```
> # Example 1. Fourier transform of sin(t)
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```
> F:=unapply(inttrans[fourier](sin(t),t,w),w);F(1); # singularity at freq=1
```

$$F := w\sim \rightarrow I\,\pi\,(\mathrm{Dirac}(w\sim+1) - \mathrm{Dirac}(w\sim-1))$$

$$-I\,\pi\,\mathrm{Dirac}(0) \quad \textbf{(1)}$$

```
> # Example 2. Fourier transform of a sinusoid pulse
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```
> f:=t->4*sin(100*2*Pi*t)*(Heaviside(t)-Heaviside(t-2*Pi));
```

$$f := t \rightarrow 4\sin(200\,\pi\,t)\,(\mathrm{Heaviside}(t) - \mathrm{Heaviside}(t-2\,\pi)) \quad \textbf{(2)}$$

```
> F:=unapply(inttrans[fourier](f(t),t,w),w);assume(w,real);simplify(Re(F(w)));
  # Singularity at zero of the denominator indicates Dirac answer
```

$$F := w\sim \rightarrow -\frac{2\,e^{-2\,I\,(w\sim+200\,\pi)\,\pi}}{w\sim+200\,\pi} + \frac{2\,e^{2\,I\,(-w\sim+200\,\pi)\,\pi}}{w\sim-200\,\pi} + \frac{800\,\pi}{(-w\sim+200\,\pi)\,(w\sim+200\,\pi)}$$

$$-\frac{1}{-w\sim^2+40000\,\pi^2}\,(2\,(-\cos(2\,(w\sim+200\,\pi)\,\pi)\,w\sim + 200\cos(2\,(w\sim+200\,\pi)\,\pi)\,\pi + \cos(2\,(-w\sim+200\,\pi)\,\pi)\,w\sim + 200\cos(2\,(-w\sim+200\,\pi)\,\pi)\,\pi - 400\,\pi)) \quad \textbf{(3)}$$

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> # Example 3. A mixed signal with exponential and sinusoidal terms
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```
> f:=t->(4*exp(-t)+sin(4*t))*(Heaviside(t)-Heaviside(t-2*Pi));assume(w,real);simplify(Re(F(w)));
```

$$f := t \rightarrow (4\,e^{-t} + \sin(4\,t))\,(\mathrm{Heaviside}(t) - \mathrm{Heaviside}(t-2\,\pi))$$

$$-\frac{1}{(1+w\sim^2)\,(w\sim^2-16)}\,(4\,(-e^{-2\,\pi}\,w\sim^3\sin(2\,\pi\,w\sim) + e^{-2\,\pi}\cos(2\,\pi\,w\sim)\,w\sim^2 - \cos(2\,\pi\,w\sim)\,w\sim^2 + 16\,w\sim\,e^{-2\,\pi}\sin(2\,\pi\,w\sim) - \cos(2\,\pi\,w\sim) - 16\,e^{-2\,\pi}\cos(2\,\pi\,w\sim) + 17)) \quad \textbf{(4)}$$

```
> F:=unapply(inttrans[fourier](f(t),t,w),w);
```

$$F := w\sim \rightarrow \frac{4\,e^{-2\,I\,\pi\,w\sim}}{(w\sim-4)\,(w\sim+4)} + \frac{4\,(-I\,w\sim-17+w\sim^2)}{(I\,w\sim+1)\,(w\sim-4)\,(w\sim+4)} - \frac{4\,e^{-2\,I\,\pi\,w\sim-2\,\pi}}{I\,w\sim+1} \quad \textbf{(5)}$$

```
> Re(F(2)); Im(F(2)); abs(F(2)); evalf(abs(F(2)));evalf(arctan(Im(F(2))/Re(F(2))));
```

$$\frac{4}{5} - \frac{4}{5}\,e^{-2\,\pi}$$

$$\frac{-\frac{8}{5}+\frac{8}{5}\,e^{-2\pi}}{\sqrt{\left(\frac{4}{5}-\frac{4}{5}\,e^{-2\pi}\right)^2+\left(-\frac{8}{5}+\frac{8}{5}\,e^{-2\pi}\right)^2}}$$

1.785513799

-1.107148718 **(6)**