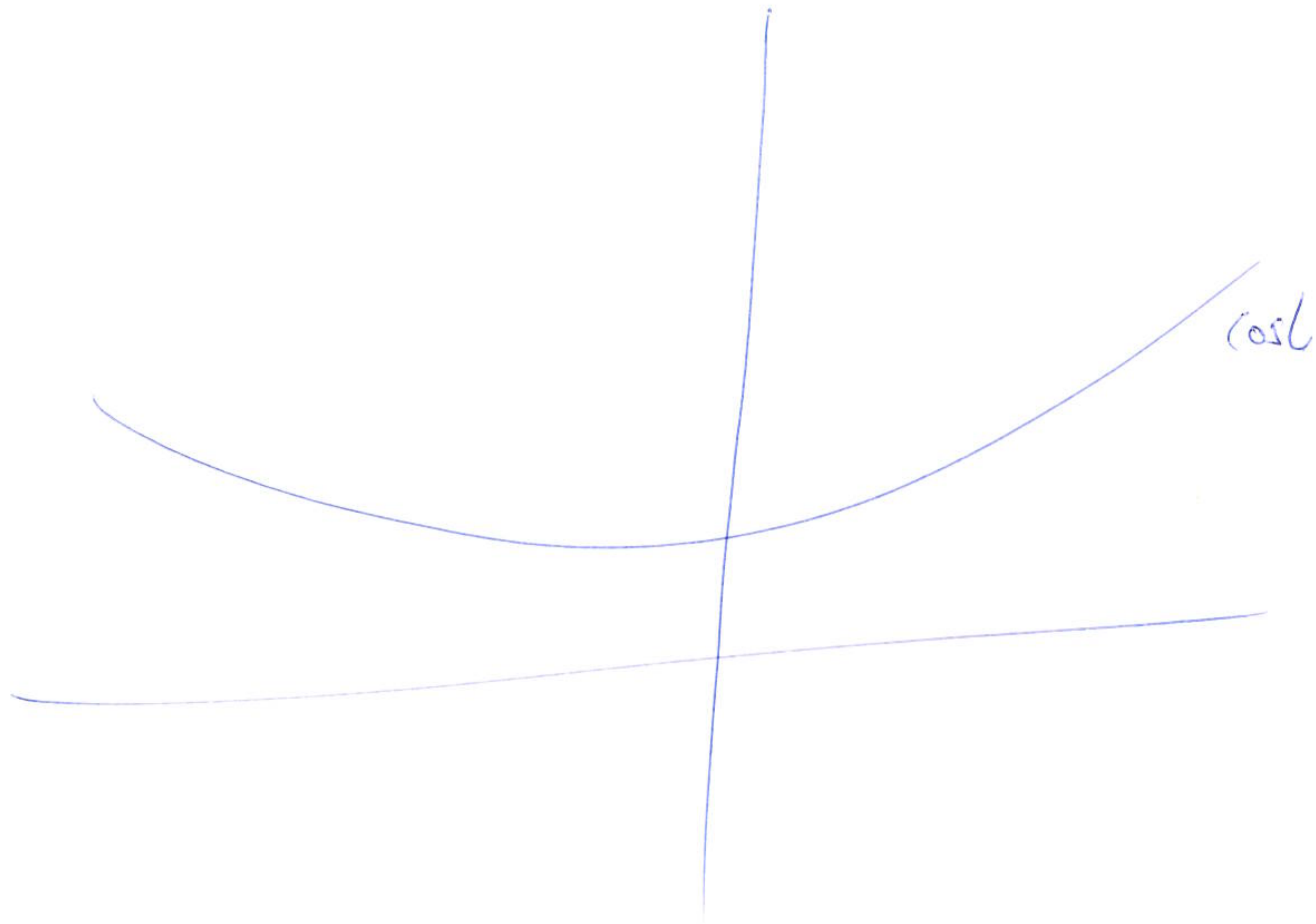
Achtung! Nicht durch ε teilen.

① $(x+\varepsilon)^2 = x^2 + 2x\varepsilon + \cancel{\varepsilon^2} = x^2 + \boxed{2x}\varepsilon$

② $(x+\varepsilon)^3 = x^3 + 3x^2\varepsilon + 3x\cancel{\varepsilon^2} + \cancel{\varepsilon^3} = x^3 + \boxed{3x^2}\varepsilon$

③ $\frac{1}{x+\varepsilon} \overset{!}{=} \frac{\varepsilon}{x\varepsilon + \varepsilon^2} = \frac{\varepsilon}{x\varepsilon} = \frac{1}{x}$

$$\frac{1}{x+\varepsilon} = \frac{x-\varepsilon}{(x+\varepsilon)(x-\varepsilon)} = \frac{x-\varepsilon}{x^2 - \cancel{\varepsilon^2}} = \frac{x-\varepsilon}{x^2} = \overset{\frac{1}{x}}{\overset{\shortparallel}{\frac{x}{x^2}}} \boxed{-\frac{1}{x^2}}\varepsilon$$


cosh

4 $e^{x+\varepsilon} = e^{x} \cdot e^{\varepsilon} = e^{x}(1+\varepsilon) = e^{x} + \boxed{e^{x}} \cdot \varepsilon$ $\hat{=} 8$

