Ordinary Differential Equations

Everything is ordinary about them

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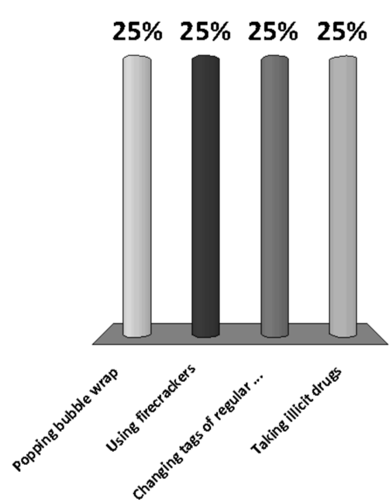
Popping tags means

A. Popping bubble wrap
B. Using firecrackers
C. Changing tags of regular items in a store with tags from clearance items
D. Taking illicit drugs



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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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END

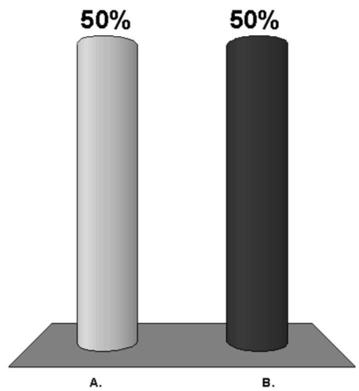
What did I learn in the ODE class?

In the differential equation

$$\frac{dy}{dx} + 3y = e^{-x}, y(0) = 6$$

the variable *x* is the ______variable

A. Independent
B. Dependent



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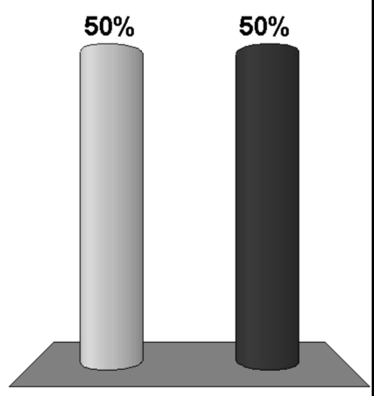

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The velocity of a body is given by

$$v(t) = e^{2t} + 5, t \geq 0$$

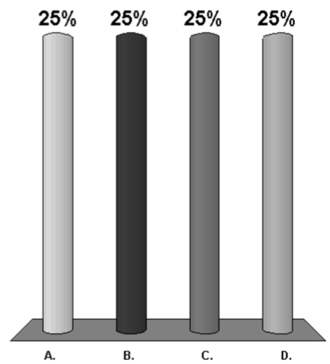
Then the distance covered by the body from *t=0* to *t=10* can be calculated by solving the differential equation for $x(10)$ for

A. $\dfrac{dx}{dt} = e^{2t} + 5, x(0) = 0$

B. $\dfrac{dx}{dt} = e^{2t} + 5, x(0) = 5$

C. $\dfrac{dx}{dt} = 2e^{2t}, x(0) = 0$

D. $\dfrac{dx}{dt} = \dfrac{e^{2t}}{2} + 5t, x(0) = 0$



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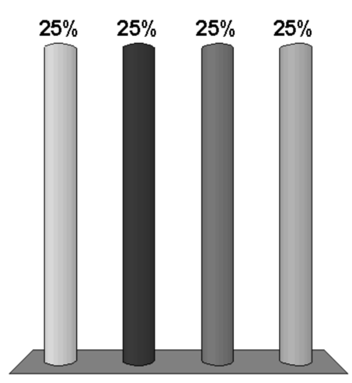
The form of the exact solution to $2\dfrac{dy}{dx} + 3y = e^{-x}, y(0) = 5$ is

A. $Ae^{-1.5x} + Be^{-x}$

B. $Ae^{-1.5x} + Bxe^{-x}$

C. $Ae^{1.5x} + Be^{-x}$

D. $Ae^{1.5x} + Bxe^{-x}$



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8.03
Euler's Method

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Euler's method of solving ordinary differential equations

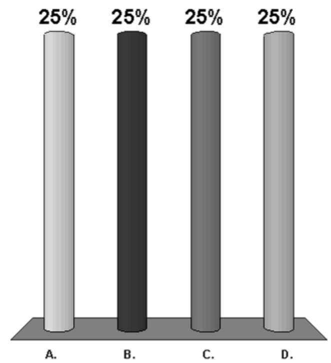
$\frac{dy}{dx} = f(x, y), y(0) = 0$ states

