Recall: $e^{\ln u} = u;\quad \ln e^{u} = u;\quad \ln x = \log_e x;\quad \ln e = 1$

Solve $e^{\ln 2x} = 18.$

$$e^{\ln 2x} = 18$$

$$2x = 18$$

$$x = 9$$

Solve $e^{3x} = 5$.

Recall: $e^{\ln u} = u$; $\ln e^u = u$; $\ln x = \log_e x$; $\ln e = 1$

$$e^{3x} = 5$$

$$\ln\left(e^{3x}\right) = \ln(5)$$

$$3x = \ln 5$$

$$x = \frac{\ln 5}{3}$$

Solve $12 - 3e^{x} = 6$.

Recall: $e^{\ln u} = u$; $\quad \ln e^{u} = u$; $\quad \ln x = \log_{e} x$; $\quad \ln e = 1$

$$12 - 3e^{x} = 6$$

$$-3e^{x} = -6$$

$$e^{x} = \frac{-6}{-3}$$

$$e^{x} = 2$$

$$\ln\left(e^{x}\right) = \ln\left(2\right)$$

$$x = \ln\left(2\right)$$

Solve $5e^{-x} = 25.$

Hint: $e^{\ln u} = u;$ $\ln e^{u} = u;$ $\ln x = \log_{e} x;$ $\ln e = 1$

$$5e^{-x} = 25$$

$$e^{-x} = 5$$

$$\ln\left(e^{-x}\right) = \ln(5)$$

$$-x = \ln 5$$

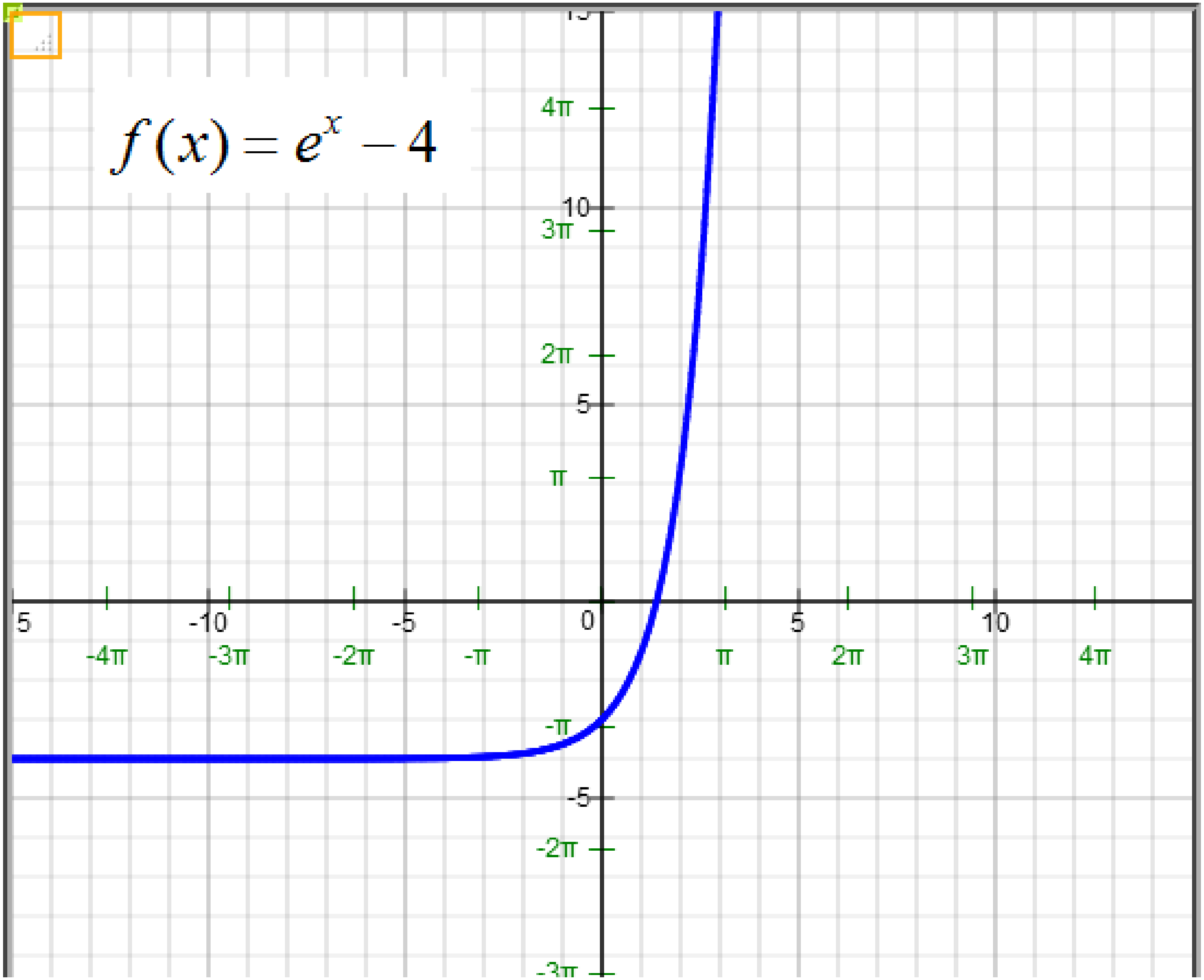
$$x = -\ln 5$$

Graph $f(x) = e^x - 4$

Calculator Input: $y = e \wedge (x) - 4$

a) Domain of $f(x) = (-\infty, \infty)$

b) Range of $f(x) = (-4, \infty)$



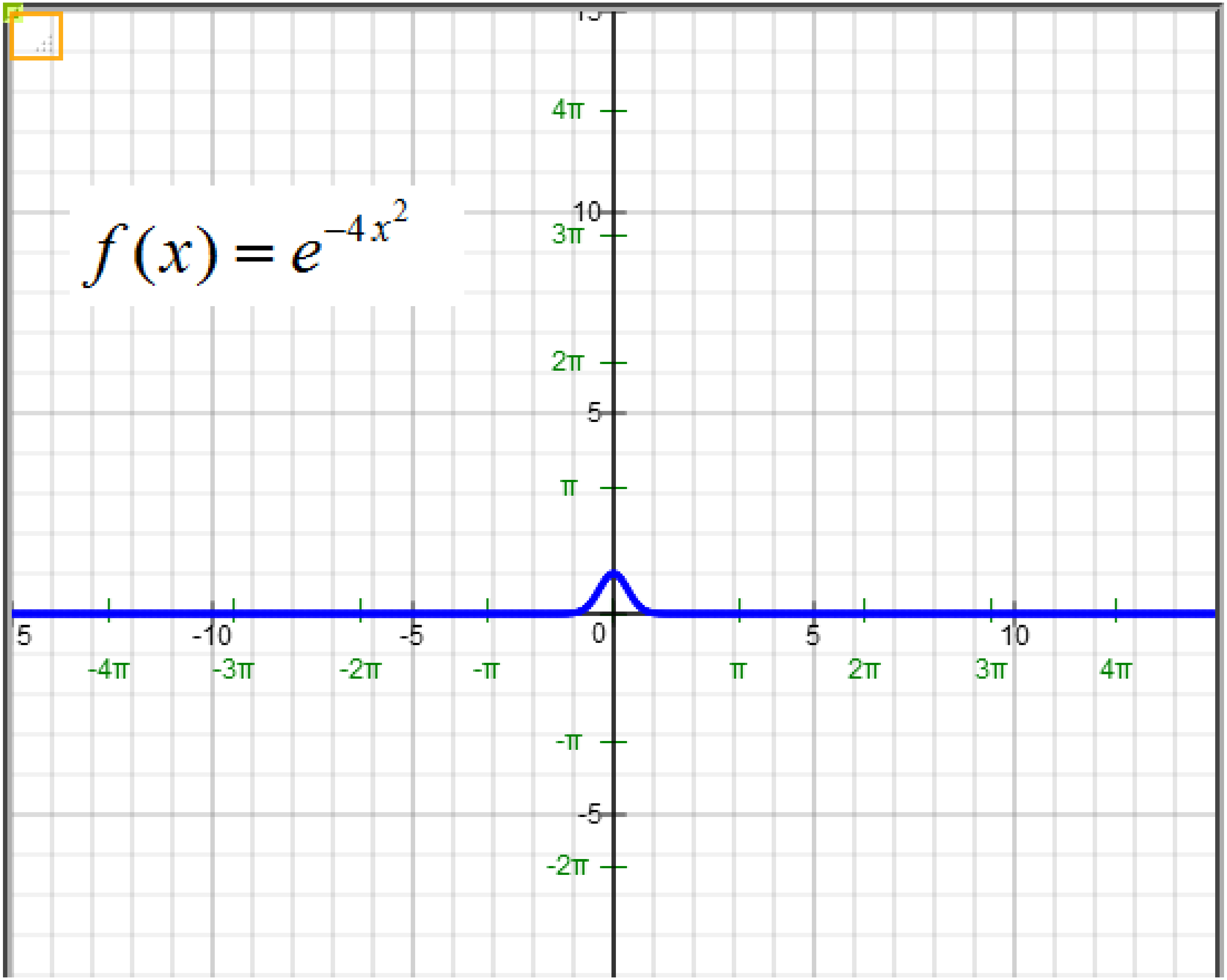
$f(x) = e^x - 4$
4π
10
3π
2π
5
π
-π
-5
-2π
-3π
5
-10
-5
0
5
10
-4π
-3π
-2π
-π
π
2π
3π
4π

