18.

Hint: Convert the differential equation into the standard form (as the same as equation 1 in textbook), and then find the integrating factor to finish the integration.

20.

Hint: Let $u = y - 1$

$\Rightarrow \frac{du}{dx} = \frac{dy}{dx}$, $u(0) = y(0) - 1 = 1$, and then we have a new differential equation:

$$\frac{du}{dx} + (\frac{3x}{x^2+1})u = 0, u(0) = 1$$

Solve u(x) and then get y(x)=u(x)+1.

22.

Hint: Just find the integrating factor and then integrate it directly. The constant C will appear after integration.

24.

Hint: Let $u = y^{-1}$ and use the method in Exercise 23 to solve the differential equation of $u(x)$. And then we get $y(x) = [u(x)]^{-1} = \frac{1}{u(x)}$.

26.

Hint: Convert the euqation into a differential equation of $u(x)$, where $u(x) = \frac{dy}{dx}$.

Solve $u(x)$ first and then $y(x) = \int u(t)dt$ can be solved.

28.

Hint: Use equation 4 in textbook and then solve the differential equation. You may use the technique of integation by parts to solve the integration.

30.

Hint: Use the results in Exercise 29 and then solve $Q(t)$. The current $I(t) = \frac{d}{dt}Q(t)$.

32. Solve the equation in Exercise 31 to get the solution:

$$P(t) = M + Ce^{-kt}, k > 0$$

For $P(0) = 0$, $P(t) = M[1 - e^{-kt}]$.

Now, try to find the value of M_1 and M_2 respectively by the given values.

34.

Hint: Let $y(t)$ be the amount of chlorine in the tank at time t . What is the

amount of liquid in the tank at time t ? The concentration of chlorine at time t ? The rate of chlorine leaving the tank at time t ?
Find out the differential equation: $\dfrac{dy}{dt} = p(t)$ and then solve $y(t)$.

36.
Hint: Use the equation in Exercise 35(a) :

$$v = \frac{mg}{c}(1 - e^{\frac{-ct}{m}})$$

Differentiate it with respect to m to find $\frac{dv}{dm}$.
Can you ensure that $\dfrac{dv}{dm} > 0$ for all $m > 0$?
(You may use the substitution $u = \frac{-ct}{m}$ to simplify the expression of $\frac{dv}{dm}$, where $u > 0$ for all $m > 0$ and all $t > 0$.)