# Predictor-corrector solver for ODE

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

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# Concept

# Concept

For predictor-corrector requared:

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

# Predictor-corrector schemes

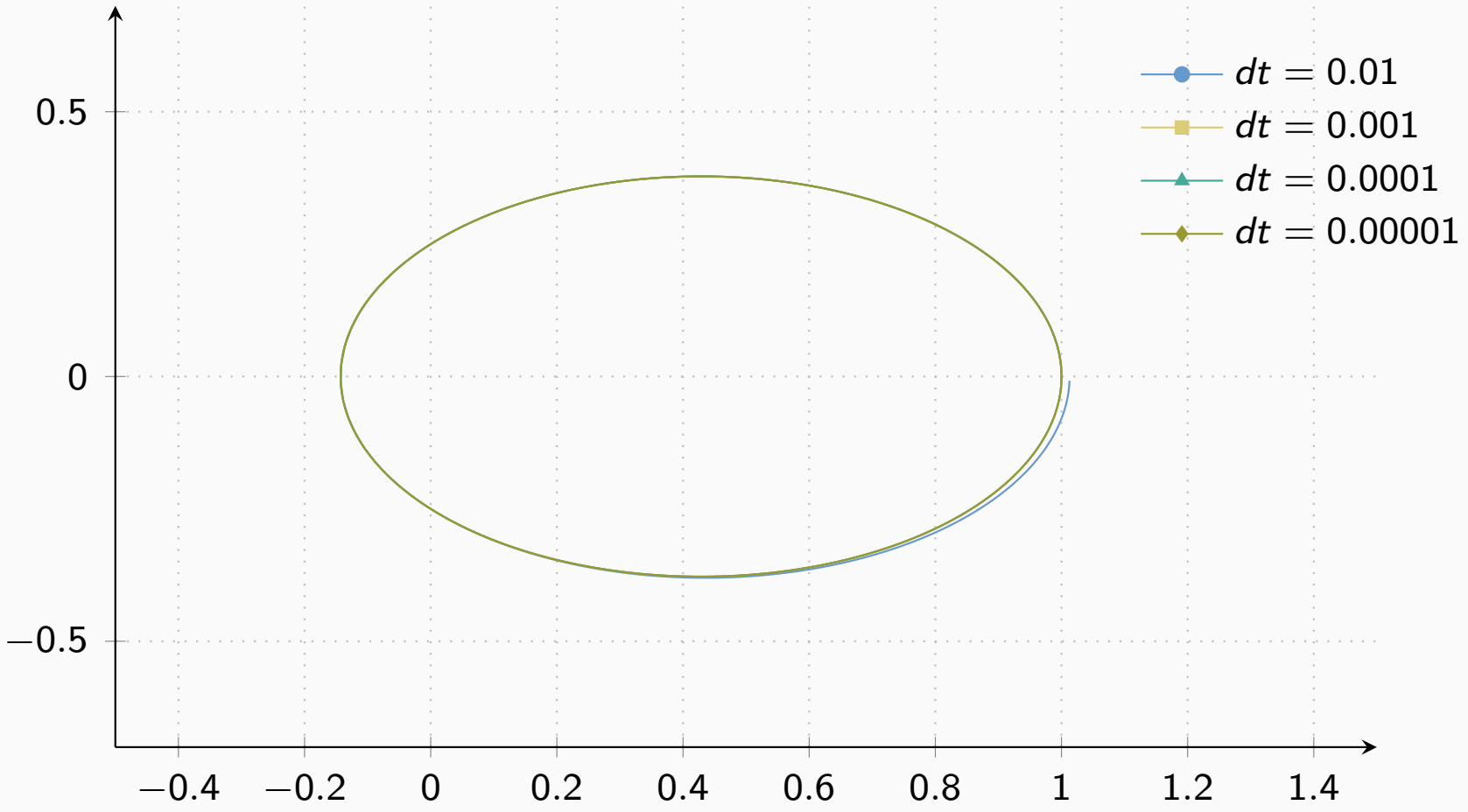
- Using the outcome of the explicit (predictor) method as an initial guess for the corrector (impicit) method
- Using the predictor result as a beginning value in an interative substitution in impicit method

