

$$\int_0^{\pi} \sin x \, dx$$
$$= \left[-\cos x \right]_0^{\pi}$$

$$= -\cos(\pi) - (-\cos 0)$$

$$= -(-1) + 1$$

$$= 1 + 1 = 2$$

$$f(x) = \sin x$$

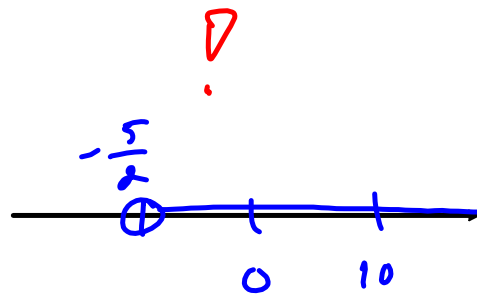
$$F(x) = -\cos x$$

$$F(\pi) - F(0)$$

MAA4 & 5

MAOL s. 54-55

$$\begin{aligned} \underline{E1} \quad & -2x - 5 < 0 \\ & -2x < 5 \quad | :(-2) \\ & x > -\frac{5}{2} \end{aligned}$$



$$\underline{E2} \quad 3x^2 - 2x - 4 < 0 \leftarrow$$

$$a = 3$$

$$b = -2$$

$$c = -4$$

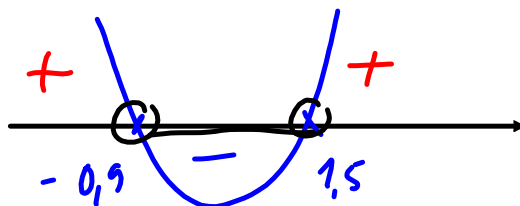
$$\text{nollakohtat: } 3x^2 - 2x - 4 = 0$$

solve

$$x = -0,9 \text{ tai } x = 1,5$$

$$\begin{aligned} D &= b^2 - 4ac \\ &= (-2)^2 - 4 \cdot 3 \cdot (-4) \\ &= 4 + 48 \\ &= 52 > 0 \end{aligned}$$

SpeedCrunch
Digi-MAUL



$$V: \quad -0,9 < x < 1,5$$

E3

$$x^3 + x^2 - 6x \geq 0$$

$$x^3 \geq -x^2 + 6x$$

no kalasteht

$$x^3 + x^2 - 6x = 0$$

yht. tek.

$$x(x^2 + x - 6) = 0$$

fuksen ns.

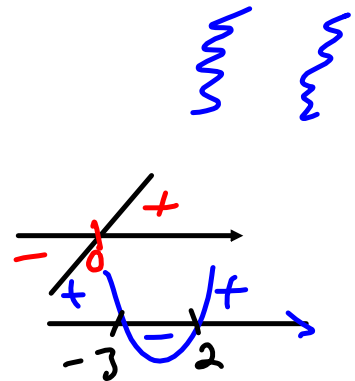
$$x = 0 \text{ tai } x^2 + x - 6 = 0$$

$$x = \dots$$

$$x = 2 \text{ tai } x = -3$$

4f / π mat. widget

	-3	0	2	
x	-	-	+	+
$x^2 + x - 6$	+	-	-	+
$x(x^2 + x - 6)$	-	+	-	+



log. epäyht.

$$e^x < 1$$

$$e^x < e^0$$

$$e \approx 2,712 \dots$$

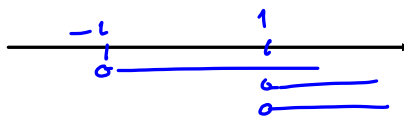
$$\underline{x < 0}$$

MADL
5.19

MADR 8/458

$$a) \ln(x+1) - \ln(x-1) = \ln 4 + \ln 2$$

$$\begin{array}{l} x+1 > 0 \quad \text{ja} \quad x-1 > 0 \\ x > -1 \quad \text{ja} \quad x > 1 \end{array}$$

määr. ehto: $x > 1$ 

$$\ln \frac{x+1}{x-1} = \ln 4 \cdot 2$$

$$\ln \frac{x+1}{x-1} = \ln 8$$

$$\frac{x+1}{x-1} = 8$$

$$\frac{x+1}{x-1} - \frac{8}{1} = 0$$

$$\frac{x+1-8(x-1)}{x-1} = 0$$

$$\frac{x+1-8x+8}{x-1} = 0$$

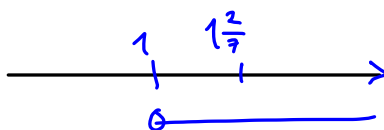
$$\frac{-7x+9}{x-1} = 0$$

$$\text{os.} = 0$$

$$-7x+9 = 0$$

$$-7x = -9 \quad | :(-7)$$

$$x = \frac{9}{7} = 1 \frac{2}{7} \quad \text{käy, kunnos me}$$



$$V: 1 \frac{2}{7}$$

rat. epäyht.

