MEEN 357-Task 3 | | Ian Wilhite

2) Chapra $\rightarrow e^{-x} = 1 - x + \frac{x^2}{2!} - \frac{x^3}{3!} + \ldots$

	error:	% error
$h_1(5) = 1$	$1 - e^{-5} = 0.993$	$0.993/e^{-5} = 14{,}700\%$
$h_2(5) = -4$	$-4-(e^{-5}) = -4.007$	$-4.007/e^{-5} = 59{,}500\%$
$h_3(5) = 8.5$	$8.5-(+e^{-5}) = 8.493$	$8.493/e^{-5} = 126{,}100\%$

Canale $\rightarrow e^{-x} = \frac{1}{e^{x}} = \frac{1}{1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \ldots}$

	error:	% error:
$a_1(5) = \frac{1}{1} = 1$	$1 - e^{-5} = 0.993$	$\frac{0.993}{e^{-5}} = 14{,}700\%$
$a_2(5) = \frac{1}{6} = 0.1\overline{66}$	$\frac{1}{6} - e^{-5} = 0.160$	$\frac{0.160}{e^{-5}} = 2{,}373\%$
$a_3(5) = \frac{1}{18.5} = 0.\overline{054}$	$\frac{1}{18.5} - e^{-5} = 0.047$	$\frac{0.047}{e^{-5}} = 702\%$

3) The Canale method of approximation is substantially more effective at approaching the true value by direct approach rather than oscillation, and does so much faster

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$f(x) = 25x^3 - 6x^2 + 7x - 88$

