IMPORTANT PRACTISE QUESTIONS

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LAPLACE TRANSFORMS

Find laplace transform of following:-

(Q1) $\sin^5 t$ (Q2) $\cos t \cos 2t \cos 3t$ (Q3) $\sin^4 t$

(Q4) $\sinh^4 t$ (Q5) $\sqrt{1+\sin t}$ (Q6) $(\sqrt{t}-1)^2$

(Q7) $\sinh\frac{t}{2} \cdot \sin\frac{\sqrt{3}t}{2}$ (Q8) $\frac{\cos 2t \sin t}{e^t}$ (Q9) $e^{-4t}\sin t \sinh t$

(Q10) $e^t \sin 2t \sin 3t$ (Q11) $e^{-3t}\cosh 5t \sin 4t$

(Q12) $\sin 2t \cos t \cosh 2t$

(Q13) $f(t) = \cos t$, for $0<t<\pi$ and $f(t) = \sin t$, for $t>\pi$

(Q14) $f(t) = t$, for $0<t<1/2$; $f(t) = t-1$, $\frac{1}{2}<t<1$;
$f(t) = 0$, $t>1$

(Q15) $f(t) = \cos t$, $0<t<2\pi$; $f(t) = 0$, $t>2\pi$

(Q16) $f(t) = t^2$, $0<t<1$; $f(t) = 1$, $t>1$

(Q17) $f(t) = 0$, $0<t<\pi$; $f(t) = \sin^2(t-\pi)$, $t>\pi$

(Q18) $t\cos 3t$ (Q19) $(1+te^{-t})^3$ (Q20) $t\sin^3 t$

(Q21) $t\sin 2t \cosh t$ (Q22) $t\cos^2 t$ (Q23) $t^5 \cosh t$

(Q24) $te^{3t}\sin t$ (Q25) $t\sqrt{1+\sin t}$ (Q26) $te^{3t}\,\mathrm{erf}\sqrt{t}$

(Q27) $t\left(\frac{\sin t}{e^t}\right)^2$ (Q28) If $L[f(t)] = \frac{s+3}{s^2+s+1}$ find $L[t f(2t)]$

(Q29) If $L[\mathrm{erf}\sqrt{t}] = \frac{1}{s\sqrt{s+1}}$, find $L[t\,\mathrm{erf}\,3\sqrt{t}]$

(Q30) $te^t \sin 2t \cos t$ (Q31) $t\sqrt{1-\sin t}$

(Q32) $te^{3t}\sinh 2t$ (Q33) $t\cos(\omega t-\alpha)$

(Q34) $(t+\sin 2t)^2$ (Q35) $(t\sinh 2t)^2$

(Q36) $\dfrac{e^{-2t}\sin 2t\cosh t}{t}$ (Q37) $\dfrac{\sin^2 t}{t^2}$ (Q38) $\dfrac{\sin t\sin 5t}{t}$

(Q39) If $L[\sin\sqrt{t}] = \dfrac{\sqrt{\pi}}{2s\sqrt{s}}\cdot e^{-1/4s}$ find $L[\sin 2\sqrt{t}]$

(Q40) Find $\int_0^\infty e^{-t}\,\mathrm{erfc}\sqrt{t}\,dt$ where $\mathrm{erfc}\sqrt{t} = \dfrac{1}{\sqrt{s+1}(\sqrt{s+1}+1)}$

(Q41) $\int_0^t\int_0^t\int_0^t t\sin t\,(dt)^3$ (Q42) $\int_0^t u\cos^2 u\,du$

(Q43) $\int_0^t ue^{-3u}\cos^2 2u\,du$ (Q44) $\int_t^\infty \dfrac{\cos u}{u}\,du$

(Q45) $\int_0^t ue^{-3u}\sin^2 u\,du$ (Q46) Solve $\int_0^\infty e^{-t}\int_0^t u^2\sinh u\cosh u\,du\,dt$

(Q47) $\dfrac{d}{dt}\left(\dfrac{1-\cos 2t}{t}\right)$ (Q48) If $L[f(t)] = \dfrac{s+2}{s^2+2}$ find $L[f'(t)]$

(Q49) If $J_0(t) = \dfrac{1}{\pi}\int_0^\pi \cos(t\cos\theta)\,d\theta$ P.T. $L[J_0(t)] = \dfrac{1}{\sqrt{s^2+1}}$

