Ex:

a) A frequency-domain circuit is shown above. Write the value of phasor voltage $V_1$ in rectangular form.

b) Given $\omega = 500$ rad/s, write a numerical time-domain expression for $v_1(t)$, the inverse phasor of $V_1$.

sol'n: a) The dependent-source voltage cancels out the voltage across the $3 \, \text{k}\Omega$ resistor, yielding the equivalent of a wire, (i.e. $0\text{V}$).

We may also ignore the bottom part of the circuit, which is shorted out by the middle wire.

Thus far, we have the following circuit:
Now we observe that the $j2k\Omega$ and $-j2k\Omega$ in parallel are equivalent to an open circuit:

$$j2k\Omega \parallel -j2k\Omega = j2k\Omega \cdot 1 \parallel -1 = j2k\Omega \cdot -1 = 0$$

Thus, the $L$ and $C$ disappear:

Now we use Ohm's law:

$$V_i = (1+j)\ mA \cdot 2k\Omega = 2+j2\ V$$

b) In polar form, $V_i = 2\sqrt{2} \angle 45^\circ \ V$

In the time domain, we have

$$V_i(t) = 2\sqrt{2} \cos(500t + 45^\circ) \ V$$

Note: We could also directly take the inverse phasor of $2+j2\ V$:

$$V_i(t) = 2\cos(500t) - 2\sin(500t) \ V$$