

MATH 113 - HOMEWORK 9 SOLUTION

4.1 #3) $\frac{dy}{dx} = \frac{1}{x^2} + x, x > 0, y(2) = 1$: Integrate to get

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

Set $x=2$ to find C : $-\frac{1}{2} + \frac{4}{2} + C = 1$; $C = -\frac{1}{2} \rightarrow$

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

#4) $\frac{d^2 r}{dt^2} = \frac{2}{t^3}, \frac{dr}{dt} \Big|_{t=1} = 1, r(1) = 1$

Integrate twice : first $\frac{dr}{dt} = -t^{-2} + C_1$; at $t=1$ get $-1 + C_1 = 1$
so $C_1 = 2$

now second integration : $\frac{dr}{dt} = -t^{-2} + 2 \Rightarrow r(t) = t^{-1} + 2t + C_2$

At $t=1, 1+2+C_2 = 1$, so $C_2 = -2$ $\Rightarrow r(t) = t^{-1} + 2t - 2$

#5) At $x=-1, y=1$: $\frac{dy}{dx} = x-1$ so $y = \frac{1}{2}x^2 - x + C$; $x=-1$ gives

$$\frac{1}{2} + 1 + C = 1, C = -\frac{1}{2}$$

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

4.2 #4) $\int x^3 (x^4 - 1)^2 dx, u = x^4 - 1, du = 4x^3 dx$

$$\frac{1}{4} \int u^2 du = \frac{1}{4} \cdot \frac{1}{3} u^3 + C = \frac{1}{12} (x^4 - 1)^3 + C$$

#29) $\int \frac{dx}{2x-1}$: $du = 2x-1, du = 2 dx$ get $\frac{1}{2} \int \frac{du}{u} = \frac{1}{2} \ln|u| + C$

$$= \frac{1}{2} \ln|2x-1| + C$$

#48) $\frac{dy}{dx} = 1 + \frac{1}{x}; y(1) = 3 \rightarrow y = x + \ln x + C$

using $x=1$ to find C : $1 + 0 + C = 3, C = 2$ $y = x + \ln x + 2$