

FRI 2-24-06

2nd ORDER DIFFERENTIAL EQUATIONS

"DIFF EQ"

$$\text{Ex) } \frac{d^2y}{dx^2} = 2x+4; y(0)=-1; y'(1)=2$$

2 INITIAL CONDITIONS

Soln: $y'' = 2x+4$

$$y' = \int (2x+4) dx = x^2 + 4x + C \quad y'(1) = 2$$

$$2 = 1^2 + 4 \cdot 1 + C$$

$$2 = 1 + 4 + C$$

$$\underline{\underline{-3 = C}}$$

$y' = x^2 + 4x - 3$ Now Find y .

$$y = \int (x^2 + 4x - 3) dx = \frac{1}{3}x^3 + 2x^2 - 3x + C_2$$

$$y(x=0) = -1 = \frac{1}{3} \cdot 0^3 + 2 \cdot 0^2 - 3 \cdot 0 + C_2$$

$$\underline{\underline{-1 = C_2}}$$

$$\underline{\underline{y = \frac{1}{3}x^3 + 2x^2 - 3x - 1}}$$

CHECK:

y''
✓✓✓

Ex) GIVEN: $a(t) = -16$, $s(0) = 3$, $v(0) = 8$.

FIND $s(t)$ (THE POSITION FUNCTION)

SOLN: $a(t) = v'(t) = s''(t)$

$$s''(t) = -16$$

$$s'(t) = -16t + C_1 = v(t)$$

$$v(t=0) = 8 = -16 \cdot 0 + C_1$$

$$8 = C_1$$

$$\underline{v(t) = -16t + 8}$$

$$\underline{s(t) = \int v(t) dt = \int (-16t + 8) dt}$$

$$s(t) = -8t^2 + 8t + C_2$$

$$s(t=0) = -8 \cdot 0^2 + 8 \cdot 0 + C_2 = 3$$

$$\therefore C_2 = 3$$

$$\therefore \underline{\underline{s(t) = -8t^2 + 8t + 3}}$$

ANSWERS TO O.T.L.

$$\int 4 \sin 2x \, dx = -2 \cos 2x + C$$

$$(14) -3 \cos x + \frac{1}{3} \cos 3x + C$$

$$(16) 2 \sec x + C$$

$$(18) \ln |x-2| - \frac{1}{3} \cos 5x + \frac{1}{2} e^{-2x} + C$$

$$(28) y = \frac{1}{2}x^2 - \frac{1}{x} - \frac{1}{2}$$

$$(34) y = \ln |x| - 3$$

O.T.L.

- CORRECT TODAY'S (BRING ? ON MON.)
- P 312-4 15, ²³23, 25, 29, 33, 36, 41, 44
- NO G.C.: $\int \sin^2 x dx = ?$ (HINT: USE $\cos 2x$ IDENT.)
- AP R.B.F. 25, 26

HEY! MAKE SURE YOU KNOW THE S PYTH. IDENTITIES:

$\cos^2 x + \sin^2 x = 1$

$1 + \tan^2 x = \sec^2 x$ $\cos^2 x = 1 - \sin^2 x$

$\cot^2 x + 1 = \csc^2 x$ $\sin^2 x = 1 - \cos^2 x$