(Q50) Find $L[\mathrm{erf}\sqrt{t}]$ hence find $\int_0^\infty \mathrm{erf}\sqrt{t}\cdot e^{-t}\,dt$

(Q51) If $\int_0^\infty e^{-2t}\cdot\sin(t-\alpha)\cos(t-\alpha)\,dt = \dfrac{3}{8}$ find α

(Q52) If $L[\mathrm{erf}\sqrt{t}] = \dfrac{1}{s\sqrt{s+1}}$ find $\int_0^\infty e^{-2t}\,\mathrm{erf}(2\sqrt{t})\,dt$

(Q53) Solve $\int_0^\infty \dfrac{t^2\sin 3t}{e^{2t}}\,dt$ (Q54) Solve $\int_0^\infty e^{-t}\dfrac{\sin^2 t}{t}\,dt$

(Q55) Solve $\int_0^\infty e^{-\sqrt{2}t}\sin t\sinh t$

(Q56) Find laplace of $\frac{e^{-at}-\cos at}{t}$ hence evaluate $\int_0^\infty \frac{e^{-t}-\cos t}{te^{4t}}\,dt$

(Q57) Solve $\int_0^\infty \left(\frac{\sin 2t+\sin 3t}{te^t}\right)dt$

(Q58) Find $L[\operatorname{erf}\sqrt{t}]$

(Q59) Find $L[\operatorname{erf}\sqrt{3t}]$ & evaluate $\int_0^\infty \operatorname{erf}(2\sqrt{t})e^{-5t}\,dt$

(Q60) Find $\int_0^\infty \sin(tx^2)\,dx$ hence find $\int_0^\infty \sin x^2\,dx$

(Q61) Find $\int_0^\infty e^{-tx^2}\,dx$ hence find $\int_0^\infty e^{-x^2}\,dx$

ANSWERS

(1) $\dfrac{120}{(s^2+1)(s^2+9)(s^2+25)}$ (2) $\dfrac{1}{4}\left(\dfrac{1}{s}+\dfrac{s}{s^2+4}+\dfrac{s}{s^2+16}+\dfrac{s}{s^2+36}\right)$

(3) $\dfrac{1}{4}\left(\dfrac{3s}{2}-\dfrac{2s}{s^2+4}+\dfrac{1}{s^2+16}\right)$ (4) $\dfrac{1}{8}\left(\dfrac{3}{s}+\dfrac{4s}{s^2-4}+\dfrac{s}{s^2+16}\right)$

(5) $\dfrac{4s}{4s^2+1}+\dfrac{2}{4s^2+1}$ (6) $\dfrac{1}{s^2}-\dfrac{\sqrt{\pi}}{s^{3/2}}+\dfrac{1}{s}$ (7) $\dfrac{\sqrt{3}\,s}{2(s^4+s^2+1)}$

(8) $\dfrac{s^2+2s-2}{(s^2+2s+10)(s^2+2s+2)}$ (9) $\dfrac{2s+8}{(s^2+6s+10)(s^2+10s+26)}$

(11) $\dfrac{4(s^2+6s+50)}{(s^2-4s+20)(s^2+16s+80)}$ $\Longleftrightarrow$ (10) $\dfrac{12(s-1)}{(s^2-2s+2)(s^2-2s+26)}$

(Q12) $\dfrac{3(s^2+13)}{s^4+10s^2+169}+\dfrac{s^2+5}{s^4-6s^2+25}$ (13) $\dfrac{s+e^{-s\pi}(s-1)}{s^2+1}$

(14) $\dfrac{1}{s^2}-\dfrac{e^{-s}}{s^2}-\dfrac{e^{-s/2}}{s}$ (15) $\dfrac{s(1-e^{-2\pi s})}{s^2+1}$ (16) $\dfrac{-(1+e^{-s})}{s}$

(17) $\dfrac{e^{-\pi s}}{2s}-\dfrac{(e^{-\pi s}s)}{s^2+4}$ (18) (Q19) $\dfrac{1}{s}-\dfrac{3}{(s+1)^3}+\dfrac{6}{(s+2)^3}+\dfrac{6}{(s+3)^3}$

(Q20) $\dfrac{24s(s+5)}{(s^2+1)^2(s^2+9)^2}$ (21) $2\left[\dfrac{s-1}{(s^2-2s+5)^2}+\dfrac{s+1}{(s^2+2s+5)^2}\right]$

