2. Laplace

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LAPLACE TRANSFORMS

```
syms t s
f = [function]
laplace_transform = laplace(f, t, s)
simplify(laplace_transform)
```

Evaluate

$$f(t) = e^{at} \sin bt$$

```
>> syms s t a b;
>> f=exp(a*t)*sin(b*t);
>> laplace(f,t,s)

ans =

b/(b^2 + (a - s)^2)
```

Evaluate

$$ke^{-at}\cos(wt)$$

```
>> syms k w a s t;
>> t=laplace(k*exp(-a*t)*cos(w*t),t,s)

t =

(k*(a + s))/((a + s)^2 + w^2)
```

```
>> syms k w a s t;
>> t=laplace(k*exp(-a*t)*cos(w*t),t,s)

t =

(k*(a + s))/((a + s)^2 + w^2)


>> simplify(t)

ans =

(k*(a + s))/((a + s)^2 + w^2)
```

Heaviside Function

Using unit step function, find the laplace transform of $f(t) = t$

```
>> syms t s
>> syms a positive
>> laplace(heaviside(t-a)*(t-a),t,s)

ans =

exp(-a*s)/s^2
```

Using unit step function, find

$$\mathcal{L}[f(t)] \text{ where } f(t) = \sin 2t - \sin 3t \text{ and } a = 0$$

```
>> syms t s
>> laplace(heaviside(t)*(sin(2*t)-sin(3*t)))

ans =

2/(s^2 + 4) - 3/(s^2 + 9)
```

→ same as just finding Laplace since $a = 0$

Dirac δ Function / Unit Impulse Function

Find $\mathcal{L}[\text{Dirac}(t-a)]$

```
>> syms a positive
>> syms t s
>> laplace(dirac(t-a),t,s)

ans =

exp(-a*s)
```