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**System of First-Order Ordinary Differential Equations(ODEs)**

**using Runge-Kutta 4th Order formula (ivp)**

x ’(t) = f(t, x(t), y(t)) = f (t, x, y)

y ‘(t) = g(t, x(t), y(t)) = g (t, x, y)

**Runge-Kutta 4th Order Formula**

+2 ;

+2

*where* f1-f4; g1-g4; is the slopes (2 sets of slopes)

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**System of Third-Order Ordinary Differential Equations(ODEs)**

**using Runge-Kutta 4th Order formula**

Extended and reformulated the formula above (System of First-Order Ordinary Differential Equations),then we got:

x ’’’(t) = f (t, x(t), y(t), z(t), x ’(t), y ‘(t), z ‘(t), x ‘’(t), y ‘’(t), z ‘’(t))

or x ’’’= f (t, x, y, z, x ‘, y ‘,z ‘, x ‘’, y ‘’, z ‘’)

y ’’’(t) = g (t, x(t), y(t), z(t), x ’(t), y ‘(t), z ‘(t), x ‘’(t), y ‘’(t), z ‘’(t))

or y ’’’= g (t, x, y, z, x ‘, y ‘,z ‘, x ‘’, y ‘’, z ‘’)

z ’’’(t) = h (t, x(t), y(t), z(t), x ’(t), y ‘(t), z ‘(t), x ‘’(t), y ‘’(t), z ‘’(t))

or z ’’’= h (t, x, y, z, x ‘, y ‘,z ‘, x ‘’, y ‘’, z ‘’)

**Runge-Kutta 4th Order Formula**

+2 ;

+2

+2

+2 ;

+2

+2

+2 ;

+2

+2

*where* f1-f4; g1-g4,…..,n1-n4; are the slopes (9 set of slopes)

For inputing 9 variables + var t in textbox we set as followed:

x ’=p ; y ’=q ; z’=r ; x ’’ =s ; y ’’=u ; z ’’=v ;

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*for k = 0,1,2,3,…..,M-1 ;*

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*===*

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*h is step size; interval [a,b], subinterval M ;*

This solution using Initial Value Problem(IVP)

*with Initial value(initial condition) x(t0) = ; y(t0) = ; z(t0) = ;*

*x’(t0) = ; y(t0) = ; z’(t0) = ;*

*x’’(t0) = ; y’’(t0) = ; z’’(t0) = ;*