Yohan Lee Lab 9

Examples

In[7]:= **SumConvergence[x^n, n]**

Out[7]= Abs[x] < 1

In[1]:= **NumberLinePlot[SumConvergence[x^n, n], x]**

Out[1]=
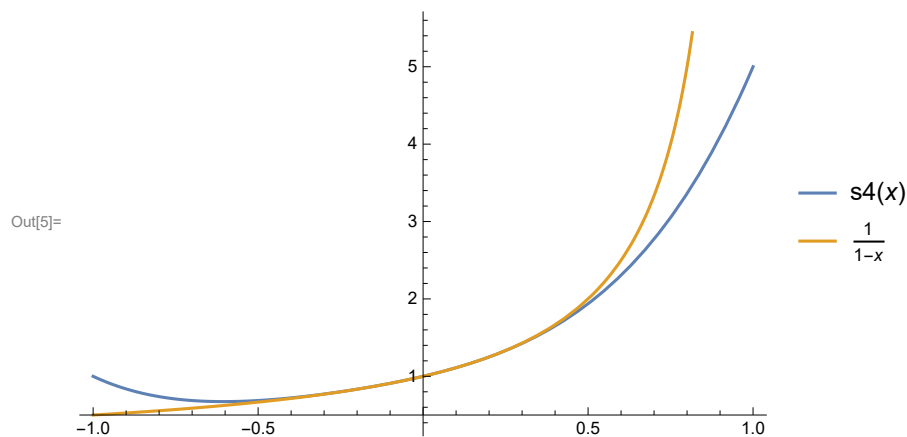

In[2]:= **Sum[x^n, {n, 0, Infinity}]**

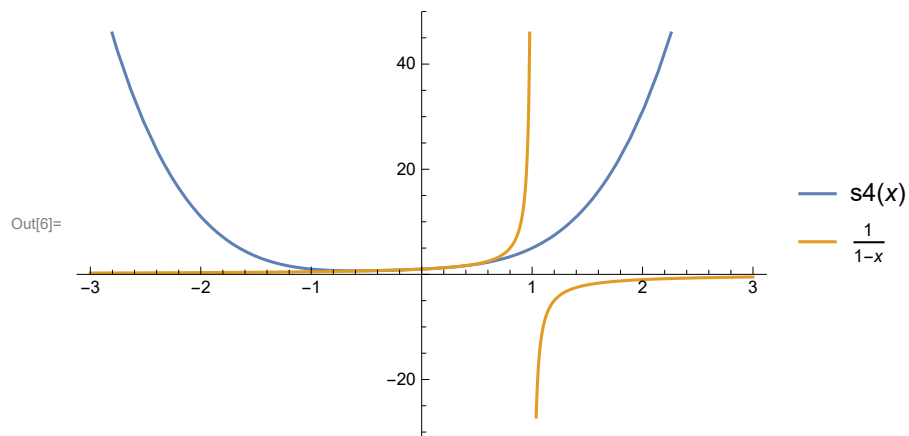Out[2]= $\dfrac{1}{1-x}$

In[3]:= **s4[x_] := Sum[x^n, {n, 0, 4}]**

In[4]:= **Function$\left[x, \sum_{n=0}^{4} x^n\right]$**

Out[4]= Function$\left[x, \sum_{n=0}^{4} x^n\right]$

In[5]:= **Plot$\left[\{s4[x], 1/(1-x)\}, \{x, -1, 1\},$ PlotLegends → "Expressions"$\right]$**

Out[5]=

In[6]:= `Plot[{s4[x], 1 / (1 - x)}, {x, -3, 3}, PlotLegends → "Expressions"]`

Out[6]=

In[8]:= `s16[x_] := Sum[x^n, {n, 0, 16}]`

In[9]:= $\text{Function}\left[x, \sum_{n=0}^{16} x^n\right]$

Out[9]= $\text{Function}\left[x, \sum_{n=0}^{16} x^n\right]$

In[10]:= `Plot[{s16[x], 1 / (1 - x)}, {x, -1, 1}, PlotLegends → "Expressions"]`

Out[10]=

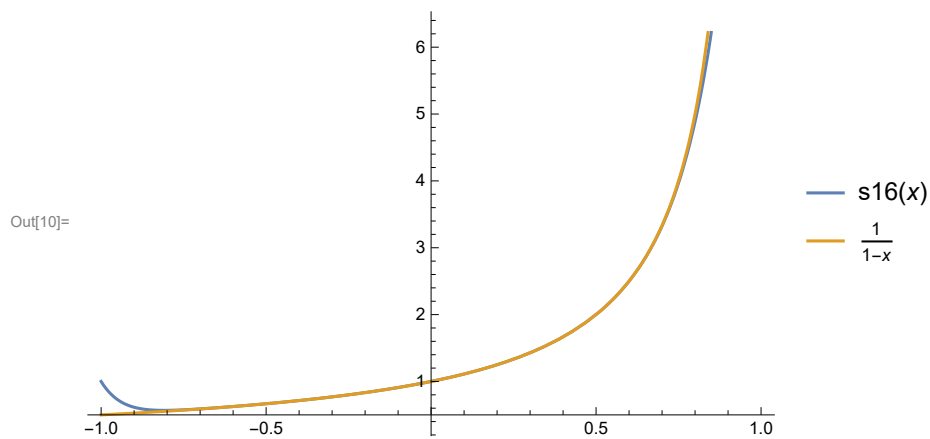In[11]:= `Plot[{s16[x], 1/(1-x)}, {x, -3, 3}, PlotLegends → "Expressions"]`