(22) $\dfrac{1}{2s^2}+\dfrac{s^2-4}{2(s^2+4)^2}$ (23) $60\left[\dfrac{1}{(s-1)^6}+\dfrac{1}{(s+1)^6}\right]$

(24) $\dfrac{2s-6}{(s^2-6s+10)^2}$ (25) $\dfrac{4(4s^2+4s-1)}{(4s^2+1)^2}$ (26) $\dfrac{3s-7}{2(s-3)^2(s-2)^{3/2}}$

(27) $\dfrac{1}{2}\left[\dfrac{s^2+4s}{s^2+4s+8}-\dfrac{1}{(s+2)^2}\right]$ (28) $\dfrac{s^2+12s+8}{(s^2+2s+4)^2}$

(29) $\dfrac{9(s+6)}{2s^2(s+9)^{3/2}}$ (30) $\dfrac{3(s-1)}{(s^2-2s+10)^2}+\dfrac{s-1}{s^2-2s+2}$ (31) $\dfrac{4(4s^2-4s-1)}{(4s^2+1)^2}$

(32) $\dfrac{4(s-3)}{(s^2-6s+5)^2}$ (33) $\dfrac{(s^2-\omega^2)\cos\alpha+2\omega s\sin\alpha}{(s^2+\omega^2)^2}$

(34) $\dfrac{2}{s^3}+\dfrac{s}{(s^2+1)^2}+\dfrac{1}{2s}-\dfrac{s}{2(s^2+4)}$ (35) $\dfrac{1}{2}\left[\dfrac{1}{(s-4)^3}+\dfrac{1}{(s+4)^3}\right]$

(36) $\dfrac{\pi}{2}-\dfrac{1}{2}\tan^{-1}\left(\dfrac{s+1}{2}\right)-\dfrac{1}{2}\tan^{-1}\left(\dfrac{s+3}{2}\right)$ (37) $\dfrac{\pi}{4}-\dfrac{s}{4}\log\left(\dfrac{s^2+4}{s^2}\right)$ $-\dfrac{1}{2}\tan^{-1}\left(\dfrac{s}{2}\right)$ (38) $\dfrac{1}{2}\log\left(\dfrac{s^2+36}{s^2+16}\right)$ (39) $\dfrac{4\sqrt{\pi}}{s\sqrt{s}}e^{-1/s}$ (40) $\dfrac{1}{\sqrt{6}}$

(41) $\dfrac{2}{s^2(s^2+1)^2}$ (42) $\dfrac{1}{2s^3}+\dfrac{s^2-4}{2s(s^2+4)^2}$ (43) $\dfrac{1}{2s(s+3)^2}+\dfrac{s^2+6s-7}{2s(s^2+6s+25)^2}$ (44) $\dfrac{\log(s^2+1)}{2s}$ (45) $\dfrac{1}{2s}\left[\dfrac{1}{(s+3)^2}+\dfrac{s^2+6s+5}{(s^2+6s+13)^2}\right]$

(46) $\dfrac{-2}{125}$ (47) $s\log\left(\dfrac{\sqrt{s^2+4}}{s}\right)$ (48) $\dfrac{2(s-1)}{s^2+2}$ (50) $\dfrac{1}{s\sqrt{s+1}}$, $\dfrac{1}{\sqrt{2}}$

(51) $\dfrac{\pi}{4}$ (52) $\dfrac{1}{\sqrt{6}}$ (53) $\dfrac{18}{2197}$ (54) $\dfrac{1}{4}\log 5$ (55) $\dfrac{\pi}{8}$ (56) $\log\sqrt{\dfrac{s^2+a^2}{(s+a)^2}}$ $\log\dfrac{\sqrt{17}}{5}$ (57) $\dfrac{3\pi}{4}$ (58) $\dfrac{1}{s\sqrt{s+1}}$ (59) $\dfrac{2}{s\sqrt{s+4}}$, $\dfrac{2}{15}$

(60) $\dfrac{\pi}{2\sqrt{2s}}$, $\dfrac{1}{2}\sqrt{\dfrac{\pi}{2}}$ (61) $\dfrac{\pi}{2\sqrt{s}}$, $\dfrac{\sqrt{\pi}}{2}$