Predictor-corrector solver for ODE

Using Predictor-corrector solvers for 2- and 3- body problems

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Concept

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For predictor-corrector requared:

- First explicit method (predictor)
- Second impicit method (corrector)
- Predictor-corrector scheme (explaned next)

Predictor-corrector schemes

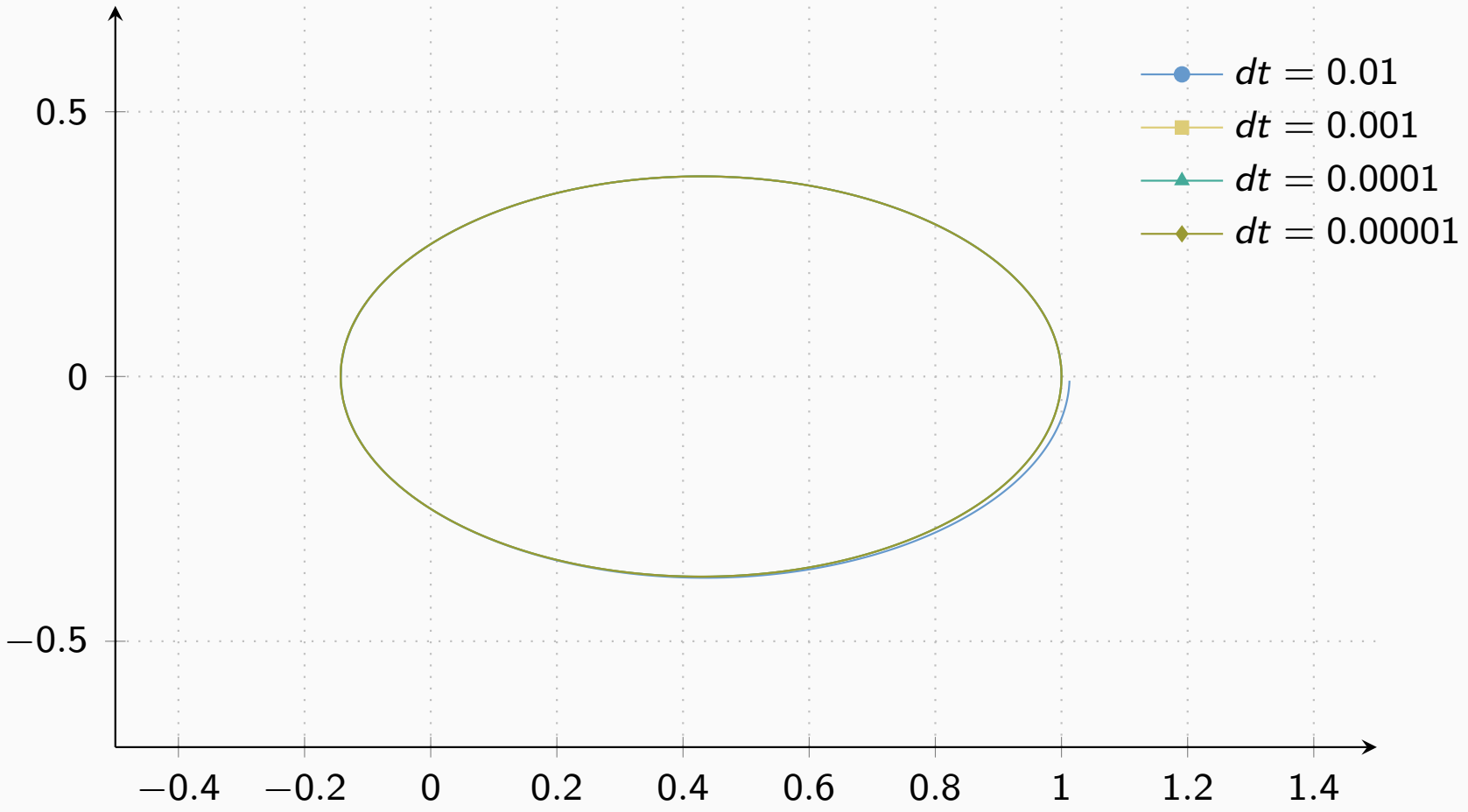
- Using the outcome of the explicit (predictor) method as an initial guess for the corrector (impicit) method
- Using the predictor result as a beginning value in an interative substitution in impicit method

Predictor-corrector order of approximation

- Interpolation Adams method has $+1$ order of approximation of enterpolation Adams method
- Adams interpolation and extrapolation methods can be used as a predictor-corrector pair
- Resulting predictor-corrector method will give interpolation's method approximation