Out[11]=

—— s16(*x*)

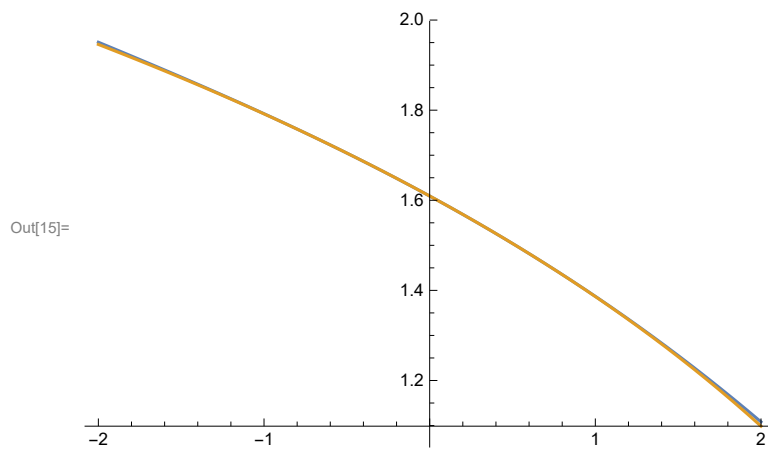—— $\frac{1}{1-x}$
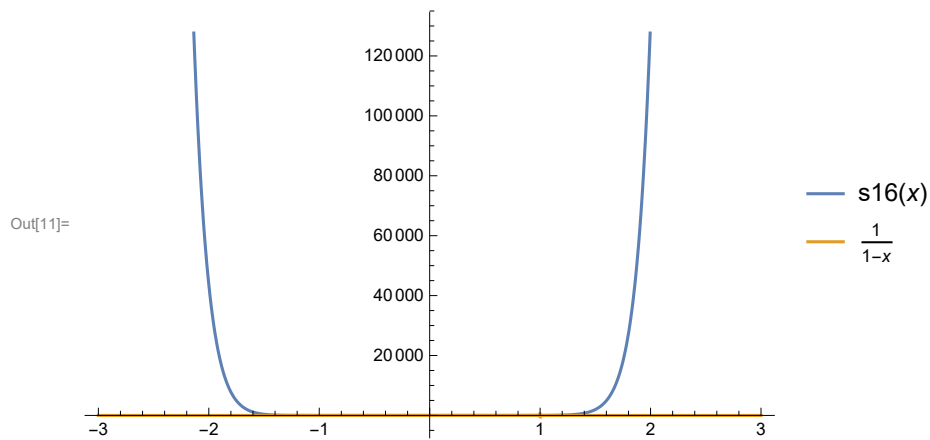
In[12]:= `Series[Log[5 - x], {x, 0, 5}]`

Out[12]= $\text{Log}[5] - \frac{x}{5} - \frac{x^2}{50} - \frac{x^3}{375} - \frac{x^4}{2500} - \frac{x^5}{15\,625} + O[x]^6$

In[13]:= `logSeries[x_] := Log[5] - x / 5 - x^2 / 50 - x^3 / 375`

In[14]:= $\text{Function}\left[x, \text{Log}[5] - \frac{x}{5} - \frac{x^2}{50} - \frac{x^3}{375}\right]$

Out[14]= $\text{Function}\left[x, \text{Log}[5] - \frac{x}{5} - \frac{x^2}{50} - \frac{x^3}{375}\right]$

In[15]:= `Plot[{logSeries[x], Log[5 - x]}, {x, -2, 2}]`

Out[15]=

In[16]:= `Plot[{logSeries[x], Log[5 - x]}, {x, -5, 5}]`

Out[16]=
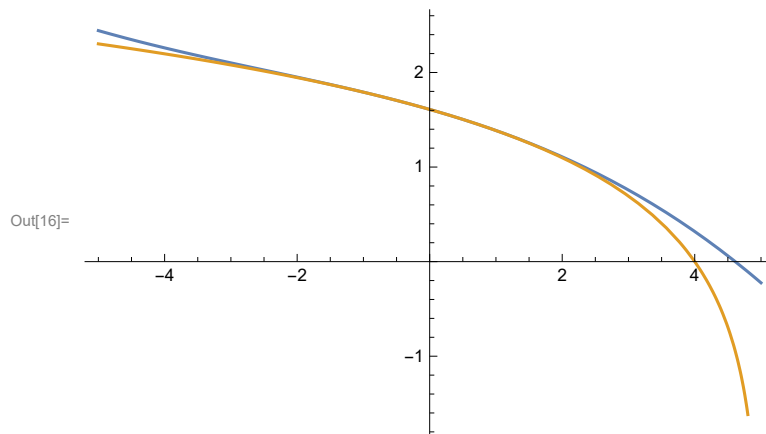
In[17]:= `NumberLinePlot[SumConvergence[x^n / (n * 5^n), n], x]`

Out[17]=

Questions

Q1)

In[18]:= $\text{Sum}\left[(-1)\wedge n * x\wedge(2\,n) \middle/ \text{Factorial}[2\,n], \{n, 0, \text{Infinity}\}\right]$

Out[18]= $\text{Cos}[x]$

In[34]:= $\text{SumConvergence}\left[(-1)\wedge n * x\wedge(2\,n) \middle/ \text{Factorial}[2\,n], n\right]$

Out[34]= `True`

The domain of Cos is all real numbers.