# 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

# Interpolatin Adams method

# Second order



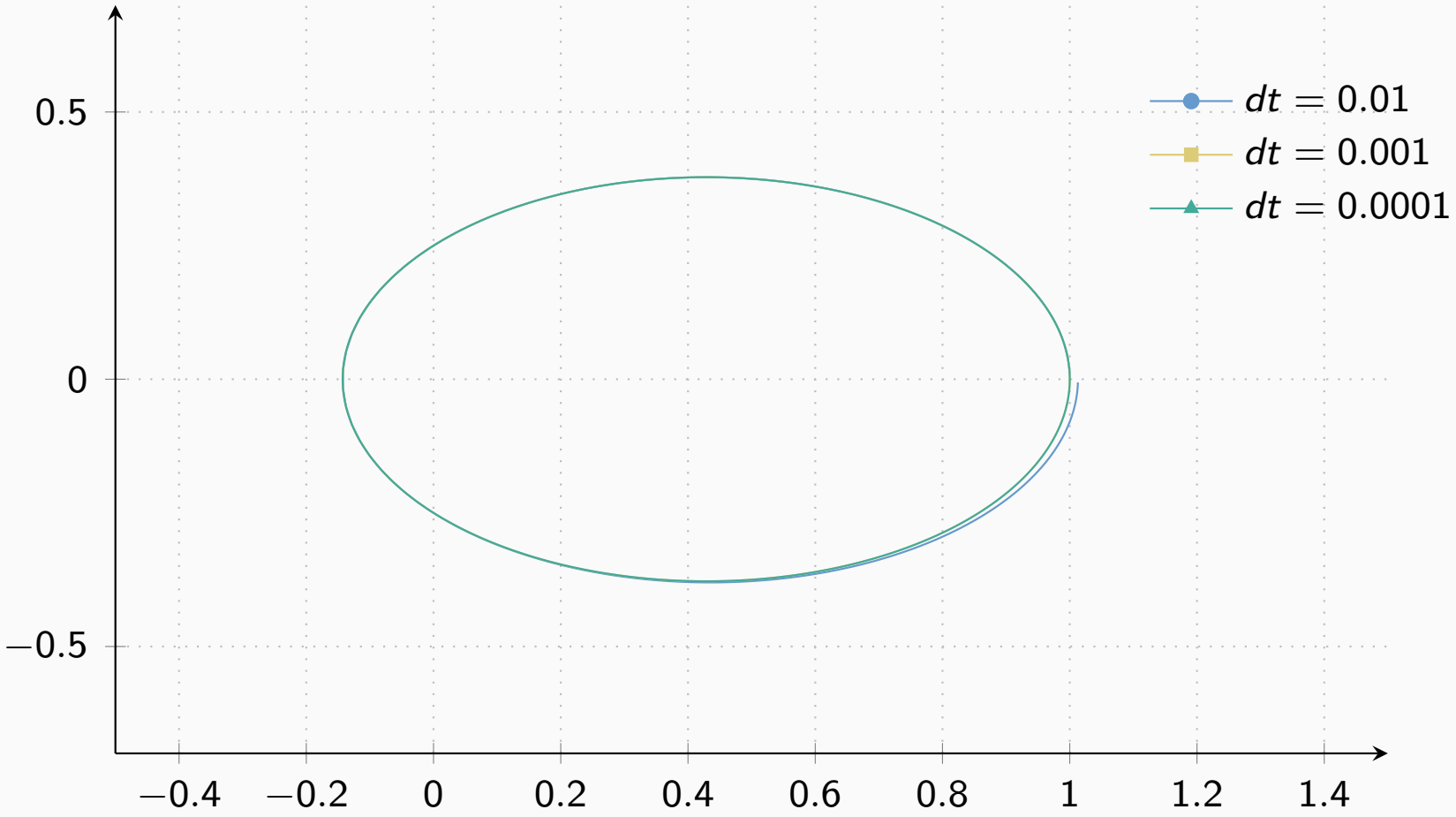
