1. Which system is linear?

   ☐ $y(t) = 3x(t - 2)$

   ☐ $y(t) = x(t)^2$

   ☐ $y(t) = x(t) + 1$

   ☐ $y(t) = |x(t)|$

2. Convolution with h(t) gives the output of any system, linear or not.

   ☐ True ☐ False

3. X(0), the Fourier transform at zero frequency, equals the total area under x(t).

   ☐ True ☐ False

4. Sampling at f_s places copies of the signal's spectrum at every multiple of f_s.

   ☐ True ☐ False

5. $H(s) = (s + 3)/((s + 1)(s + 5))$. Where are the poles and zero?

   ☐ Poles at -3; zeros at -1 and -5

   ☐ Poles at 1 and 5; zero at 3

   ☐ Poles at -1 and -5; zero at -3

   ☐ Poles at -1, -3 and -5

6. $y[n] = 0.5y[n-1] + x[n]$, starting at rest. What is the impulse response h[n]?

   ☐ 0.5^n for $n \geq 0$

   ☐ 1 for $n \geq 0$

   ☐ 0.5 at $n = 1$ only

   ☐ 2^n for $n \geq 0$

7. In the z-domain, delaying a signal by one sample multiplies its transform by z^{-1}.

   ☐ True ☐ False

8. The system $y = 2x + 5$ is linear.

   ☐ True ☐ False

9. A unit step into $h(t) = e^{-t}u(t)$ gives, for $t \geq 0$,

   ☐ e^{-t}

   ☐ $1 - e^{-t}$

   ☐ $1 + e^{-t}$

10. An input with spectrum $X(\omega)$ passes through a system with frequency response $H(\omega)$. The output spectrum is

    ☐ $X(\omega) \cdot H(\omega)$

    ☐ $X(\omega) + H(\omega)$

    ☐ $X(\omega)/H(\omega)$

    ☐ $X(\omega) * H(\omega)$, a convolution

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1. **$y(t) = 3x(t - 2)$**

   A scaled delay obeys superposition and scaling. Squaring and the absolute value fail scaling; adding 1 gives a non-zero output for zero input.

2. **False**

   The derivation uses linearity (to add the responses) and time invariance (to shift one h). Without both, one impulse response does not describe the system.

3. **True**

   Put $\omega = 0$: $e^0 = 1$, so $X(0) = \int x(t)\,dt$. For a pulse that is $A\tau$.

4. **True**

   Multiplying by an impulse train in time convolves the spectrum with an impulse train in frequency, which copies it to each kf_s.

5. **Poles at -1 and -5; zero at -3**

   Poles make the denominator zero ($s = -1, -5$); the zero makes the numerator zero ($s = -3$).

6. **0.5^n for $n \geq 0$**

   An impulse gives $y[0] = 1$, then each sample halves: $1, 0.5, 0.25, \cdots = 0.5^n$.

7. **True**

   Each term $x[n-1]z^{-n}$ re-indexes to $z^{-1}\,x[m]z^{-m}$. That is why difference equations become algebra in z.

8. **False**

   Zero input gives 5, but a linear system must map zero to zero. Its graph is a straight line, but "linear" here means superposition.

9. **$1 - e\hat{}(-t)$**

   $\int_0^t e^{-(t-\tau)}\,d\tau = 1 - e^{-t}$. It starts at 0 and settles at the DC gain 1.

10. **$X(\omega) \cdot H(\omega)$**

    Convolution in time is multiplication in frequency. That single property is why filters are designed in the frequency domain.

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