Remarks on tutorial 3

Note that Q2(d) = Q3(a). Use the method of undetermined coefficients to solve Q2(b)

Q4 (A) Chain Rule
$$\frac{df(x)}{dy} = \frac{df(x)}{dx} \frac{dx}{dy}$$

Apply Chain Rule to the right-hand side of the following equation

$$\frac{d^2y}{dx^2} = \frac{d}{dy} \left[\frac{1}{2} (y')^2 (x) \right]$$

(B) Suppose that the earth were to stop moving. Then the earth would fall towards the sun according to

$$\ddot{r} = -\frac{GM}{r^2}$$

Use the first part result of Q4, we get

$$\frac{d}{dr}\left[\left(r'\right)^{2}\right] = -\frac{GM}{r^{2}}$$

$$d\left[(r')^2 \right] = -\frac{GM}{r^2} dr$$

Now Integrate both sides

Remember
$$\int df(x) = \int f'(x)dx = f(x)$$

(C) From (B), we have

$$(\dot{r})^2 = 2GM\left(\frac{1}{r} - \frac{1}{R}\right) \qquad \dot{r} = -\sqrt{2GM\left(\frac{1}{r} - \frac{1}{R}\right)}$$

(D) Initial condition

$$t = 0, r = R, \dot{r} = 0$$

(E) Now find t when $r = \frac{2}{3}R$

i.e., reach the orbit of Venus

(F) We need to find the integral

$$\int \frac{1}{\sqrt{\frac{1}{r} - \frac{1}{R}}} dr$$

Let x=r/R Then we need to find the integral

$$\int \frac{\sqrt{x}}{\sqrt{1-x}} dx$$

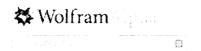
$$\int \frac{1}{|\frac{1}{x} - 1|} dx = \int \frac{1}{|1 - x|} dx$$

$$= \sin^{-1}(|x|) - |x|(1-x)$$

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sqrt[x]/sqrt[1-x]

Traditional Form Input Form Output Fo

HOW TO ENTER INPUT RANDOM EXAMPLE

 $\sin^{-1}(\sqrt{x}) - \sqrt{-(x-1)x}$

Time to compute: 0.02 sec

sin(*): inverse sine [properties]

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