Graph $f(x) = e^{-4x^2}$

Calculator Input: $y = e \wedge \left(-4x^2\right)$

a) Domain of $f(x) = \left(-\infty, \infty\right)$

b) Range of $f(x) = (0,\ 1]$


$f(x) = e^{-4x^2}$
4π
10
3π
2π
5
π
0
-π
-5
-2π
5
-10
-5
5
10
-4π
-3π
-2π
-π
π
2π
3π
4π

Review:

1) $f(x) = \ln(\text{expression}), \quad f'(x) = \frac{1}{\text{expression}} \cdot D_x(\text{expression})$

2) $\int \frac{1}{x} dx = \ln|x| + C; \quad \int \frac{1}{ax+b} dx = \frac{1}{a} \ln|ax+b| + C$

3) $f(x) = e^{\text{expression}}, \quad f'(x) = e^{\text{expression}} \cdot D_x(\text{expression})$

4) $\int e^x dx = e^x + C; \quad \int e^{ax} dx = \frac{1}{a} e^{ax} + C$

5) $f(x) = \log_b(\text{expression}), \quad f'(x) = \frac{1}{\ln b} \frac{1}{\text{expression}} \cdot D_x(\text{expression})$

6) $\int a^x dx = \frac{1}{\ln(a)} a^x + C; \quad \int a^{bx} dx = \frac{1}{b} \frac{1}{\ln(a)} a^x + C$

Let $y = e^{x-4}$. Find y'.

Recall: For $y = e^{\text{expression}} \Rightarrow y' = \left(e^{\text{expression}}\right) \cdot D_x\left(\text{expression}\right)$

$$y' = e^{x-4} \cdot D_x\left(x-4\right) = e^{x-4} \cdot \left(1\right) = e^{x-4}$$

Let $y = 5e^{4x^2+2}$. Find y'.

Recall: For $y = e^{\text{expression}} \Rightarrow y' = \left(e^{\text{expression}}\right) \cdot D_x\left(\text{expression}\right)$

$$y' = 5e^{4x^2+2} \cdot D_x\left(4x^2 + 2\right) = 5e^{4x^2+2} \cdot \left(8x\right) = 40xe^{4x^2+2}$$

Let $y = x^2 \cdot e^{2x}$. Find y'

Hint: Use Product Rule for Derivative.

Let F = First Factor; S = Second Factor

Recall: For $y = e^{\text{expression}} \Rightarrow y' = \left(e^{\text{expression}}\right) \cdot D_x\left(\text{expression}\right)$

$$y' = F \cdot D_x(S) + S \cdot D_x(F)$$

$$y' = \left(x^2\right) \cdot D_x\left(e^{2x}\right) + \left(e^{2x}\right) \cdot D_x\left(x^2\right)$$

$$y' = \left(x^2\right) \cdot \left(2e^{2x}\right) + \left(e^{2x}\right) \cdot (2x)$$

Let $y = \dfrac{2}{e^x + e^{-x}}$. Find y'.

