

Complex Series (3B)

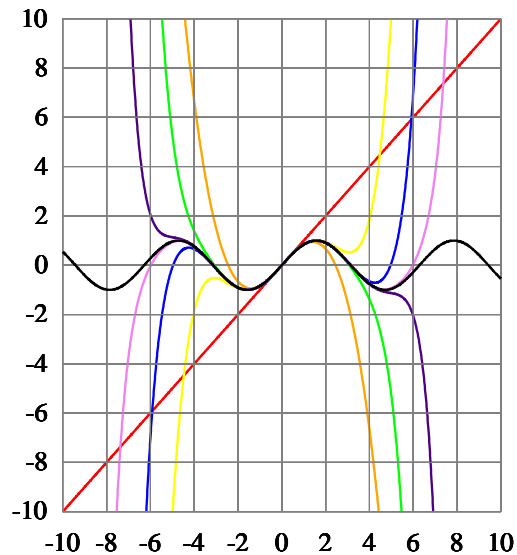
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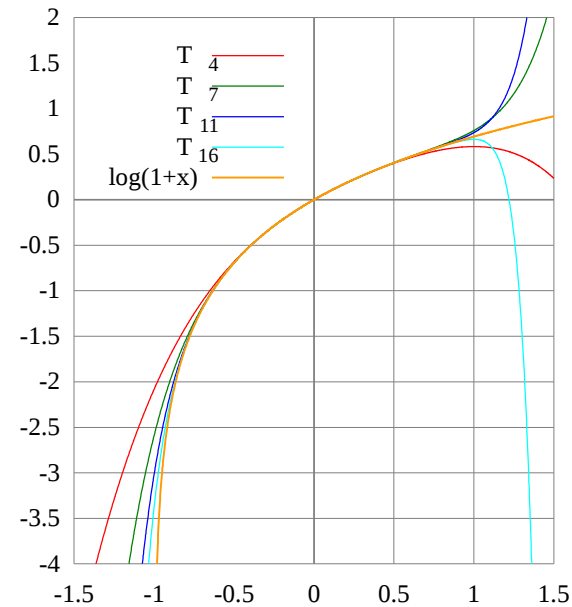
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Taylor Series – real



As the degree of the Taylor polynomial rises, it approaches the correct function. This image shows $\sin(x)$ and its Taylor approximations, polynomials of degree 1, 3, 5, 7, 9, 11 and 13.

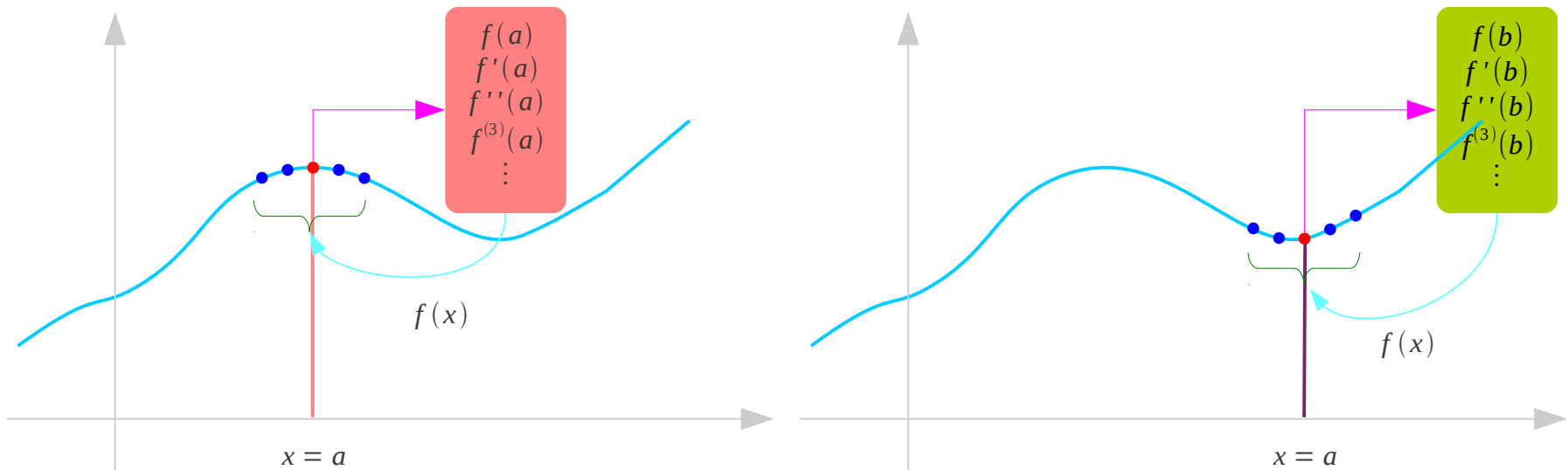


The Taylor polynomials for $\log(1+x)$ only provide accurate approximations in the range $-1 < x \leq 1$. Note that, for $x > 1$, the Taylor polynomials of higher degree are worse approximations.

