SM212 Laplace Transform Table

	$f(t)$	$F(s) = L\{f(t)\}$
Definition	$f(t)$	$\int_0^\infty e^{-st} f(t)dt$
Basic Forms	1	$\frac{1}{s}$
	t^n	$\frac{n!}{s^{n+1}}$
	e^{at}	$\frac{1}{s-a}$
	$\sin(kt)$	$\frac{k}{s^2+k^2}$
	$\cos(kt)$	$\frac{s}{s^2+k^2}$
Derivative Forms	$f'(t)$	$sF(s) - f(0)$
	$f''(t)$	$s^2F(s) - sf(0) - f'(0)$
	$f'''(t)$	$s^3F(s) - s^2 f(0) - sf'(0) - f''(0)$
	$f^{(n)}(t)$	$s^n F(s) - s^{n-1} f(0) - \ldots - f^{n-1}(0)$
Translation	$e^{at} f(t)$	$F(s-a)$
	$e^{at}\sin(kt)$	$\frac{k}{(s-a)^2+k^2}$
	$e^{at}\cos(kt)$	$\frac{s-a}{(s-a)^2+k^2}$
Unit Step Functions	$U(t-a)$	$\frac{e^{-as}}{s}$
	$f(t-a)U(t-a)$	$e^{-as}F(s)$
	$f(t)U(t-a)$	$e^{-as}L\{f(t+a)\}$
Derivatives of Transforms	$t^n f(t)$	$(-1)^n \frac{d^n}{ds^n} F(s)$
Convolution	$f * g$	$F(s)G(s)$
	Note: $f * g = \int_0^t f(\tau)g(t-\tau)d\tau$	
	$\int_0^t f(\tau)d\tau$	$\frac{F(s)}{s}$
Dirac Delta	$\delta(t-a)$	e^{-as}

<table>
<tr><td>Fourier Series</td><td>

$$f(x) \sim \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos\frac{n\pi x}{p} + b_n \sin\frac{n\pi x}{p}$$

$$a_0 = \frac{1}{p}\int_{-p}^{p} f(x)dx$$

$$a_n = \frac{1}{p}\int_{-p}^{p} f(x)\cos\frac{n\pi x}{p}dx$$

$$b_n = \frac{1}{p}\int_{-p}^{p} f(x)\sin\frac{n\pi x}{p}dx$$

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<tr><td>Sine Series</td><td>

$$f(x) \sim \sum_{n=1}^{\infty} b_n \sin\frac{n\pi x}{P}$$

$$b_n = \frac{2}{p}\int_{0}^{p} f(x)\sin\frac{n\pi x}{p}dx$$

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<tr><td>Cosine Series</td><td>

$$f(x) \sim \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos\frac{n\pi x}{p}$$

$$a_0 = \frac{2}{p}\int_{0}^{p} f(x)dx$$

$$a_n = \frac{2}{p}\int_{0}^{p} f(x)\cos\frac{n\pi x}{p}dx$$

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<tr><td rowspan="3">An Important Trigonometric Identity</td><td>

$\cos(a+b) = \cos(a)\cos(b) - \sin(a)\sin(b)$

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$\sin(a+b) = \sin(a)\cos(b) + \cos(a)\sin(b)$

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$$c_1 \sin(\omega x) + c_2 \cos(\omega x) = A sin(\omega x + \phi)$$

$$A = \sqrt{c_1^2 + c_2^2}$$

$$\phi = \tan^{-1}\left(\frac{c_2}{c_1}\right)$$

Note: **(1)** to calculate ϕ properly, c_1 must be the constant assigned the $\sin(\omega x)$ and c_2 must be the constant assigned the $\cos(\omega x)$. **(2)** If $c_1 < 0$, add π to the answer provided by your calculator.

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