

1. Find the general solutions of each of the following equations.

(a) $2yy'' = (y')^2 + y^2$	(b) $xyy'' + x(y')^2 = 2yy'$	(c) $y'' + y' + x = 0$
(d) $yy'' - (y')^2 - y' = 0$	(e) $y'''(y')^2 - (y'')^3 = 0$	(f) $y''' = (y'')^2$
(g) $(y'')^2 = (y')^2 + 1$	(h) $(e^x + 1) + y' = 0$	(i) $yy''' + 3yy'y'' = 0$
(j) $(1 - x^2)y'' + xy' = 2$	(k) $xy'' = y' + x \sin\left(\frac{y'}{x}\right)$	

2. Find the general solutions of each of the following equations, by using variation of parameters.

(a) $y'' + y = \frac{1}{\sin x}$	(b) $y'' + 2y' + y = xe^x + \frac{1}{xe^x}$
(c) $y''' + y' = \tan x$	(d) $y'' + y = \frac{1}{\sin 2x}$

3. Find the general solutions of each of the following equations.

(a) $y'' + 3y' + 4y = x^2 - 1$	(b) $y''' + y'' - y' = x^2 - 2x - 5$
(c) $y^{(iv)} + y'' = 2 \cos x$	(d) $y'' - 3y' + 2y = x \cos x$
(e) $y'' + y' - 2y = 3xe^x + 5$	(f) $y'' + y = 4 \sin x$
(g) $y'' - 5y' = 3x^2 + \sin 5x$	(h) $y'' - 4y' + 8y = e^{2x} + \sin 2x$
(i) $y'' - 4y' + 5y = e^{2x} \sin^2 x$	(j) $y'' + 4y = 8 \sin^2 x$
(k) $y'' + 4y' + 5y = 2x - e^{-4x} + \sin 2x$	(l) $y''' - 3y'' + 4y' - 12y = x + e^{2x}$

4. Find the general solutions of each of the following equations satisfying the given initial conditions.

(a) $y''' + 3y' - 2y = 9e^{2x}$, $y(0) = 0$, $y'(0) = -3$, $y''(0) = 3$
(b) $yy'' = 2x(y')^2$, $y(2) = 2$, $y'(2) = \frac{1}{2}$
(c) $y'' - 3y' + 2y = xe^{-x}$, $y(0) = \frac{1}{9}$, $y'(0) = 0$
(b) $y'' - 5y' - 6y = e^{3x}$, $y(0) = 2$, $y'(0) = 1$

5. Find the general solutions of each of the following equations.

(a) $x^2y'' - 4xy' + y = 0$	(b) $x^2y'' + xy' + 16y = 0$
(c) $2x^2y'' - 3xy' - 18y = \ln x$	(d) $2x^2y'' - 3xy' + 2y = \ln x^3$
(e) $x^2y'' - 3xy' + 4y = x^3$	(f) $x^2y'' + 3xy' + y = 1 - x$
(g) $x^3y''' + 2x^2y'' - xy' + y = x^{-1}$	(h) $x^2y'' - xy' + 2y = x^2 \ln x$
(i) $x^2y'' + 4xy' + 3y = (x-1) \ln x$	(j) $x^3y''' - 2x^2y'' - xy' + 4y = \sin(\ln x)$
(k) $y'' + 4y' + 5y = 2x - e^{-4x} + \sin 2x$	(l) $y''' - 3y'' + 4y' - 12y = x + e^{2x}$