1. $4y''+36y=\csc 3x$

{

$y=c_1\cos 3x+c_2\sin 3x-\frac{1}{12}x\cos 3x+\frac{1}{36}\ln(\sin 3x)\sin 3x$

}

2. $y''+y=(x-1)\cos x$

{ $y=c_1\cos x+c_2\sin x+\frac{1}{4}x\cos x+\left(\frac{1}{4}x^2-\frac{1}{2}x\right)\sin x$ }

3. $x^3y'''-3x^2y''+6xy'-6y=x^2\ln x$

{ $y=c_1x+c_2x^2+c_3x^3-\frac{1}{2}x^2(\ln x)^2$ }

4. $(x^2+1)y''-2xy'+2y=0$

{ $y=c_1x+c_2(x^2-1)$ }

5. $x^2y''-2y=\ln x \quad (x>0) \qquad y(1)=\frac{1}{2} \qquad y'(1)=0$

{ $y=\frac{1}{4}x^2+\frac{1}{4}-\frac{1}{2}\ln x$ }

6. $x^2y''-2xy'+2y=x^2+2$

$\{y=c_1x+c_2x^2+x^2\ln x+1\}$

7. $\left(x^2-x\right)y''-xy'+y=0$

$\{y=c_1\left(x\ln x+1\right)+c_2x\}$

8. Find the inverse Laplace transform of $\frac{2}{s^4}(\frac{1}{s}-\frac{3}{s^2}+\frac{4}{s^6})$

$\{\frac{1}{12}t^4-\frac{1}{20}t^5+\frac{8}{9!}t^9\}$

9. Find the Laplace transform of $4t\sin(2t)$

$\{\frac{16s}{(s^2+4)^2}\}$

10. Find the Laplace transform of $\{\cos2t+4\sin(2t)\}$

$\{\frac{s+8}{s^2+4}\}$

11. Find the Laplace transform of $\{2t^2e^{-3t}-4t+1\}$

$\{\frac{4}{(s+3)^3}-\frac{4}{s^2}+\frac{1}{s}\}$

12. Find the Laplace transform of

$$f(t) = \begin{cases} 2t - \sin(t)\,; \; for\; 0 \le t < \pi \\ 0 \quad\quad ; \; for\; t \ge \pi \end{cases}$$

$$\left\{ \frac{2}{s^2} - \frac{1}{s^2+1} - \frac{2}{s^2}e^{-\pi s} - \frac{2\pi}{s}e^{-\pi s} - \frac{1}{s^2+1}e^{-\pi s} \right\}$$

13. Find the Laplace transform of $e^{-2t}\cos(3t)$

$$\left\{ \frac{s+2}{s^2+4s+13} \right\}$$

14. Find the Laplace transform of $te^{-2t}\cos(3t)$

$$\left\{ \frac{s^2+4s-5}{(s^2+4s+13)^2} \right\}$$

15. Find the Laplace transform of

$$f(t) = \begin{cases} \cos(t) \quad\quad\quad ; \; for\; 0 \le t < 2\pi \\ 2 - \sin(t) \quad ; \; for\; t \ge 2\pi \end{cases}$$

$$\left\{ \frac{s}{s^2+1} + \left(\frac{2}{s} - \frac{s}{s^2+1} - \frac{1}{s^2+1}\right)e^{-2\pi s} \right\}$$

16. Find the inverse Laplace transform of $\frac{2s-5}{s^2+16}$

$$\left\{ 2\cos(4t) - \frac{5}{4}\sin(4t) \right\}$$

17. Find the inverse Laplace transform of $\frac{se^{-3s}}{s^2+4}$

$\{\ u(t-3)\cos(2(t-3))\ \}$

18. Find the Laplace transform of $\{e^{-t}(1-t^2+\sin t)\}$

$\{\ \frac{1}{s+1}-\frac{2}{(s+1)^3}+\frac{1}{(s+1)^2+1}\ \}$

19. Find the inverse Laplace transform of $\frac{5}{(s+7)^2}$

$\{\ 5te^{-7t}\ \}$