Recall: $y = (\text{expression})^{\text{n}} \Rightarrow y = n(\text{expression})^{\text{n-1}} \cdot D_x\left(\text{expression}\right)$

Recall: $D_x(e^{power}) = e^{power} \cdot D_x(power)$

$$y' = \frac{D \cdot D_x\left(N\right) - N \cdot D_x\left(D\right)}{D^2}$$

$$y' = \frac{\left(e^x + e^{-x}\right) \cdot D_x\left(2\right) - 2 \cdot D_x\left(e^x + e^{-x}\right)}{\left(e^x + e^{-x}\right)^2}$$

$$y' = \frac{\left(e^x + e^{-x}\right) \cdot \left(0\right) - 2 \cdot \left(e^x + -1e^{-x}\right)}{\left(e^x + e^{-x}\right)^2} = \frac{-2(e^x - e^{-x})}{\left(e^x + e^{-x}\right)^2}$$

Let $y = \dfrac{3e^x + 1}{4e^x - 1}$. Find y'

Hint: Use Quotient Rule for Derivative.

Hint: $\mathrm{D}_x(e^{power}) = e^{power} \cdot \mathrm{D}_x(power)$

Let N = Numerator Factor; D = Denominator Factor

$$y' = \frac{D \cdot D_x(N) \text{ - } N \cdot D_x(D)}{D^2}$$

$$y' = \frac{\left(4e^x - 1\right) \cdot D_x\left(3e^x + 1\right) \text{ - } \left(3e^x + 1\right) \cdot D_x\left(4e^x - 1\right)}{\left(4e^x - 1\right)^2}$$

$$y' = \frac{\left(4e^x - 1\right) \cdot \left(3e^x\right) \text{ - } \left(3e^x + 1\right) \cdot (4\mathrm{e}^{\mathrm{x}})}{\left(4e^x - 1\right)^2}$$

Let $f(x) = e^{3x} \cdot \ln x$. Find equation of tangent line at (1, 0)

Hint: Use Product Rule for Derivative.

Let F = First Factor; S = Second Factor

$$f'(x) = F \cdot D_x\left(S\right) \; + \; S \cdot D_x\left(F\right)$$

$$f'(x) = \left(e^{3x}\right) \cdot D_x\left(\ln x\right) \; + \; \left(\ln x\right) \cdot D_x\left(e^{3x}\right)$$

$$f'(x) = \left(e^{3x}\right) \cdot \left(\frac{1}{x}\right) \; + \; \left(\ln x\right) \cdot \left(3e^{3x}\right)$$

slope of tangent line: $f'(1) = \left(e^{3x}\right) \cdot \left(1/x\right) \; + \; \left(\ln x\right) \cdot \left(3e^{3x}\right)$ Note: ln1=0

$$= \left(e^{3}\right) \cdot \left(1\right) \; + \; \left(0\right) \cdot \left(3\right) = e^{3}$$

Equation of Tangent Line: $y - y_1 = m(x - x_1)$

$$y - 0 = e^{3}\left(x - 1\right)$$

Let $f(x)=\dfrac{e^{x}-e^{-x}}{2}=\dfrac{1}{2}e^{x}-\dfrac{1}{2}e^{-x}$. Find extremums.

$$f'(x)=\frac{1}{2}e^{x}-\frac{1}{2}\left(-1e^{-x}\right)=\frac{1}{2}e^{x}+\frac{1}{2}\left(e^{-x}\right)$$

