ANSWERS TO POWER SERIES ESTIMATION FOR A DEFINITE INTEGRAL EXPLORATION

1. $\dfrac{\ln(1+x)}{x} = 1 - \dfrac{x}{2} + \dfrac{x^2}{3} - \dfrac{x^3}{4} + \dfrac{x^4}{5} - \ldots$

2, 3, 4 & 5:

$$\int_0^{0.5} \left(1-\frac{x}{2}+\frac{x^2}{3}-\frac{x^3}{4}\right)dx \quad 0.447483$$

$$\int_0^{0.5} \frac{\ln(1+x)}{x}\,dx \quad 0.448414$$

$$0.44841420692383-0.44748263888889 \quad 0.000932$$

$$\frac{(0.5)^5}{25} \quad 0.00125$$

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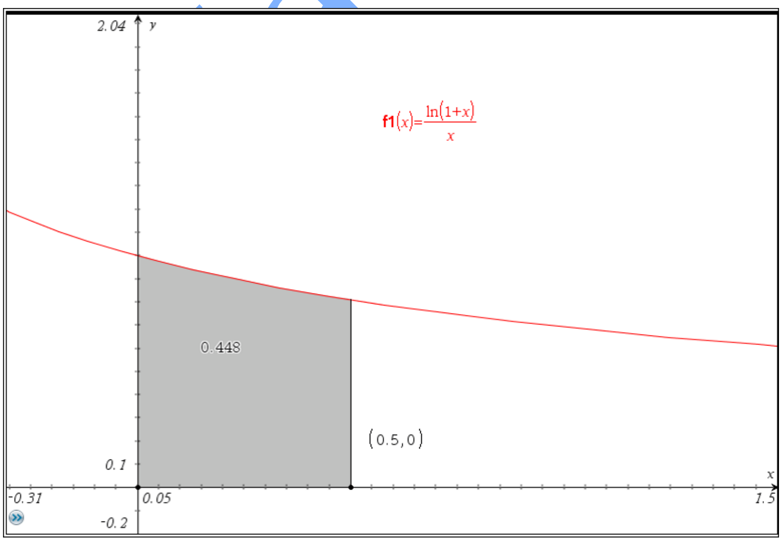
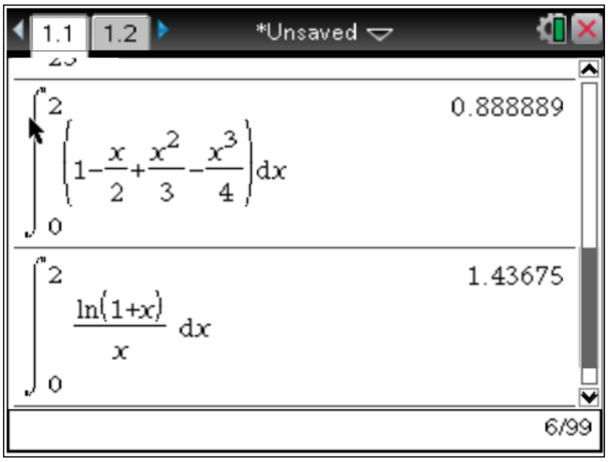
The approximation is correct to 2 decimal places when using the first four terms. The absolute value of the error is less than the first unused term $\dfrac{x^5}{25}$, which evaluates to 0.00125.

The error is 0.000932 which is in agreement with the Alternating Series Estimation Theorem.



6. The series $\ln(1+x) = \sum_{k=1}^{\infty} (-1)^{k+1}\dfrac{x^k}{k} = x - \dfrac{x^2}{2} + \dfrac{x^3}{3} - \dfrac{x^4}{4} + \ldots$ converges for $-1 < x \le 1$ so we cannot approximate the area which goes beyond this interval.


1.1
1.2
*Unsaved
$\int_0^2 \left(1-\frac{x}{2}+\frac{x^2}{3}-\frac{x^3}{4}\right)dx$
0.888889
$\int_0^2 \frac{\ln(1+x)}{x}\,dx$
1.43675
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