Taylor Series – real

$$f(x) = f(a) + f'(a)(x-a) + \frac{f''(a)}{2!}(x-a)^2 + \cdots + \frac{f^{(n)}(a)}{n!}(x-a)^n + \cdots$$

around $x = a$



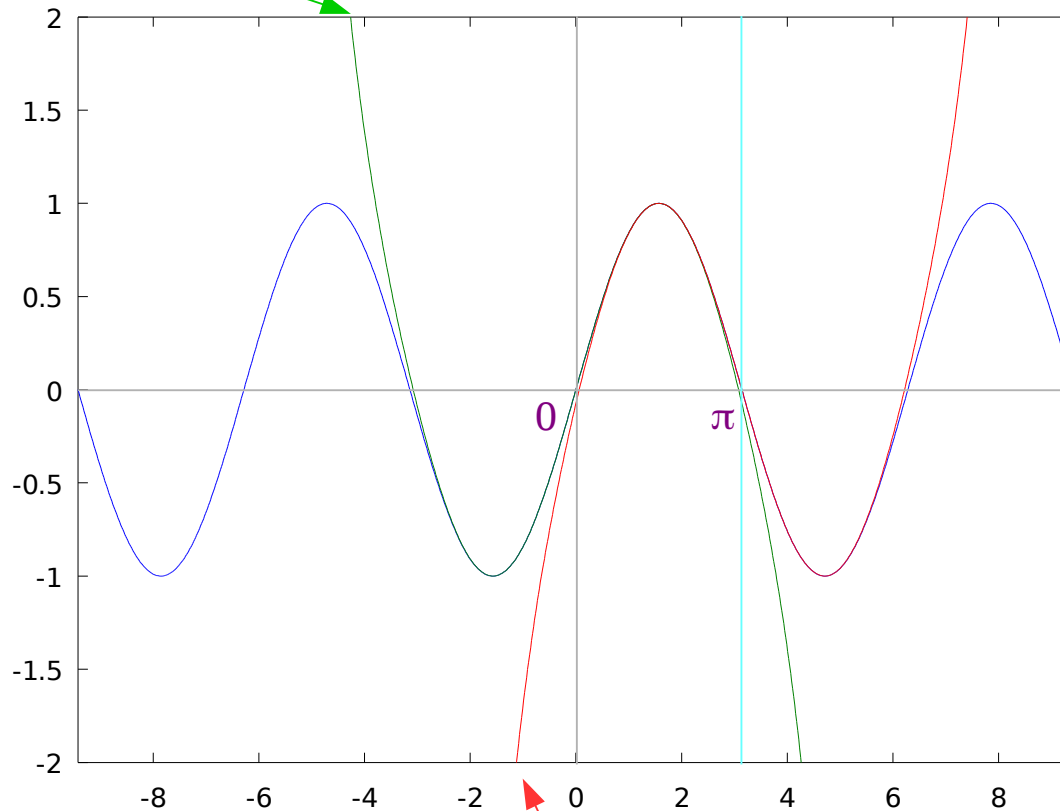
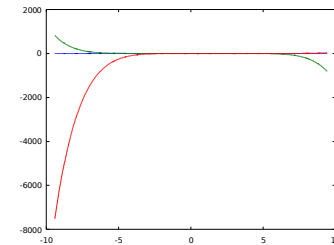
$$f(x) = f(b) + f'(b)(x-b) + \frac{f''(b)}{2!}(x-b)^2 + \cdots + \frac{f^{(n)}(b)}{n!}(x-b)^n + \cdots$$

around $x = b$

Taylor Series Expansion – sin(x)

$$f(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!}$$

Taylor series expansion at $x = 0$



for $-1 < x < +1$

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

for $\pi - 1 < x < \pi + 1$

$$g(x) = \sin(x)$$

Taylor series expansion at $x = \pi$

$$g(x) = -(x-\pi) + \frac{(x-\pi)^3}{3!} - \frac{(x-\pi)^5}{5!} + \frac{(x-\pi)^7}{7!}$$

Taylor Series – real

References

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- [2] <http://planetmath.org/>
- [3] M.L. Boas, “Mathematical Methods in the Physical Sciences”
- [4] E. Kreyszig, “Advanced Engineering Mathematics”
- [5] D. G. Zill, W. S. Wright, “Advanced Engineering Mathematics”
- [6] T. J. Cavicchi, “Digital Signal Processing”