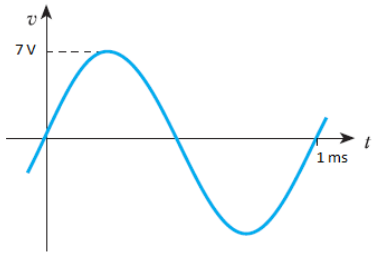
6.1 A signal v is described by the expression $v = 15 \sin 100t$. What is the angular frequency of this signal, and what is its peak magnitude?

6.2 A signal v is described by the expression $v = 25 \sin 250t$. What is the frequency of this signal (in Hz), and what is its r.m.s. magnitude?

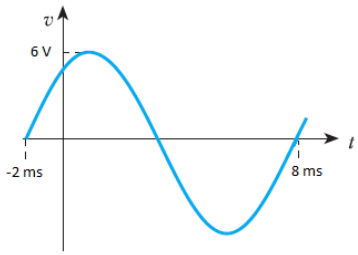
6.3 Give an expression for a sinusoidal signal with a peak voltage of 20 V and an angular frequency of 300 rad/s.

6.4 Give an expression for a sinusoidal signal with an r.m.s. voltage of 14.14 V and a frequency of 50 Hz.

6.5 Give an expression for the waveform shown in the following diagram.



6.6 Give an expression for the waveform shown in the following diagram.



6.7 Give an expression relating the voltage across a resistor to the current through it.

6.8 Give an expression relating the voltage across an inductor to the current through it.

6.9 Give an expression relating the voltage across a capacitor to the current through it.

6.10 If a sinusoidal current is passed through a resistor, what is the phase relationship between this current and the voltage across the component?

6.11 If a sinusoidal current is passed through a capacitor, what is the phase relationship between this current and the voltage across the component?

6.12 If a sinusoidal current is passed through an inductor, what is the phase relationship between this current and the voltage across the component?

6.13 How can the word 'civil' assist in remembering the phase relationship between currents and voltages in inductors and capacitors?

6.14 Explain what is meant by the term 'reactance'.

6.15 What is the reactance of a resistor?

6.16 What is the reactance of an inductor?

6.17 What is the reactance of a capacitor?

6.18 Calculate the reactance of an inductor of 20 mH at a frequency of 100 Hz, being sure to include the units in your answer.

6.19 Calculate the reactance of a capacitor of 10 nF at an angular frequency of 500 rad/s, being sure to include the units in your answer.

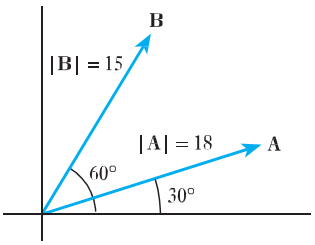
6.20 A sinusoidal voltage of 15 V r.m.s. at 250 Hz is applied across a 50 μF capacitor. What will be the current in the capacitor?

6.21 A sinusoidal current of 2 mA peak at 100 rad/s flows through an inductor of 25 mH. What voltage will appear across the inductor?

6.22 Explain briefly the use of a phasor diagram.

6.23 What is the significance of the length and direction of a phasor?

6.24 Estimate the magnitude and phase of $(\mathbf{A} + \mathbf{B})$ and $(\mathbf{A} - \mathbf{B})$ in the following phasor diagram.



6.25 A voltage is formed by summing two sinusoidal waveforms of the same frequency. The first has a magnitude of 20 V and is taken as the reference phase (that is, its phase angle is taken as 0°). The second has a magnitude of 10 V and leads the first waveform by 45°. Draw a phasor diagram of this arrangement and hence estimate the magnitude and phase of the resultant signal.

6.26 A sinusoidal current of 3 A at 100 Hz flows through a series combination of a resistor of 25 Ω and an inductor of 75 mH. Use a phasor diagram to determine the voltage across the combination and the phase angle between this voltage and the current.

6.27 A sinusoidal voltage of 12 V at 500 Hz is applied across a series combination of a resistor of 5 kΩ and a capacitor of 100 nF. Use a phasor diagram to determine the current through the combination and the phase angle between this current and the applied voltage.

6.28 Use a phasor diagram to determine the magnitude and phase angle of the impedance formed by the series combination of a resistance of 25 Ω and a capacitance of 10 μF, at a frequency of 300 Hz.

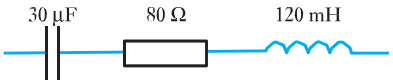
6.29 If $x = 5 + j7$ and $y = 8 - j10$, evaluate $(x + y)$, $(x - y)$, $(x \times y)$ and $(x \div y)$.

6.30 What is the complex impedance of a resistor of 1 kΩ at a frequency of 1 kHz?

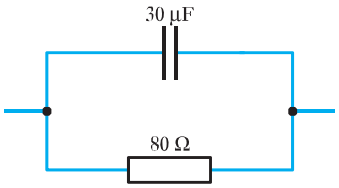
6.31 What is the complex impedance of a capacitor of 1 μF at a frequency of 1 kHz?

6.32 What is the complex impedance of an inductor of 1 mH at a frequency of 1 kHz?

6.33 Determine the complex impedance of the following arrangements at a frequency of 200 Hz.

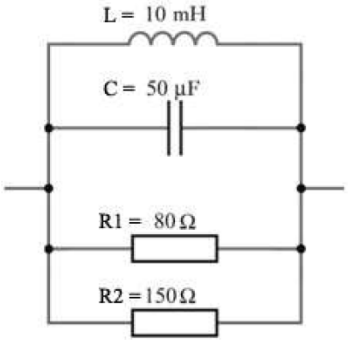


(a)



(b)

6.34 Determine the complex impedance of the following arrangement at a frequency of 100 Hz.



6.35 Use your answer to Exercise 6.34 to devise a simpler arrangement of components that would have a similar behaviour to the circuit of Exercise 6.34 at a frequency of 100 Hz.

6.36 Repeat the calculations of Exercise 6.34 assuming that the circuit will be used at a frequency of 200 Hz.

6.37 Use your answer to Exercise 6.36 to devise a simple arrangement of components that would have a similar behaviour to the circuit of Exercise 6.34 at a frequency of 200 Hz.

6.38 Express $x = 20 + j30$ in polar form and in exponential form.

6.39 Express $y = 25\angle -40°$ in rectangular form and in exponential form.

6.40 A voltage $v = 60 \sin 314t$ is applied across a series combination of a 10 Ω resistor and an inductance of 50 mH. Determine the magnitude and phase of the resulting current.

6.41 A current of $i = 0.5 \sin 377t$ is passed through a parallel combination of a resistance of 1 kΩ and a capacitance of 5 μF. Determine the magnitude and phase of the resulting voltage across the combination.