$$\frac{3x+1}{x-4} > 0$$

määr. ehto

$$x-4 \neq 0$$

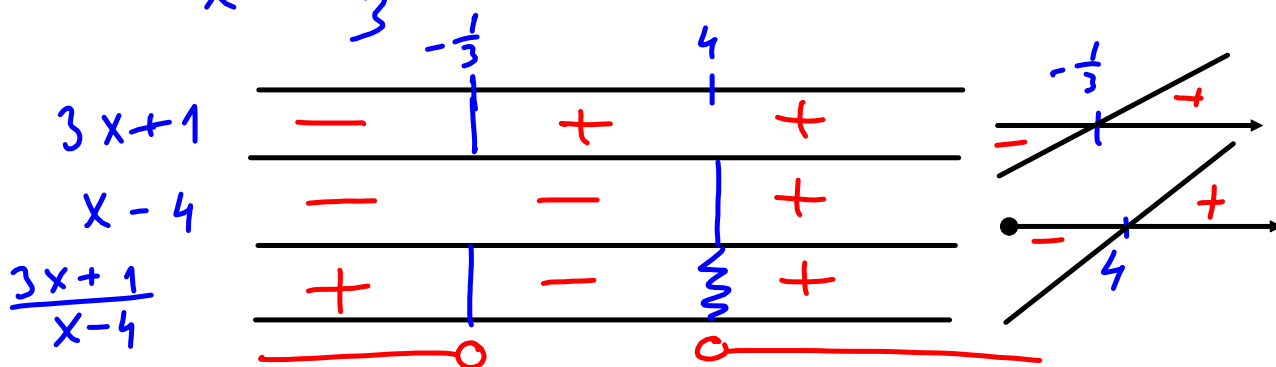
$$x \neq 4$$

os. nk: l

$$3x+1=0$$

$$3x = -1 \quad | :3$$

$$x = -\frac{1}{3}$$



$x=4$ ei kuulu määr. ehtoon

$$V: \quad x < -\frac{1}{3} \quad \text{tai} \quad x > 4$$

$$D x^{10} \qquad D e^x = e^x$$

$$D (6x^3 - x - e^x - e^2)$$

$$D \cos 2x \qquad D e^{f(x)}$$

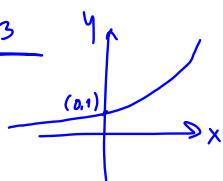
$$D e^{x^2} \qquad = e^{f(x)} \cdot f'(x)$$

$$D e^{3x} = e^{3x} \cdot 3$$

$$= 3e^{3x}$$

↑
comp. f. jalk. & der.

$$s(x) = 3x$$

$$s'(x) = 3$$


$$D x^{10} = 10 x^{10-1} = 10 x^9$$

$$D (6x^3 - x - e^x - e^2)$$

$$= D 6x^3 - D x - D e^x - D e^2$$

$$= 6 \cdot 3x^2 - 1 - e^x + 0$$

$$= 18x^2 - 1 - e^x$$

$$D \cos 2x$$

$$= 2 \cdot (-\sin 2x)$$

$$= -2 \sin 2x$$

$$s(x) = 2x$$

$$s'(x) = 2$$

$$D \sin x = \cos x$$

$$D \cos x = -\sin x$$

$$D e^{x^2}$$

$$= 2x \cdot e^{x^2}$$

$$s(x) = x^2$$

$$s'(x) = 2x$$

$$D \sin^2 x = D(\sin x \cdot \sin x) = D(\sin x)^2$$

$$= 2 \sin x \cdot \cos x$$

$$= \sin 2x$$

$$s(x) = \sin x$$

$$s'(x) = \cos x$$

$$\int (3x^5 + 4x) dx, \quad x \in \mathbb{R}$$

$$= 3 \int x^5 dx + 4 \int x dx$$

$$= 3 \cdot \frac{1}{6} x^6 + 4 \cdot \frac{1}{2} x^2 + C$$

$$= \frac{1}{2} x^6 + 2x^2 + C$$

$$\frac{1}{2} x^6 = \frac{x^6}{2}$$

$$\int (3x-4)^5 dx$$

$$= \frac{1}{3} \int (3x-4)^5 dx$$

$$= \frac{1}{3} \cdot \frac{1}{5+1} (3x-4)^{5+1} + C$$

$$s(x) = 3x-4$$

$$s'(x) = 3$$

$$3 \cdot \frac{1}{3} = 1$$

Tangentin yhtälö

$$f(x) = 2x^2 - 4$$

kohtaan $x = 1$.