NR: $e^{\varepsilon} = 1+\varepsilon$

$$e^{x} = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \frac{x^5}{5!} + \dots$$

$4! = 1 \cdot 2 \cdot 3 \cdot 4$

„leere Summe" $= 0$

„leere Produkt" $= 1$

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Pascalsches Dreieck

1

1 1

Binom. Formel. 1 2 1

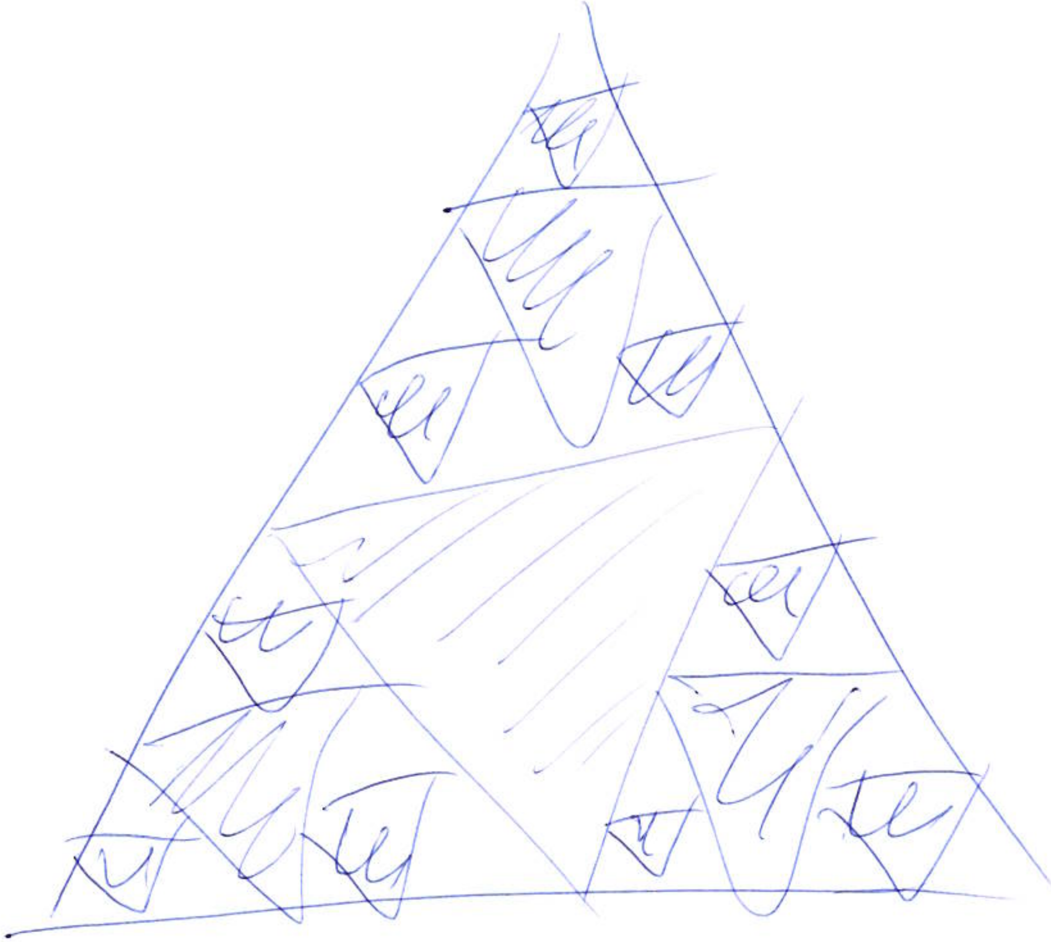
Binom. Formel ^3 1 3 3 1

1 4 6 4 1

1 5 10 10 5 1

1 6 15 20 15 6 1

Pasc. Dreieck
herangezoomt



Sierpinski-Dreieck

Modulo der Primzahlen

Additionstheorem

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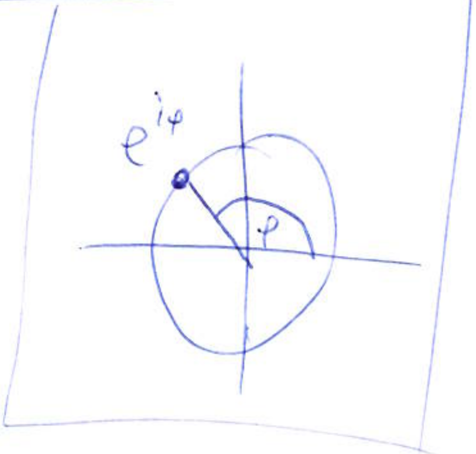
$$\sin(a+b) = \sin(a)\cos(b) + \cos(a)\sin(b)$$

$$\boxed{e^{i\varphi} = \cos(\varphi) + i\sin(\varphi)}$$

Eulersche Formel



$$\boxed{e^{i\pi} + 1 = 0}$$

Noch komplex

$$e^{i(a+b)} = e^{ia} \cdot e^{ib}$$

$$= (\cos(a) + i\sin(a)) \cdot (\cos(b) + i\sin(b))$$

$$= \underline{(\cos(a)\cos(b) - \sin(a)\sin(b))}$$

$$+ i(\underline{\sin(a)\cos(b) + \cos(a)\sin(b)})$$

$$= \underline{\cos(a+b)} + i\,\underline{\sin(a+b)}$$