# Second order

**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

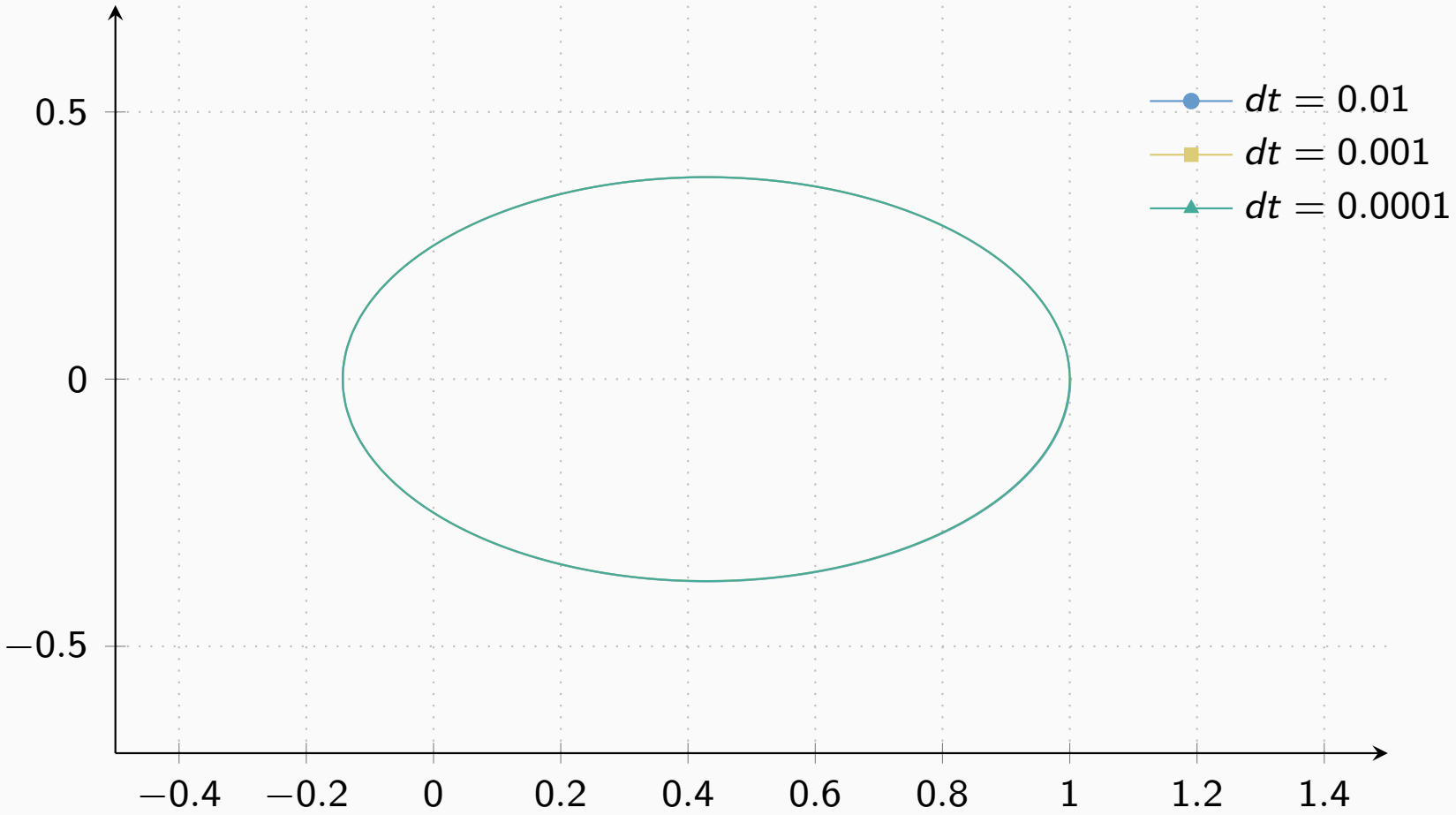


# Second order

**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



