5 **(a)** Show that, for a sinusoidal alternating voltage, the mean power transformed in a resistive load is half the maximum power.

[1]

(b) The variation with time t of the potential difference V_1 across a resistor is shown in Fig. 5.1.

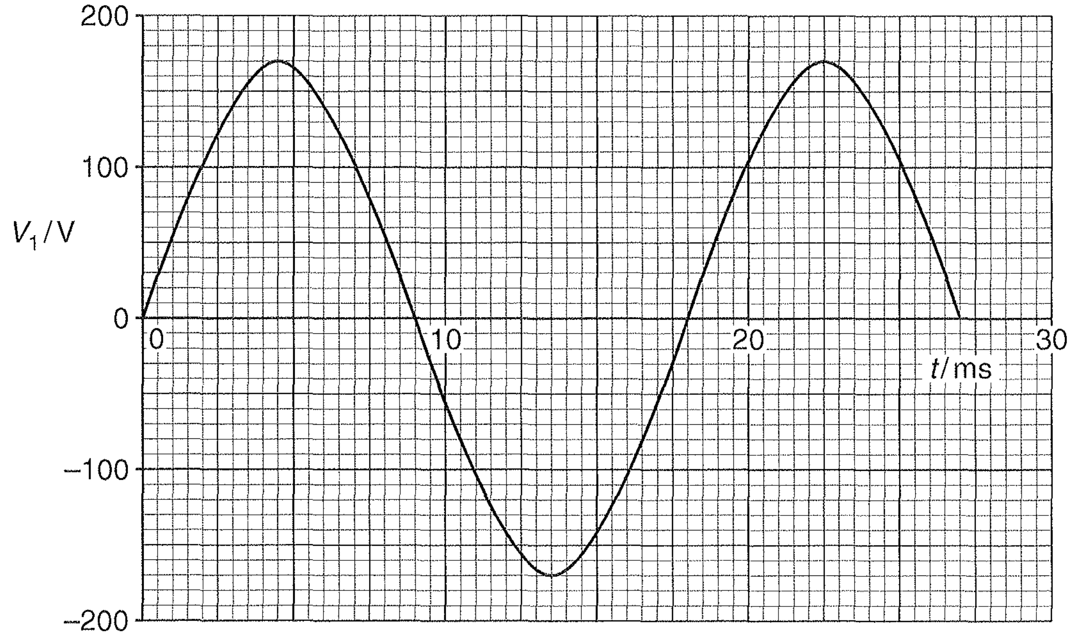

Fig. 5.1

The relation between V_1 and t is given by

$$V_1 = V_0 \sin \omega t.$$

Use Fig. 5.1 to determine

(i) ω,

ω = ... [1]

(ii) the root-mean-square voltage V_{rms} for V_1.

V_{rms} for V_1 = ... V [1]

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(c) The variation with time *t* of potential difference V_2 is shown in Fig. 5.2.

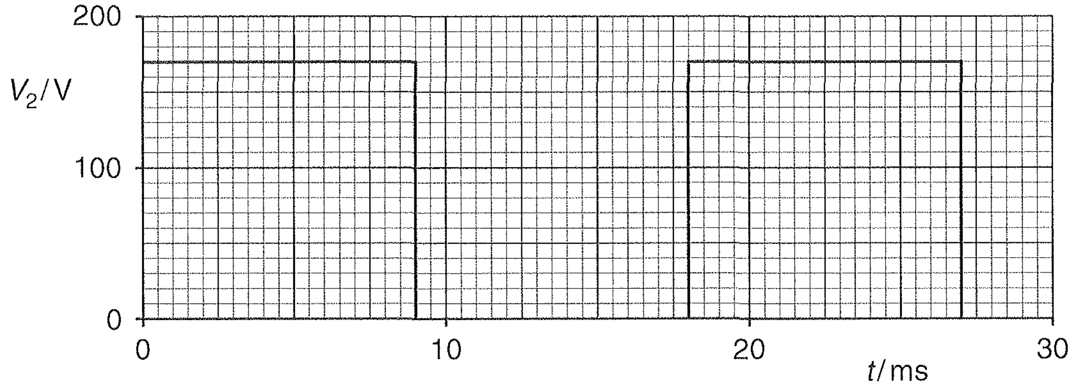

Fig. 5.2

Use Fig. 5.2 to determine V_{rms} for V_2.

V_{rms} for V_2 = ... V [1]

(d) The potential difference V_1 shown in Fig. 5.1 is connected to an ideal transformer, as shown in Fig. 5.3.

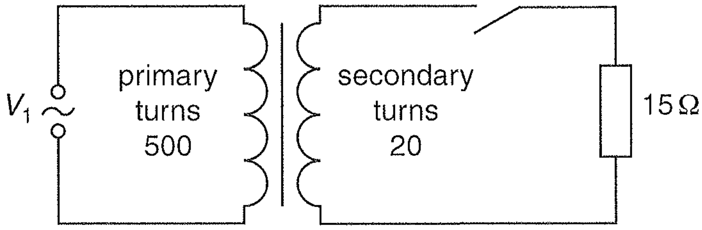

Fig. 5.3

The primary coil has 500 turns and the secondary coil has 20 turns. The secondary coil is connected to an open switch and a 15 Ω resistor.

(i) Use Faraday's law of electromagnetic induction to explain

1. how an e.m.f. is obtained across the secondary coil,

....

....

....

.... [2]

2. why the e.m.f. is less than the potential difference across the primary coil.

....

....

....

.... [2]

(ii) The switch in the secondary circuit is now closed.

Calculate the r.m.s. current in the primary circuit.

current = ... A [2]