Ordinary Differential Equations

Everything is ordinary about them

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Physical Examples

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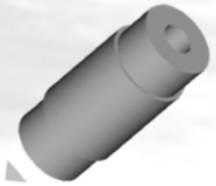
How long will it take to cool the trunnion?



$$mc\frac{d\theta}{dt} = -hA(\theta - \theta_a), \quad \theta(0) = \theta_{room}$$

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Classify the differential equation

$$3\frac{dy}{dx} + 2y = e^x,\ y(0) = 5$$

- linear
- nonlinear
- linear with fixed constants
- indeterminable to be linear or nonlinear

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Classify the differential equation

[*loading eqn.*]

- linear
- nonlinear
- linear with fixed constants
- indeterminable to be linear or nonlinear

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Classify the differential equation

$$3\frac{dy}{dx} + 2y^2 = e^x,\ y(0) = 5$$

- linear
- nonlinear
- linear with fixed constants
- indeterminable to be linear or nonlinear

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Velocity of a body

The velocity of a body is given by $v(t) = e^{2t} + 5, t \geq 0$

Then the distance covered by the body from $t = 0$ to $t = 10$ can be calculated by solving the differential equation for $x(10)$ for

- $\frac{dx}{dt} = e^{2t} + 5,\ x(0) = 0$
- $\frac{dx}{dt} = e^{2t} + 5,\ x(0) = 5$
- $\frac{dx}{dt} = 2e^{2t} + 5,\ x(0) = 0$
- $\frac{dx}{dt} = \frac{e^{2t}}{2} + 5t,\ x(0) = 0$

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To solve $y' = f(x, y),\ y(0) = y_0$, the Euler's method formula is given by

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- $y = y + f(x, y)h$
- $y_{i+1} = y_i + f(x_i, y_i)h$
- $y_{i+1} = y_i + f'(x_i, y_i)h$
- $y_{i+1} = f(x_i, y_i)h$

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The order of accuracy for a single step (local truncation error order) in Euler's method is

- $O(h)$
- $O(h^2)$
- $O(h^3)$
- $O(h^4)$

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The order of accuracy from initial point to final point (global truncation error order) while using more than one step in Euler's method is

- $O(h)$
- $O(h^2)$
- $O(h^3)$
- $O(h^4)$

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END

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