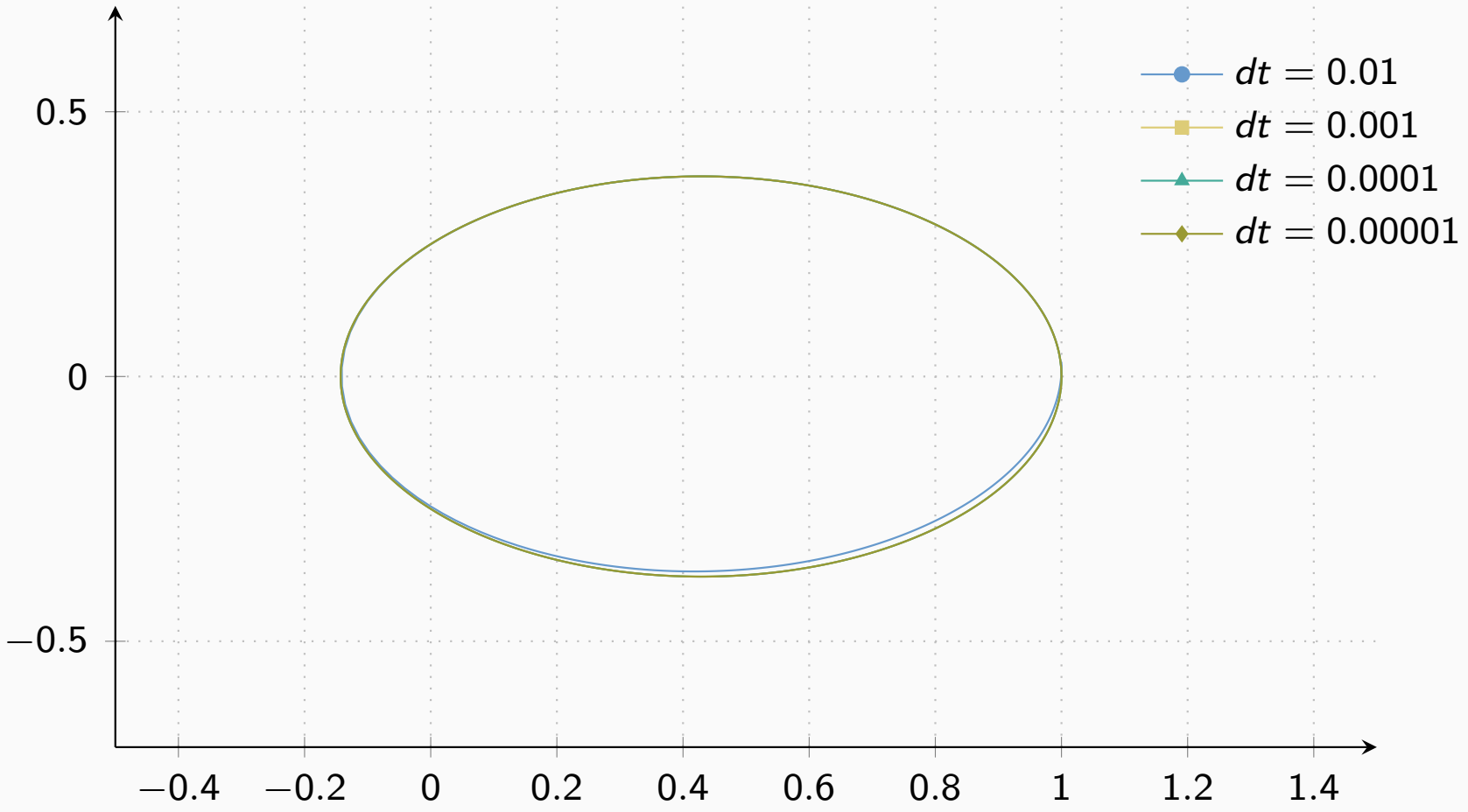
# Third order

**Table 3:** Second 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 |

# References i