Euler’s Method Application

An Application in Physics

The Question

A point P is travelling in a straight line with its velocity y in units per second satisfies the acceleration of

$$a = 2x^2 + \pi y$$

Where x is the amount of seconds elapsed

Initially, at $x = 0$ seconds P is stationary

What is the velocity of the point P when it is at $x = \frac{\pi}{e}$ seconds?

The Solution – Physical Meaning

- Recall that acceleration is first derivative of velocity y
- Here time is indicated by x

- Given that $a = 2x^2 + \pi y$

$$\therefore a = \frac{dy}{dx} = 2x^2 + \pi y$$

The Solution – The Differential

$$\frac{dy}{dx} = 2x^2 + \pi y$$

Hence velocity is the anti-derivative of the differential passing point $(0, 0)$

We have this differential but this is inseparable

The Solution – The Differential

Differential

$$\frac{dy}{dx} = 2x^2 + \pi y$$

Initial Point

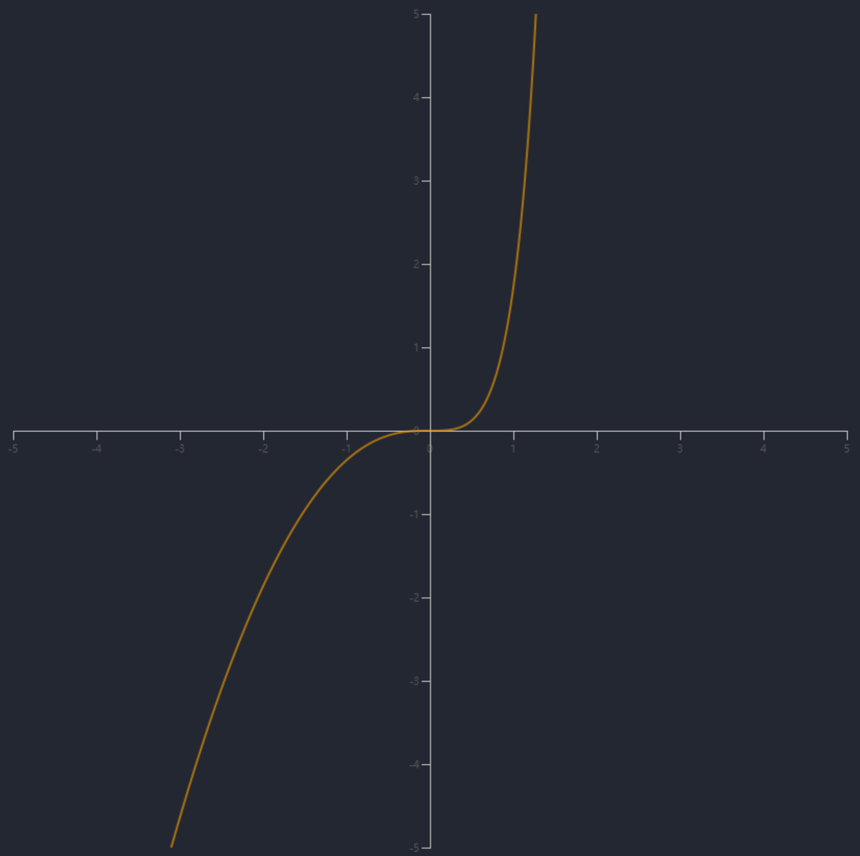
$$(0, 0)$$

Step

$$0.01$$

Use the program to solve

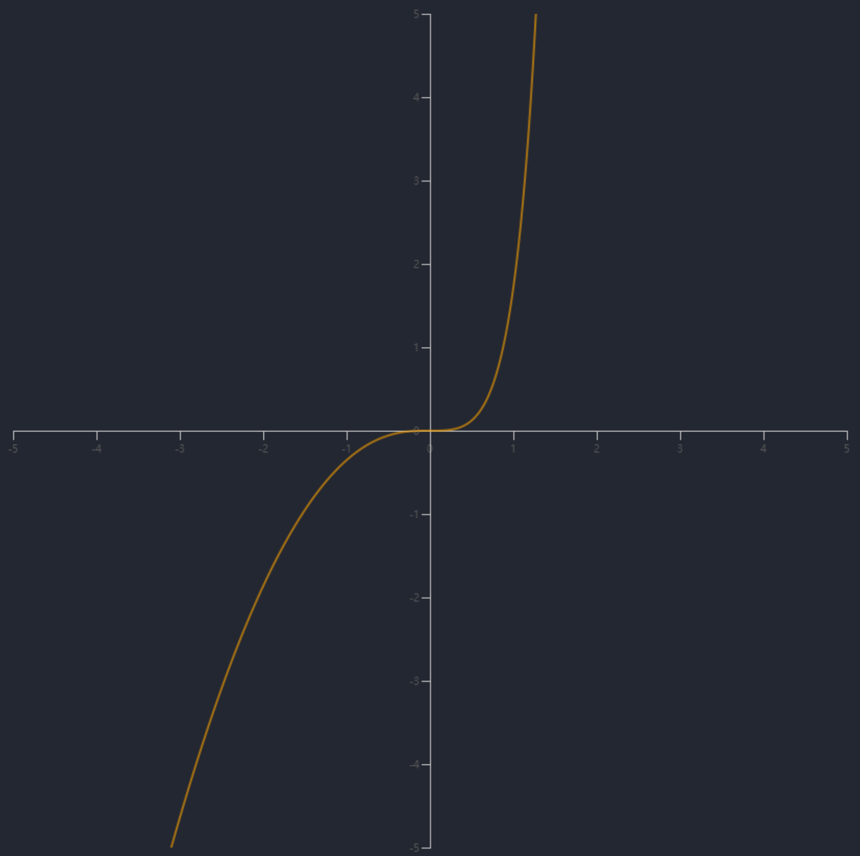
The Solution – The Differential



The Solution – Using Program

Now with the generated graph, use the "Estimate y at x" feature to find the velocity y at $x = \frac{\pi}{e}$ seconds

The Solution – The Differential



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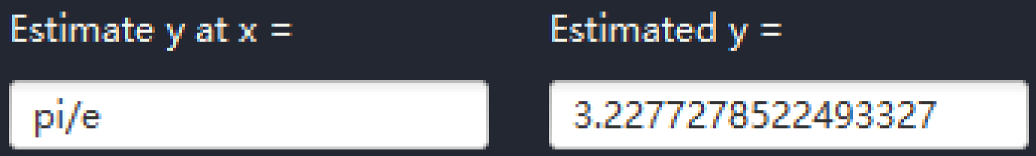

As seen, it is estimated that at $x = \frac{\pi}{e}$ seconds,

$$y \approx 3.2277278522493327 \text{ units per second}$$