

Q1.

The Laplace transform of te^{-at} is:

- (A) $1/(s+a)^2$
- (B) $s/(s+a)^2$
- (C) $1/(s^2+a)$
- (D) $a/(s+a)^2$

Q2

For the function $f(x) = e^{-x^2}$, the value of the integral

$\int_{-\infty}^{\infty} x^2 e^{-x^2} dx$ is:

- (A) $\frac{\sqrt{\pi}}{2}$
- (B) $\frac{\sqrt{\pi}}{4}$
- (C) $\frac{\sqrt{\pi}}{8}$
- (D) $\sqrt{\pi}$

Q3.

A particle moves in a potential $V(r) = -\frac{k}{r} + ar^2$.

The effective potential for angular momentum L includes a term that scales as:

- (A) L^2/r
- (B) L/r^2
- (C) L^2/r^2
- (D) L^2/r^3

Q4

A waveguide of cutoff frequency f_c is operated at $f = 1.2f_c$.

What is the phase velocity v_p of the TE mode?

- (A) $c\sqrt{1 - (f_c/f)^2}$
- (B) $c/\sqrt{1 - (f_c/f)^2}$
- (C) cf/f_c
- (D) cf_c/f



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