**Fourier Transform Pairs**

|  |  |
| --- | --- |
| **Some Basic Functions** | |
| **x(t)** | **X(ω)** |
| (Synthesis) | (Analysis) |
| (impulse) | (constant) |
| (unit rectangular pulse, width=1) | (sinc) |
| (constant) | (impulse) |
| (complex exponential) | (shifted impulse) |
| (causal exponential) | (same as Laplace w/ s=jω) |
| (Gaussian) | (Gaussian) |

|  |  |
| --- | --- |
| **Derived Functions (using basic functions and properties)** | |
| **x(t)** | **X(ω)** |
| (time scaled rectangular pulse, width=Tp) |  |
|  | (rectangular pulse in ω) |
| (triangular pulse, width=2) |  |
| (scaled triangular pulse, width=2Tp) |  |
|  |  |
|  |  |
| γ(t) (unit step function) |  |

Using these functions and some Fourier Transform Properties (next page), we can derive the Fourier Transform of many other functions.

Information at <http://lpsa.swarthmore.edu/Fourier/Xforms/FXUseTables.html>

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**Fourier Transform Properties**

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| --- | --- | --- |
| **Name** | **Time Domain** | **Frequency Domain** |
| Linearity |  |  |
| Time Scaling |  |  |
| Time Delay (or advance) |  |  |
| Complex Shift |  |  |
| Time Reversal |  |  |
| Convolution |  |  |
| Multiplication |  |  |
| Differentiation |  |  |
| Integration |  |  |
| Time multiplication |  |  |
| Parseval’s Theorem |  |  |
| Duality |  |  |
|  |  |

**Symmetry Properties**

|  |  |
| --- | --- |
| **x(t)** | **X(ω)** |
| x(t) is real | Real part of X(ω) is even,  imaginary part is odd |
| x(t) real, even | X(ω) is real and even |
| x(t) real, odd | X(ω) is imaginary and odd |

**Relationship between Transform and Series**

|  |
| --- |
| If xT(t) is the periodic extension of x(t) then:    Where cn are the Fourier Series coefficients of xT(t) and X(ω) is the Fourier Transform of x(t) |
| Furthermore |