DATA605 - Assignment 14

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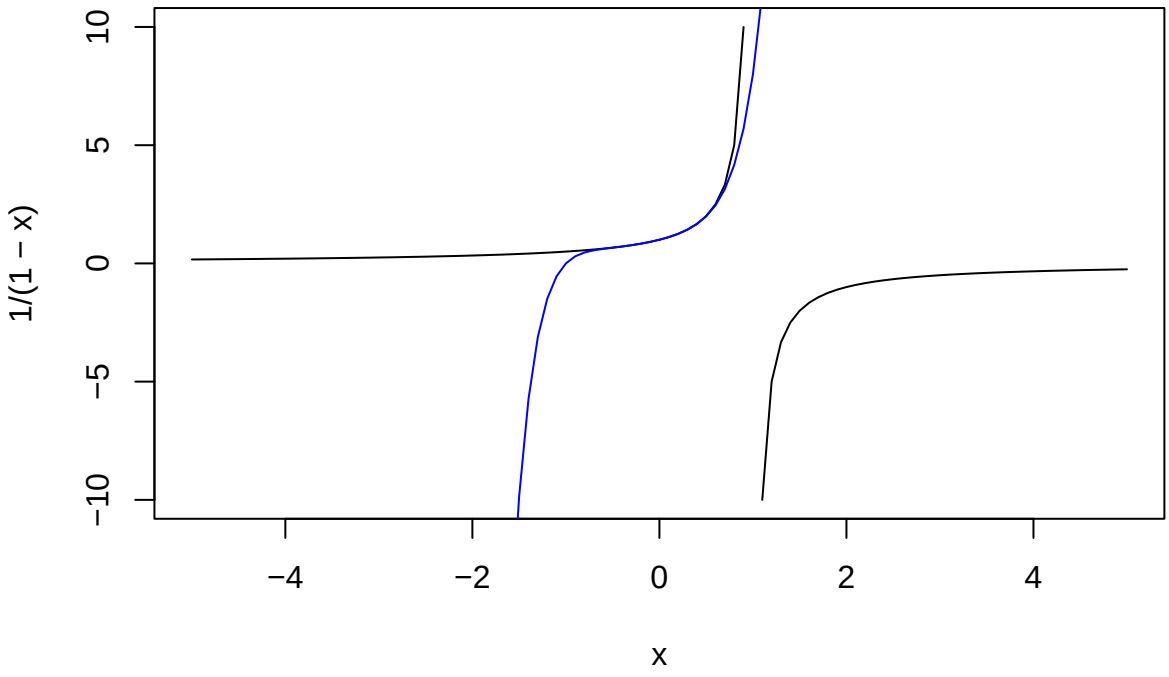
Assignment 14

1 This week, we'll work out some Taylor Series expansions of popular functions. For each function, only consider its valid ranges as indicated in the notes when you are computing the Taylor Series expansion.

$f(x) = \frac{1}{(1-x)}$

$$f(x) = \frac{1}{(1-x)} = \sum_{n=0}^{\infty} x^n = 1 + x + x^2 + x^3 + x^4 ...$$

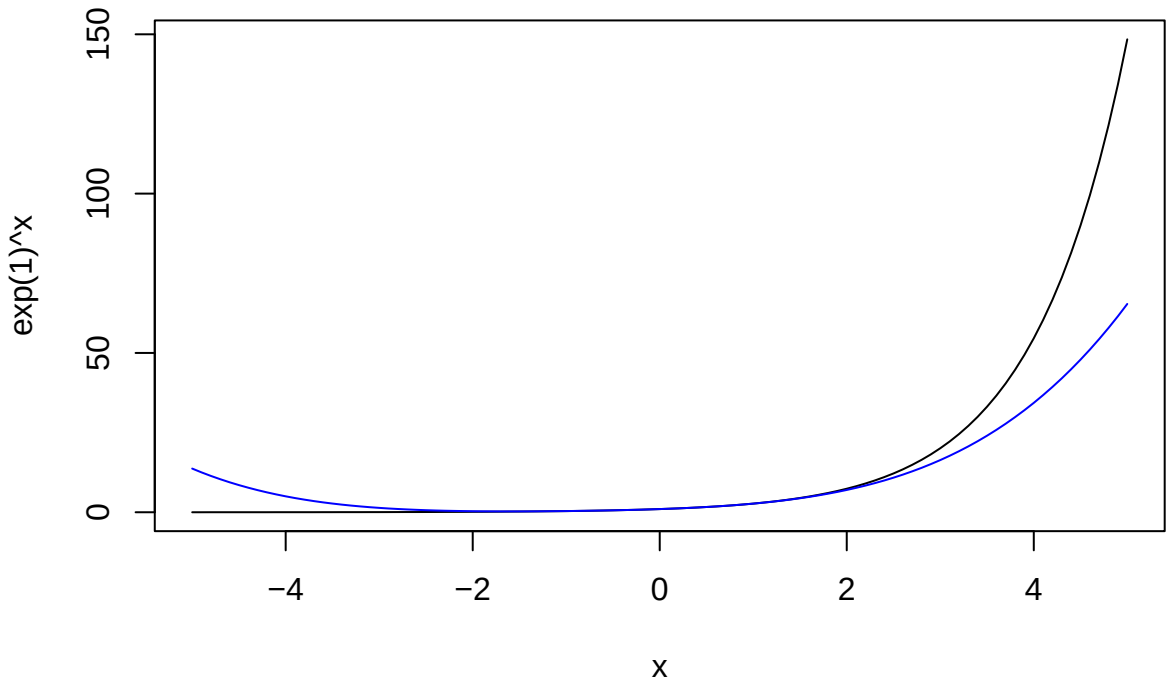
```
curve(1/(1-x),-5,5)
curve(1 + x + x^2 + x^3 + x^4 + x^5 + x^6 + x^7, -5, 5, col='blue', add=T)
```