Ratk.

$$y - y_0 = k(x - x_0)$$

↑
 $f'(x_0)$

$$\underline{x_0 = 1}$$

$$y_0 = f(x_0) = 2 \cdot 1^2 - 4 = \underline{\underline{-2}}$$

$(1, -2)$

$$f'(x) = 2 \cdot 2x - 0 = 4x$$

$$f'(1) = 4 \cdot 1 = 4 = k$$

$$y - (-2) = 4(x - 1)$$

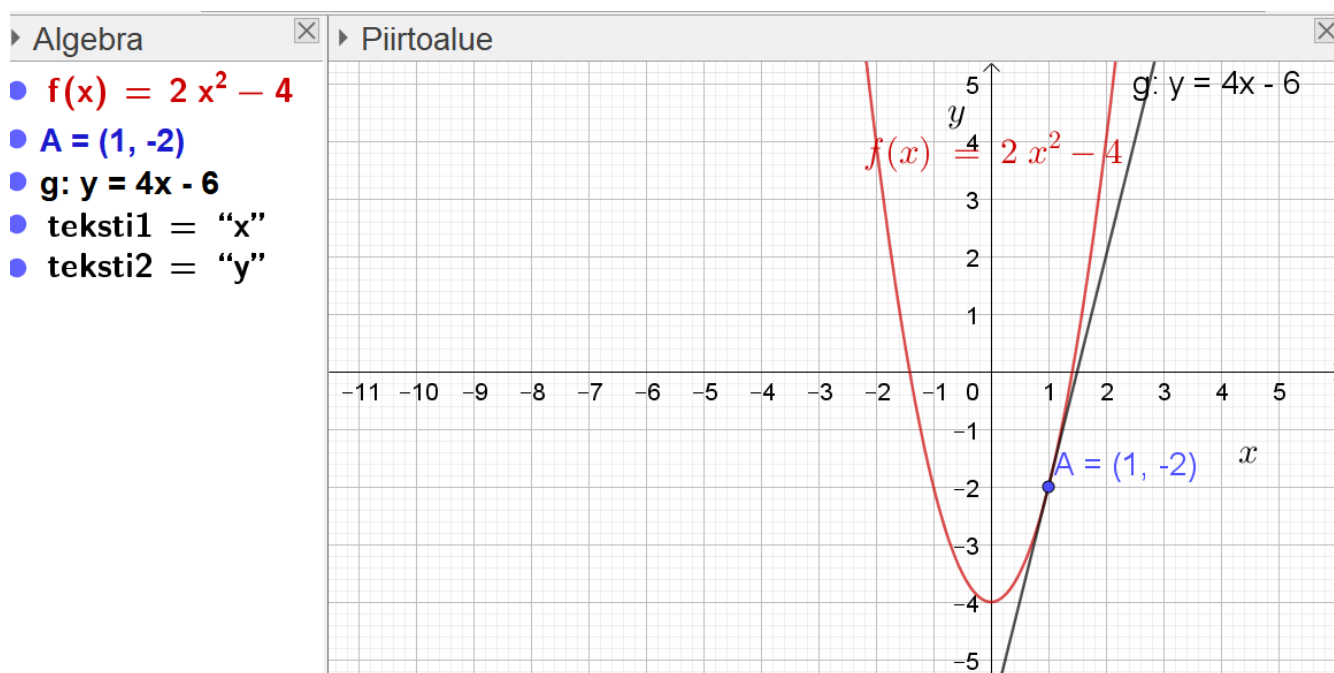
$$y + 2 = 4x - 4$$

$$y = 4x - 4 - 2$$

$$y = 4x - 6$$

$$0 = 4x - y - 6$$

$$4x - y - 6 = 0$$



$$f(x) := 2 \cdot x^2 - 4 \quad \blacktriangleright \quad \textit{Valmis}$$

Tang piirretään kohtaan $x = 1$

$$f(1) \quad \blacktriangleright \quad -2$$

Eli piste on $(1, -2)$

yhtälö

kulmakerroin

$$\frac{d}{dx}(f(x)) \quad \blacktriangleright \quad 4 \cdot x$$

$$g(x) := \frac{d}{dx}(f(x)) \quad \blacktriangleright \quad \textit{Valmis}$$

$$g(1) \quad \blacktriangleright \quad 4$$
