

## Exercise 17(e)

1. Graph of the following functions for at least two cycles:

$$(a) f(t) = \begin{cases} \sin(t) & 0 \leq t \leq \pi \\ 0 & \pi \leq t \leq 2\pi \end{cases} \text{ with period } 2\pi$$

$$(b) f(t) = \begin{cases} 0 & 0 \leq t < 1 \\ 1 & 1 \leq t < 2 \\ 0 & 2 \leq t < 3 \end{cases} \text{ with period } 3$$

2. Consider the following square waveform:

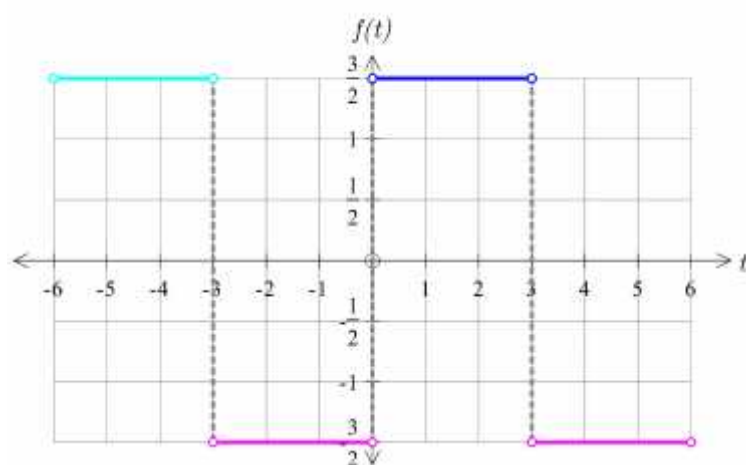


Figure 40

- (i) Determine the Fourier series of this waveform  $f(t)$ .  
 (ii) By using an appropriate value for  $t$  deduce (from part (i)) that

$$\frac{\pi}{2} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \dots$$

3. Obtain the Fourier series of the following waveform:

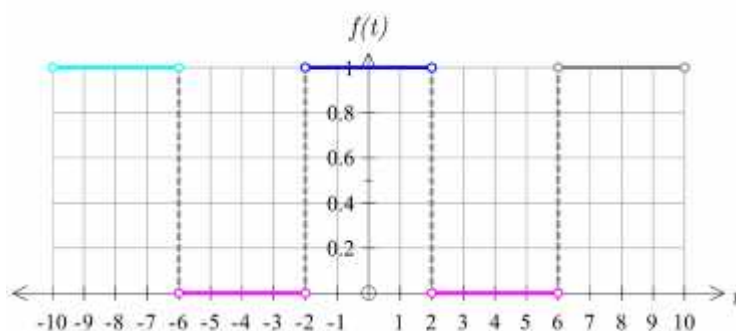


Figure 41

4. Obtain the Fourier series of the following waveform:

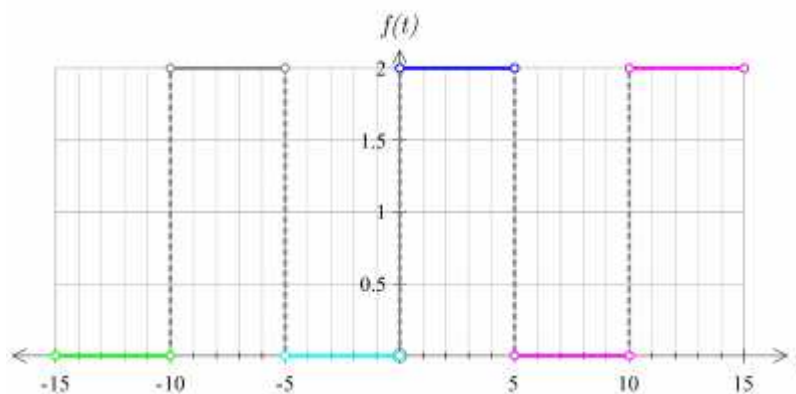


Figure 42

5. Determine the Fourier series of the following periodic waveform:

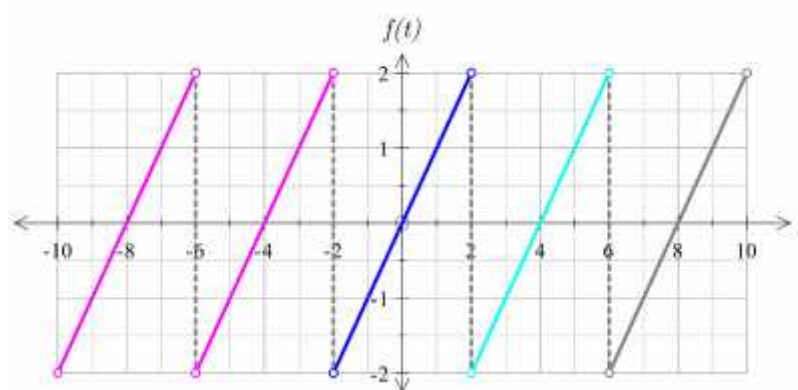


Figure 43

### Brief Solutions

2.  $\frac{6}{\pi} \left[ \sin\left(\frac{\pi t}{3}\right) + \frac{1}{3} \sin\left(\frac{3\pi t}{3}\right) + \frac{1}{5} \sin\left(\frac{5\pi t}{3}\right) + \frac{1}{7} \sin\left(\frac{7\pi t}{3}\right) + \dots \right]$
3.  $\frac{1}{2} + \frac{2}{\pi} \left[ \cos\left(\frac{\pi t}{4}\right) - \frac{\cos(3\pi t/4)}{3} + \frac{\cos(5\pi t/4)}{5} - \frac{\cos(7\pi t/4)}{7} + \dots \right]$
4.  $1 + \frac{4}{\pi} \left[ \sin\left(\frac{\pi t}{5}\right) + \frac{\sin(3\pi t/5)}{3} + \frac{\sin(5\pi t/5)}{5} + \dots \right]$
5.  $\frac{4}{\pi} \left[ \sin\left(\frac{\pi t}{2}\right) - \frac{\sin(2\pi t/2)}{2} + \frac{\sin(3\pi t/2)}{3} - \frac{\sin(4\pi t/2)}{4} + \dots \right]$