$f'(x) = 75x^2 - 12x + 7$

$f''(x) = 150x - 12$

$f'''(x) = 150$

$f(1) = -62$

$f'(1) = 70$

$f''(1) = 138$

$f'''(1) = 150$

Predictions for $f(2.5)$ centered around $x=1$

$n=0$: $f_0(2.5) = \frac{f^{(0)}(1)}{0!}(2.5-1)^0 = -62$

$n=1$: $f_1(2.5) = f_0(2.5) + \frac{f^{(1)}(1)}{1!}(2.5-1)^1 = 43$

$n=2$: $f_2(2.5) = f_1(2.5) + \frac{f^{(2)}(1)}{2!}(2.5-1)^2 = 198.25$

$n=3$: $f_3(2.5) = f_2(2.5) + \frac{f^{(3)}(1)}{3!}(2.5-1)^3 = 282.625$

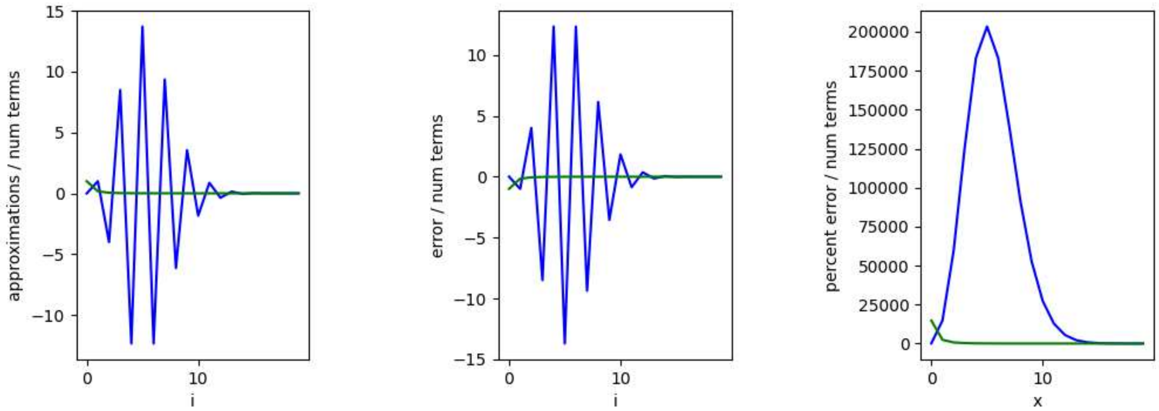
True Percent relative error

$n=0$: $\frac{|282.625-(-62)|}{282.625} \cdot 100\% = 121.94\%$

$n=1$: $\frac{|282.625-(43)|}{282.625} \cdot 100\% = 84.79\%$

$n=2$: $\frac{|282.625-(198.25)|}{282.625} \cdot 100\% = 29.85\%$

$n=3$: $\frac{|282.625-(282.625)|}{282.625} \cdot 100\% = 0\%$


approximations / num terms
i
error / num terms
i
percent error / num terms
x

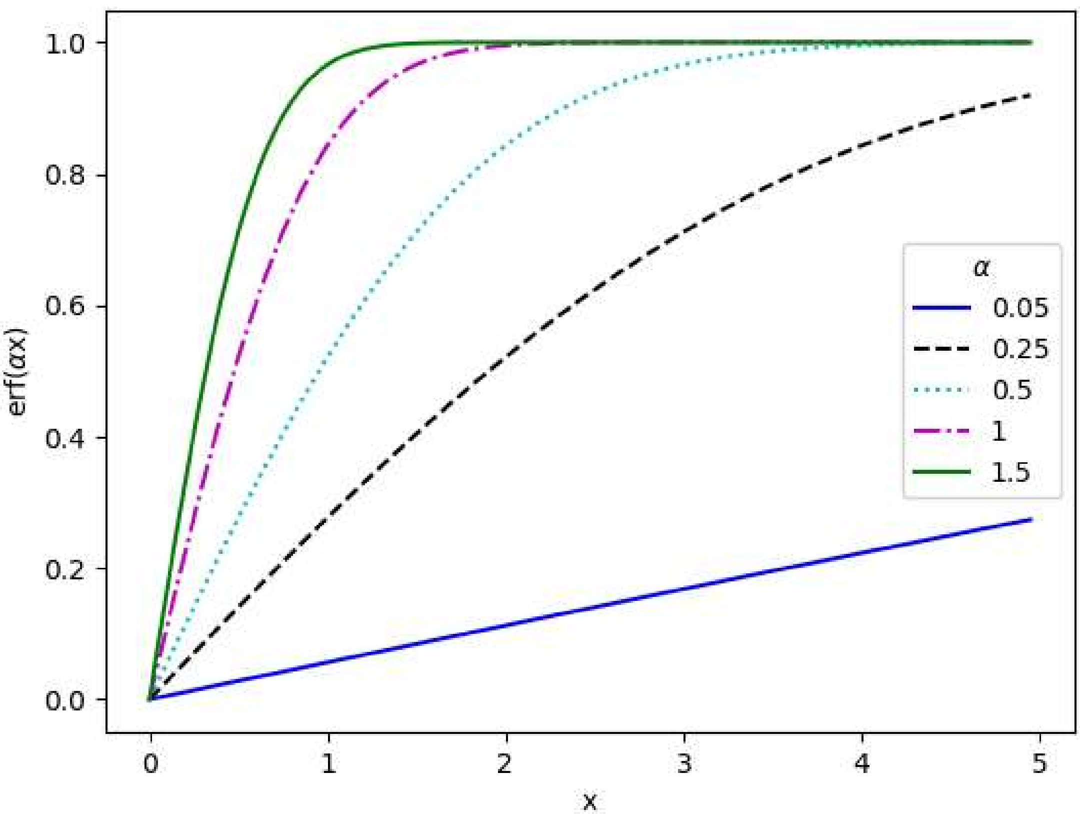

erf(αx)
x
α
0.05
0.25
0.5
1
1.5

Exhibit 1

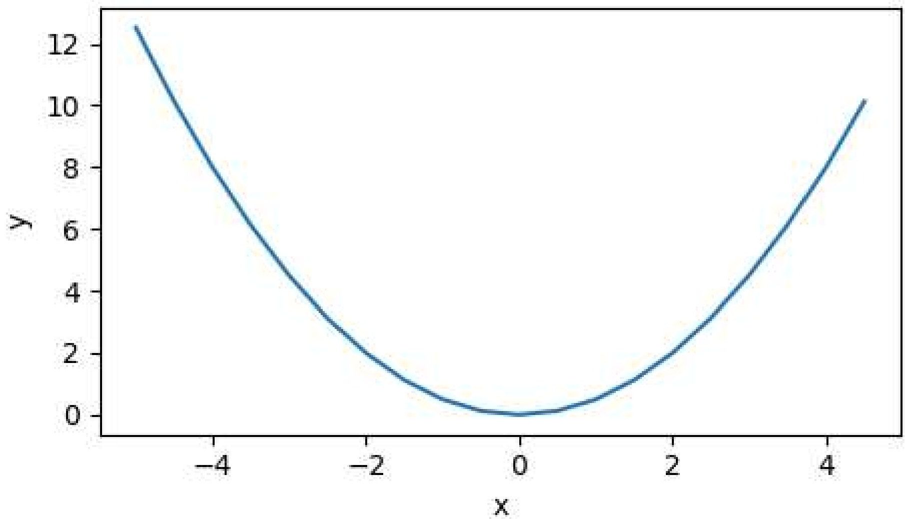


Exhibit 2