A. $y_{i+1} = y_i + f(x, y)h$

B. $y_{i+1} = y_i + f(x_i, y_i)h$

C. $y_{i+1} = y_i + f(x_i, y_i)$

D. $y_{i+1} = f(x_i, y_i)h$



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To solve the ordinary differential equation

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

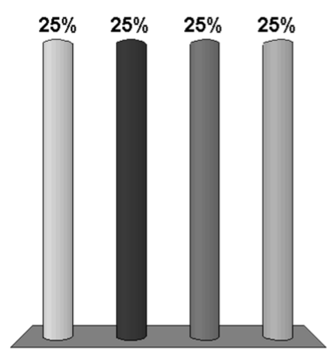
by Euler's method, you need to rewrite the equation as

A. $\frac{dy}{dx} = \sin x - 5y^2, y(0) = 5$

B. $\frac{dy}{dx} = \frac{1}{3}(\sin x - 5y^2), y(0) = 5$

C. $\frac{dy}{dx} = \frac{1}{3}(-\cos x - \frac{5y^3}{3}), y(0) = 5$

D. $\frac{dy}{dx} = \frac{1}{3}\sin x, y(0) = 5$



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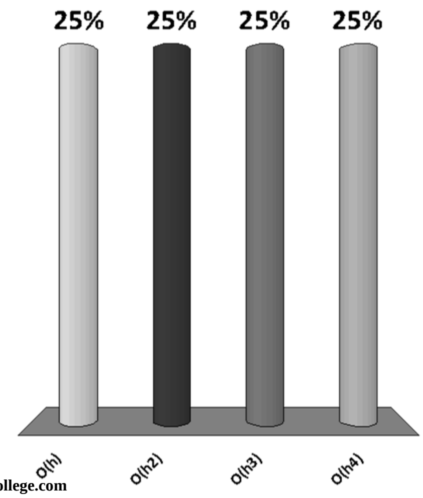
The order of accuracy for a single step in Euler's method is

A. O(h)
B. O(h^2)
C. O(h^3)
D. O(h^4)



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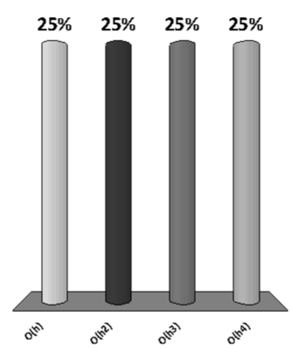
The order of accuracy from initial point to final point while using more than one step in Euler's method is

A. O(h)
B. O(h^2)
C. O(h^3)
D. O(h^4)



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END

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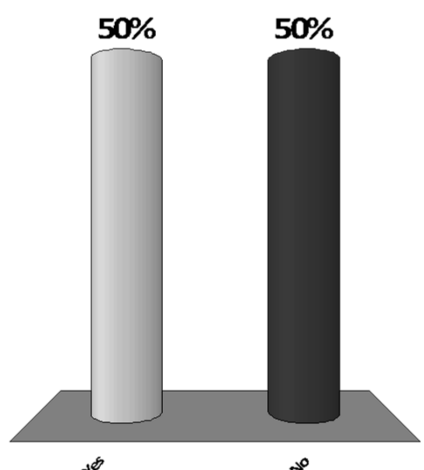
Do you know how Runge- Kutta 4th Order Method works?

A. Yes
B. No
C. Maybe
D. I take the 5th



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RUNGE-KUTTA 4TH ORDER METHOD

Runge-Kutta 4th Order Method

$$\frac{dy}{dx} = f(x, y), y(0) = y_0$$

$$y_{i+1} = y_i + \frac{1}{6}(k_1 + 2k_2 + 2k_3 + k_4)h$$

$$k_1 = f(x_i, y_i)$$

$$k_2 = f\left(x_i + \frac{1}{2}h, y_i + \frac{1}{2}k_1 h\right)$$

$$k_3 = f\left(x_i + \frac{1}{2}h, y_i + \frac{1}{2}k_2 h\right)$$

$$k_4 = f(x_i + h, y_i + k_3 h)$$

END

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