Interpolation Adams method

Second order



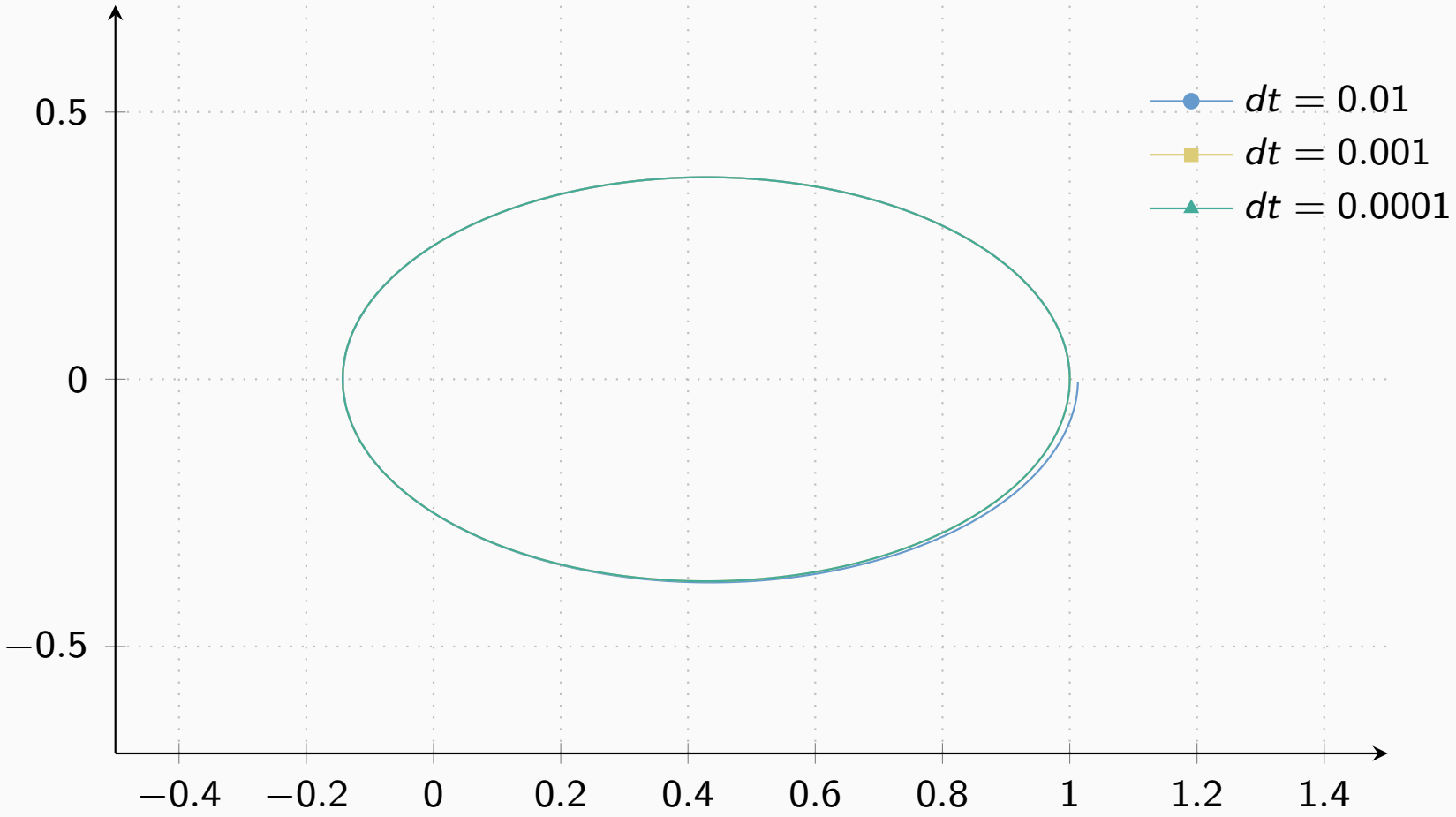
Second order

Table 1: Second order method precision

dt	x on t=T
0.01	1.01271285286200
0.001	1.00001246611392
0.0001	1.00000001277170
0.00001	1.00000000000627
exact	1.0

