

1. $v(t) = 3t^2$ volts. What is the slope dv/dt at $t = 2$ s, in volts per second?

_____ V/s
2. What is the modulus of $z = 5 - j12$?

3. Solve $2x + y = 7$ and $x - y = 2$. What is x ?

4. $dy/dt + 4y = 0$ with $y(0) = 3$. What is y at $t = 0.25$? Give two decimal places.

5. Evaluate the Laplace transform of $e^{-(4t)}$ at $s = 1$.

6. At $t = T/4$, what does the square-wave series $(4/\pi)(1 - 1/3 + 1/5 - \dots)$ add up to?

☐ 1: the bracket converges to $\pi/4$, and $(4/\pi)(\pi/4) = 1$

☐ $\pi/4$

☐ 0.785, and falling

☐ Nothing; the series diverges
7. For Gaussian noise with $\sigma = 2$ mV, a single reading of 5 mV is impossible.

☐ True

☐ False
8. $V = 3x^2y$. What is the electric field E at (1, 2)?

☐ (6xy, 3x²)

☐ (12, 3) V/m

☐ -(6, 3) V/m

☐ -(12, 3) V/m
9. A current of +2 mA for 1 s followed by -2 mA for 1 s delivers a net charge of 4 mC.

☐ True

☐ False
10. Multiplying a phasor by j rotates it by -90° .

☐ True

☐ False

1. **12 V/s**

$\frac{d}{dt}3t^2 = 6t$, which is 12 at $t = 2$.
2. **13**

$\sqrt{5^2 + 12^2} = \sqrt{169} = 13$. The minus sign affects the angle, not the length.
3. **3**

Add the equations to remove y : $3x = 9$, so $x = 3$ and $y = 1$. Check: $2 \cdot 3 + 1 = 7$.
4. **1.1**

$y = 3e^{-4t}$, so $y(0.25) = 3e^{-1} \approx 1.10$. With no input, only the homogeneous part remains.
5. **0.2**

$\mathcal{L}\{e^{-4t}\} = \frac{1}{s+4}$, which is $\frac{1}{5} = 0.2$ at $s = 1$.
6. **1: the bracket converges to $\pi/4$, and $(4/\pi)(\pi/4) = 1$**

The alternating series of odd reciprocals sums to $\frac{\pi}{4}$; scaled by $\frac{4}{\pi}$ it gives exactly 1, the value the square wave demands there.
7. **False**

5 mV is 2.5σ . Readings that far out are rare (about 1%) but they do happen.
8. **-(12, 3) V/m**

$\nabla V = (6xy, 3x^2) = (12, 3)$ at the point, and $\mathbf{E} = -\nabla V = -(12, 3)$.
9. **False**

Area below the axis subtracts, so the net charge is $2 - 2 = 0$ mC. 4 mC is the total without signs.
10. **False**

$j = 1\angle 90^\circ$, so multiplying by j adds $+90^\circ$. Multiplying by $-j$ rotates by -90° .