In[30]:= $\text{sum4}[x\_] := \text{Sum}\left[(-1)\wedge n * x\wedge(2\,n) \middle/ \text{Factorial}[2\,n], \{n, 0, 4\}\right]$

In[31]:= $\text{Function}\left[x, \sum_{n=0}^{4} \frac{(-1)^n x^{2n}}{(2n)!}\right]$

Out[31]= $\text{Function}\left[x, \sum_{n=0}^{4} \frac{(-1)^n x^{2n}}{(2n)!}\right]$

In[32]:= $\text{sum16}[x\_] := \text{Sum}\left[(-1)\wedge n * x\wedge(2\,n) \middle/ \text{Factorial}[2\,n], \{n, 0, 16\}\right]$

In[33]:= $\text{Function}\left[x, \sum_{n=0}^{16} \frac{(-1)^n x^{2n}}{(2n)!}\right]$

Out[33]= $\text{Function}\left[x, \sum_{n=0}^{16} \frac{(-1)^n x^{2n}}{(2n)!}\right]$

In[38]:= `Plot[{sum4[x], sum16[x], Cos[x]}, {x, -5, 5}, PlotLegends → "Expressions"]`
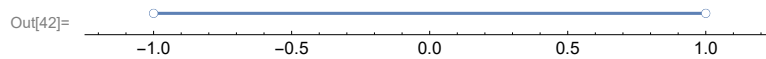
Out[38]=

— sum4(*x*)
— sum16(*x*)
— cos(*x*)
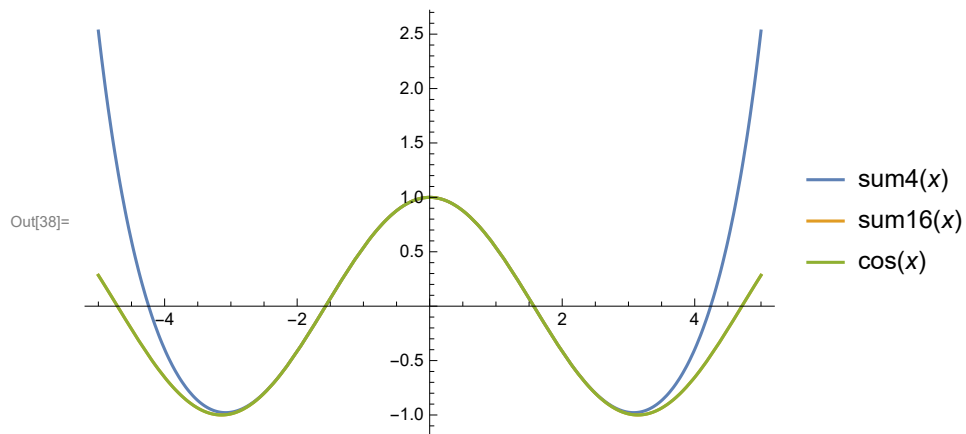
Q2)

a)

In[24]:= `Sum[(-1)^(n-1) * x^n / n, {n, 1, Infinity}]`

Out[24]= `Log[1 + x]`

In[39]:= `SumConvergence[(-1)^(n-1) * x^n / n, n]`

Out[39]= `Abs[x] < 1`

In[42]:= `NumberLinePlot[SumConvergence[(-1)^(n-1) * x^n / n, n], x]`

Out[42]=

b)

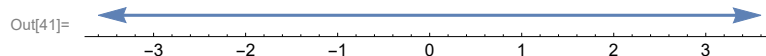In[25]:= `Sum[(-1)^n (3 x)^(2 n + 1) / Factorial[2 n + 1], {n, 0, Infinity}]`

Out[25]= `Sin[3 x]`

In[40]:= `SumConvergence[(-1)^n (3 x)^(2 n + 1) / Factorial[2 n + 1], n]`

Out[40]= `True`

Domain is all real numbers.

In[41]:= `NumberLinePlot[SumConvergence[(-1)^n (3 x)^(2 n + 1) / Factorial[2 n + 1], n], x]`

Out[41]=

c)

In[28]:= `Sum[8 (n + 1) x^n, {n, 0, Infinity}]`

Out[28]= $\dfrac{8}{(-1 + x)^2}$

In[43]:= `SumConvergence[8 (n + 1) x^n, n]`

Out[43]= $\text{Abs}[x] < 1$

In[44]:= `NumberLinePlot[SumConvergence[8 (n + 1) x^n, n], x]`

Out[44]=