Predictor as initial guess for Newton method

Second order

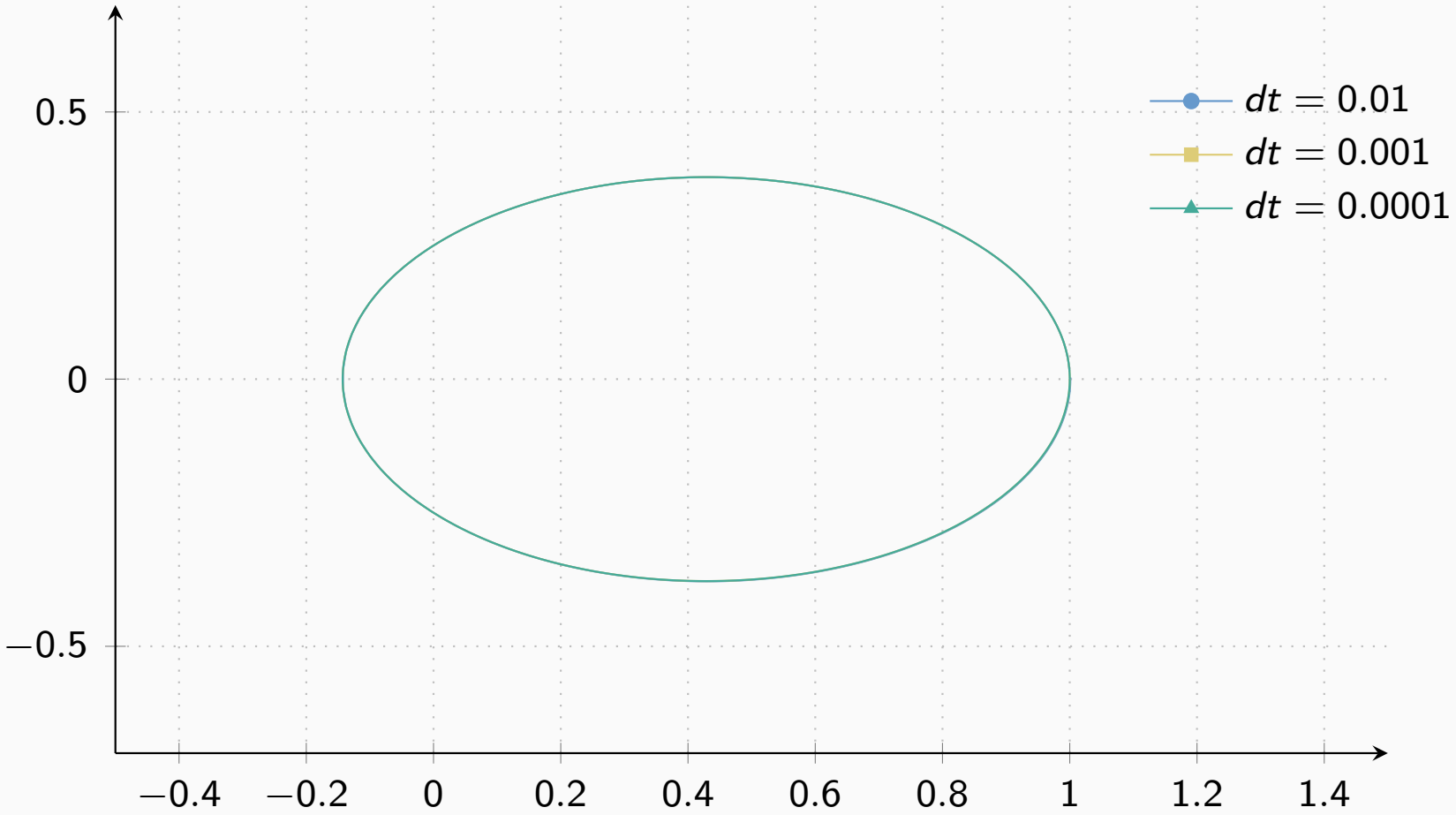


Second order

Table 2: Second order method precision

dt	x on t=T
0.01	1.012828906760525197476065 7
0.001	1.000012386627961775114511 3
0.0001	1.000000012865498484137653 5
exact	1.0