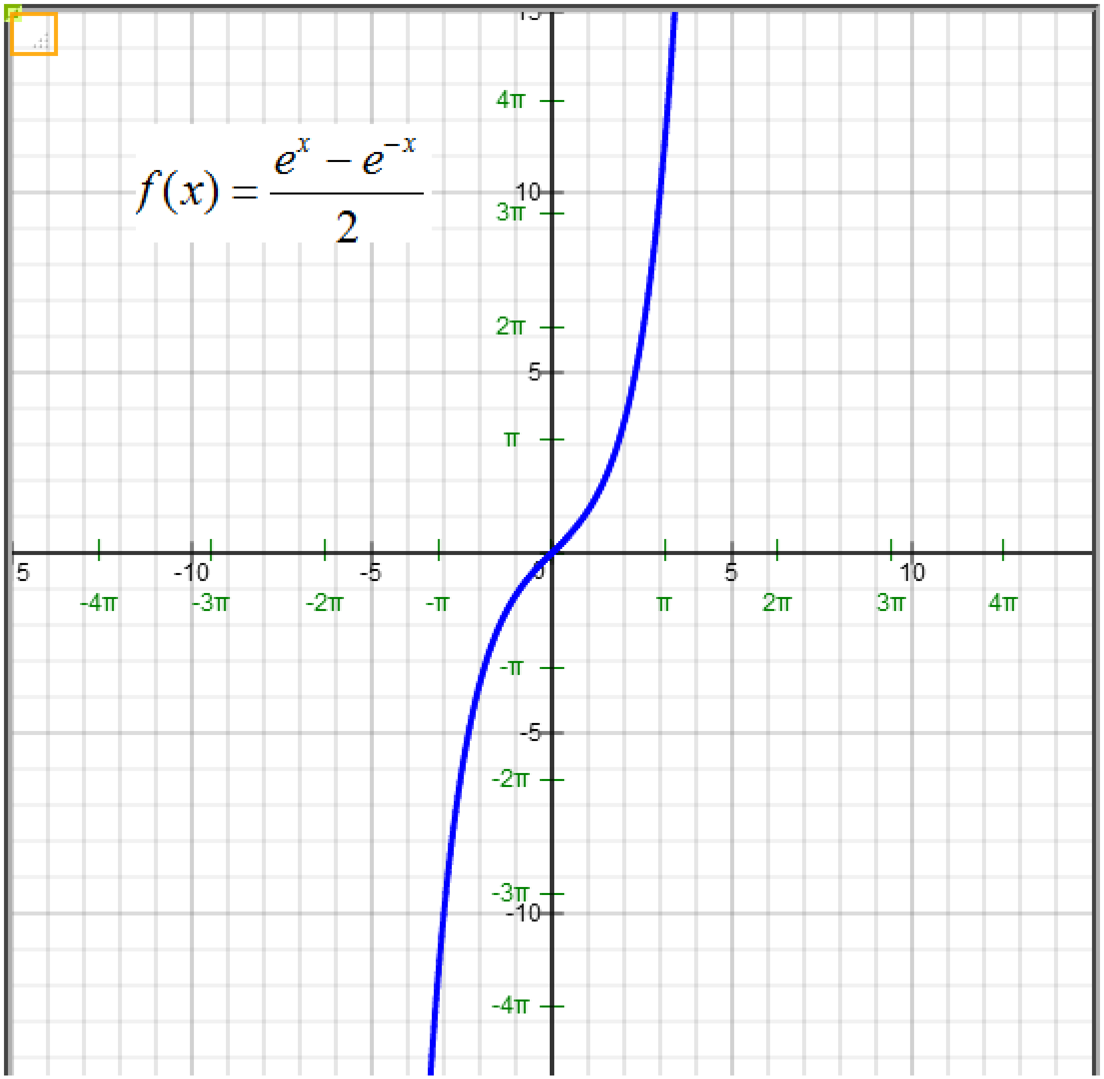
Set $f'(x)=0$

$$\frac{1}{2}e^{x}+\frac{1}{2}\left(e^{-x}\right)=0 \quad \Rightarrow \quad e^{x}+\left(e^{-x}\right)=0$$

Note: $\mathrm{e}^{x}>0;\quad e^{-x}>;\quad e^{x}+\left(e^{-x}\right)\neq 0$

Therefore, no extremum for $f(x)=\dfrac{e^{x}-e^{-x}}{2}$.

Calculator Input: $y = 0.5e \wedge (x) - 0.5e \wedge (-x)$


$f(x) = \frac{e^x - e^{-x}}{2}$
4π
10
3π
2π
5
π
-π
-5
-2π
-3π
-10
-4π
5
-10
-5
0
5
10
-4π
-3π
-2π
-π
π
2π
3π
4π