Problem 3.15

(a) The diode is on. V = 0 and I = (10 volts)/(2.7 kΩ) = 3.70 mA.

(b) The diode is off. I = 0 and V = 10 volts.

(c) The diode is on. V = 0 and I = 0.

(d) The diode is on. I = 5 mA and V = 5 volts.

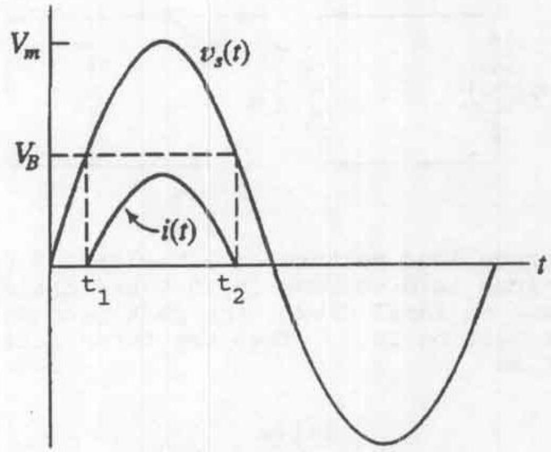
Problem 3.16

(a) D_1 is on and D_2 is off. V = 10 volts and I = 0.

(b) D_1 is on and D_2 is off. V = 6 volts and I = 6 mA.

(c) Both diodes are on. V = 30 volts and I = 33.6 mA.

Problem 3.24



Peak current flows at the instant for which $v_s(t)$ attains its maximum value. The maximum current is

$$I_{max} = \frac{V_m - V_B}{R} = \frac{20 - 14}{10} = 0.6 \text{ A}$$

As a function of time, the current is

$$i(t) = \frac{V_m \sin(\omega t) - V_B}{R}$$

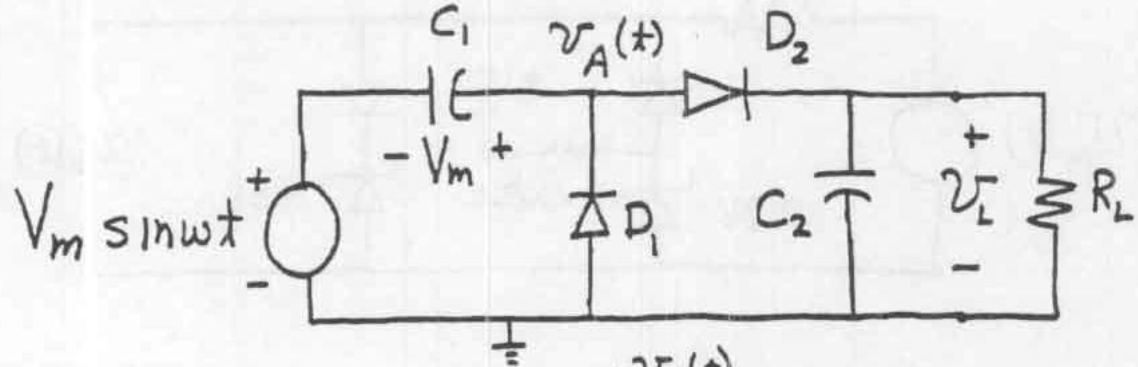
provided that this expression yields a positive result. Otherwise $i(t) = 0$. To determine the interval for which the diode is in the on state we must solve this equation:

$$i(t) = 0 = \frac{V_m \sin(\omega t) - V_B}{R} = \frac{20\sin(\omega t) - 14}{10}$$

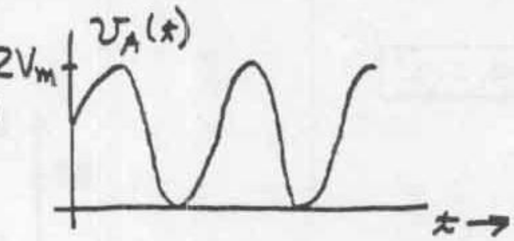
Solving we find two roots: $t_1 = 0.775/\omega$ and $t_2 = 2.37/\omega$ radian. t_1 and t_2 are indicated on the waveforms shown on the preceding page. The period of the sine wave is $T = 2\pi/\omega$. Thus the percentage of the time that the diode is on is

$$\text{diode on} = \frac{2.37/\omega - 0.775/\omega}{2\pi/\omega} \times 100\% = 25.3\%$$

Problem 3.32



$$v_A(t) = V_m + V_m \sin(\omega t)$$



Notice that C_1 and D_1 form a clamp circuit. Furthermore, D_2 and C_2 form a peak rectifier so the load voltage is approximately equal to $2V_m$ which is why this circuit is called a voltage doubler.