Third order



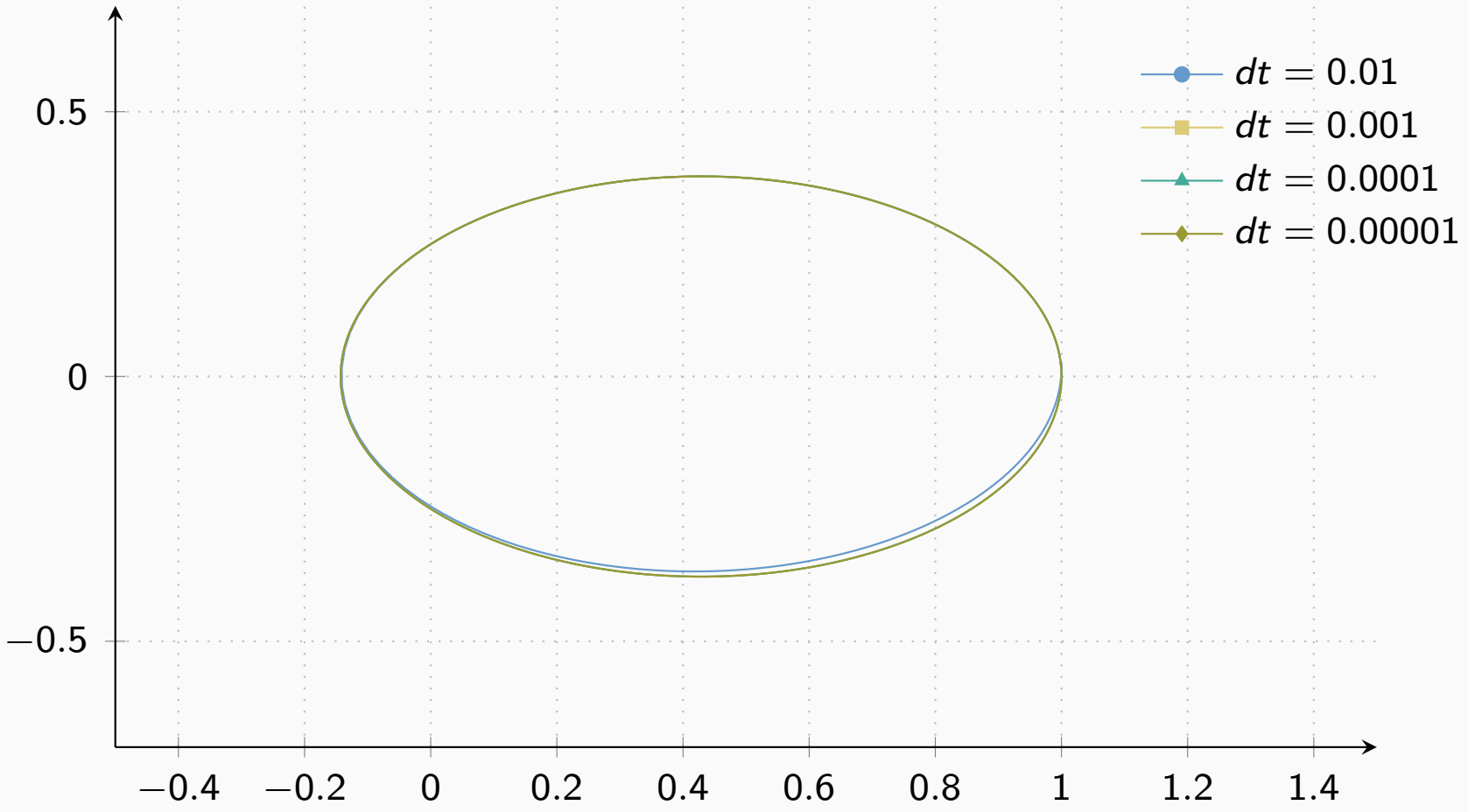
Third order

Table 3: Third order method precision

dt	x on t=T
0.01	1.000900032166876080830737 4
0.001	0.999999509738383131682606 3
0.0001	1.000000000000097194055626 1
exact	1.0

Predictor as initial value for iterative process

First order



First order

Table 4: First order method precision

dt	x on t=T
0.01	0.99983997180013386786028265
0.001	0.99999936661107170679517 49
0.0001	0.99999999997446702455 4771
0.00001	0.99999999999999974251646 78
exact	1.0

Second order

Table 5: Second order method precision

dt	x on t=T
0.01	1.01263325614658098355191 86
0.001	1.00001238428697424145595 87
0.0001	1.00000001286547507361818 03
0.00001	1.00000000001286437675422 11
exact	1.0

Third order

Table 6: Third order method precision

dt	x on t=T
0.01	1.000851057189057619157736 8
0.001	0.999999509732295943907739 5
0.0001	1.000000000000097193447143 6
0.00001	1.000000000000000000971802 3
exact	1.0

Fourth order

Table 7: Fourth order method precision

dt	x on t=T
0.01	0.99928145572184061331661 21
0.001	0.99999491234176658705579 8
0.0001	0.99999999999991252758500 56
0.00001	0.99999999999999999912537 80
exact	1.0