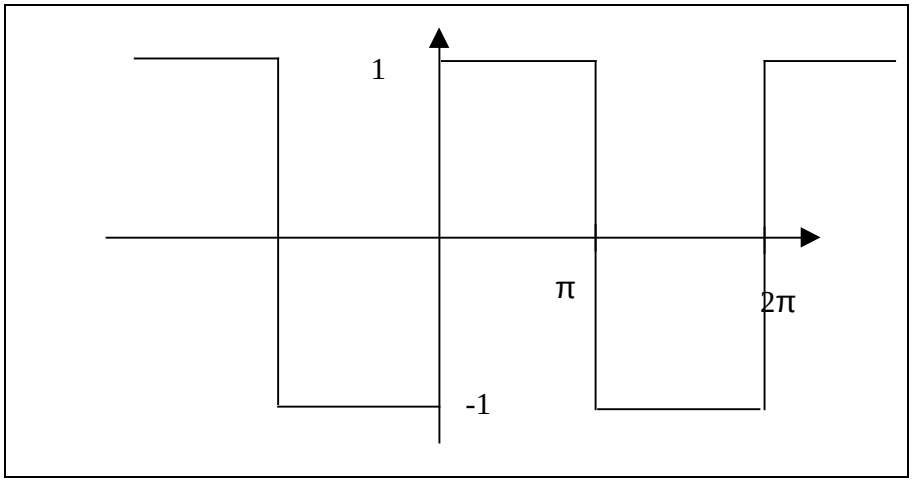
Physics 440
Quiz 10
17-Mar-2000

Name:

1. (2 pts) Find the leading term in the Fourier Series for the wave shown in the graph below.



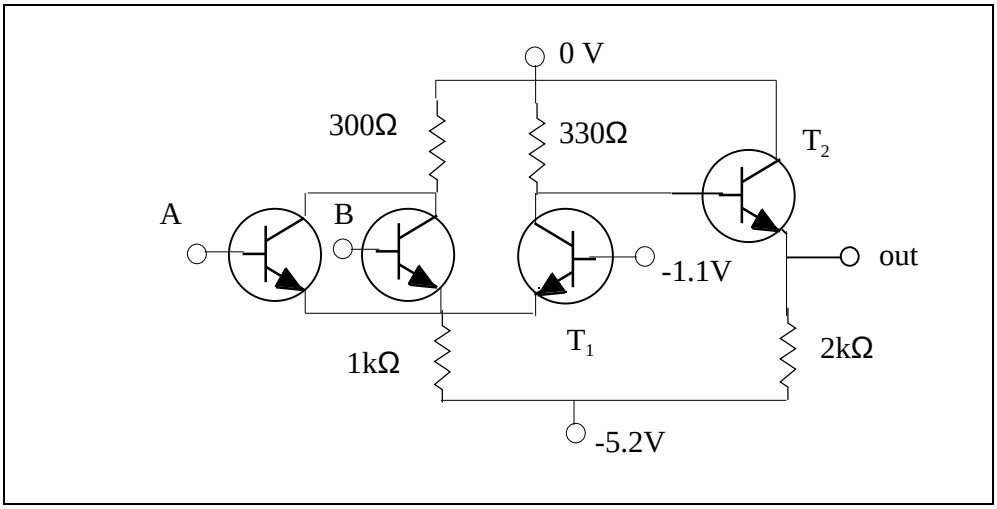
Solution: Since the function is odd (f(-t) = -f(t)) only the sine series need be considered. Thus we need to find the term:

$$a_1 = \int_{-\pi}^{\pi} f(\theta)\frac{\sin(\theta)}{\sqrt{2}}d\theta$$

$$a_1 = \frac{1}{\sqrt{2}}\{\int_{-\pi}^{0}(-1)\sin(\theta)d\theta + \int_{0}^{\pi}(1)\sin(\theta)d\theta\}$$

$$= \frac{1}{\sqrt{2}}\{\cos(\theta)\Big|_{-\pi}^{0} - \cos(\theta)\Big|_{0}^{\pi}\} = \frac{4}{\sqrt{2}}$$

2. Explain how the circuit below works under various conditions of the inputs A and B. Logic level 1 = -0.75 V and logic level 0 = -1.55 V.



Write down a truth table for this circuit.

Solution: With both A and B inputs at logic 0 (-1.55 V) neither transistor A nor B conducts. Transistor T_1, however is on. The drop across the 330 Ω resistor is sufficient to bias T_2 off which gives –5.2 volts or logic 0 for the output. If either A or B inputs are raised to –0.75 volts the transistor conducts adding more emitter current to the1 kΩ emitter resistor thus raising the common emitter point. This decreases the current in T_1 and thereby raises its collector voltage. This makes T_2 conduct making the output 0V less the V_{CD} of T_2, which is small. The output is logic 1. Clearly, this is an OR circuit with truth table:

A	**B**	**A OR B**
0	0	0
1	0	1
0	1	1
1	1	1