$f(x) = e^x$

$$f(x) = e^x = \sum_{n=0}^{\infty} \frac{x^n}{n!} = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} ...$$

```
curve(exp(1)^x,-5,5)
curve(1 + x + x^2/factorial(2) + x^3/factorial(3) + x^4/factorial(4), -5, 5, col='blue', add=T)
```



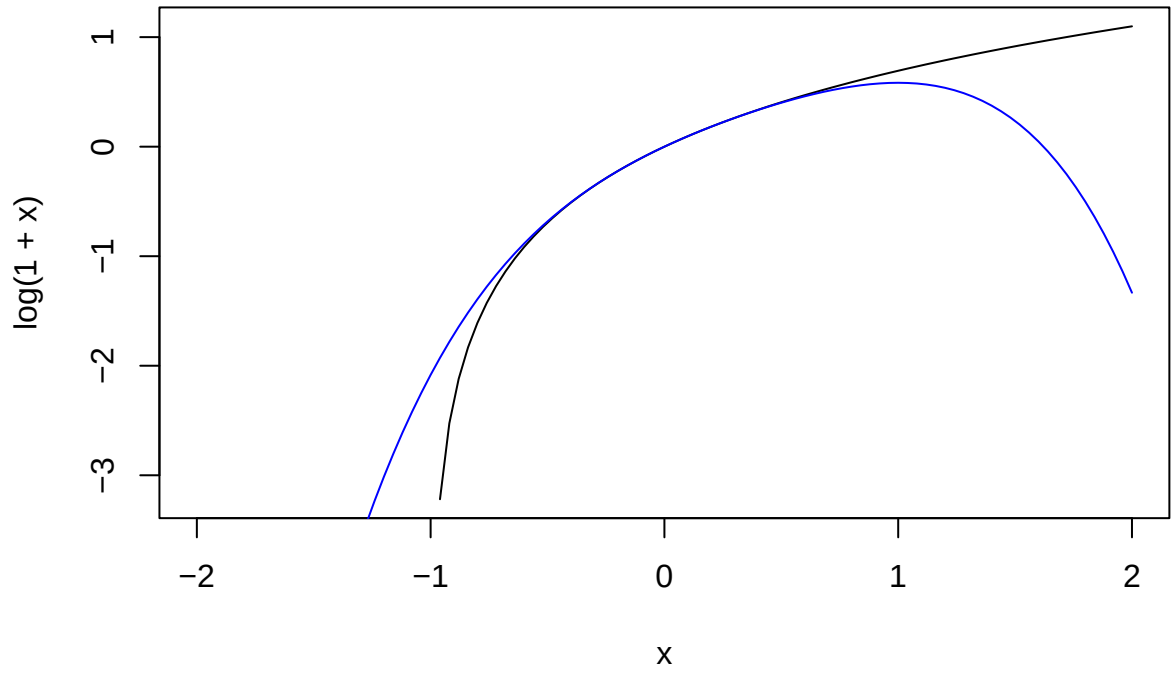
$f(x) = ln(1+x)$

$$f(x) = ln(1+x) = \sum_{n=1}^{\infty} \frac{-1^n x^n}{n} = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} ...$$

```
curve(log(1+x),-2,2)
```

```
## Warning in log(1 + x): NaNs produced
```

```
curve(x - (x^2)/2 + (x^3)/3 - (x^4)/4, -2, 2, col='blue', add=T)
```



$f(x) = x^{\frac{1}{2}}$

Taylor series for $x^{\frac{1}{2}}$ is undefined as the square root of x is not differentiable at 0.