**Tips to avoid plagiarism**

- Do not copy the solutions of your classmates.

- Your are encouraged to discuss the problems with your classmates in whatever way you like but make sure to REPRODUCE YOUR OWN SOLUTIONS in what you submit for grading.

- Cite all the online sources that you get help from.

- Keep your work in a secure place.

Problem 1

Find the Fourier transform for each of the following exactly as directed. Also sketch the amplitude spectrum and phase spectrum in each case for $-4\pi < \omega < 4\pi$.
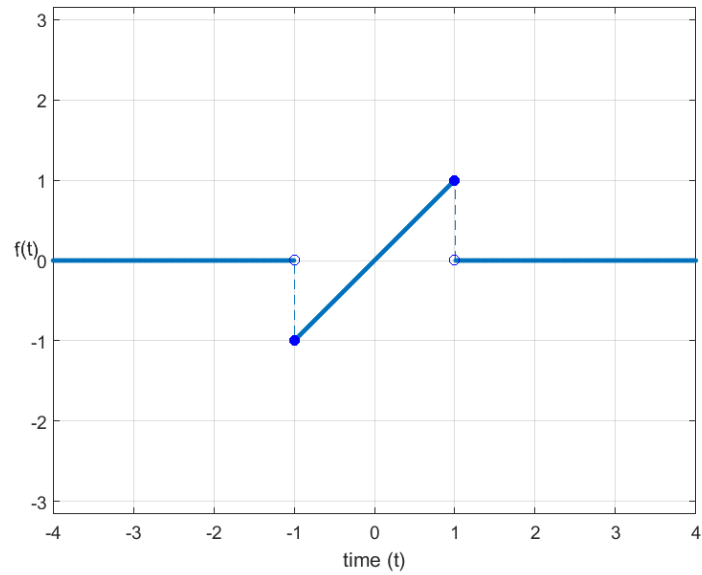
(a) Find the Fourier transform of the following function.

[Hints: Define the function in its appropriate intervals. Use evenness/oddness to simplify the Fourier transform integral.]
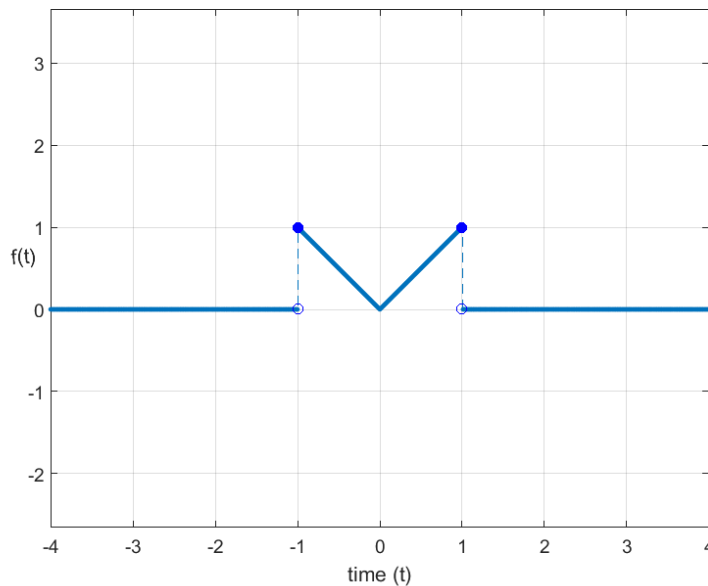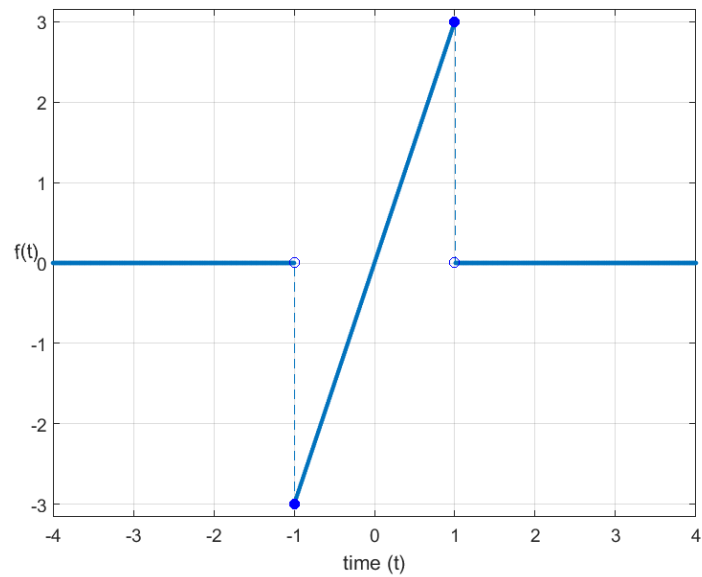
(b) Find the Fourier transform of the following function.

[Hints: Define the function in its appropriate intervals. Use evenness/oddness to simplify the Fourier transform integral.]
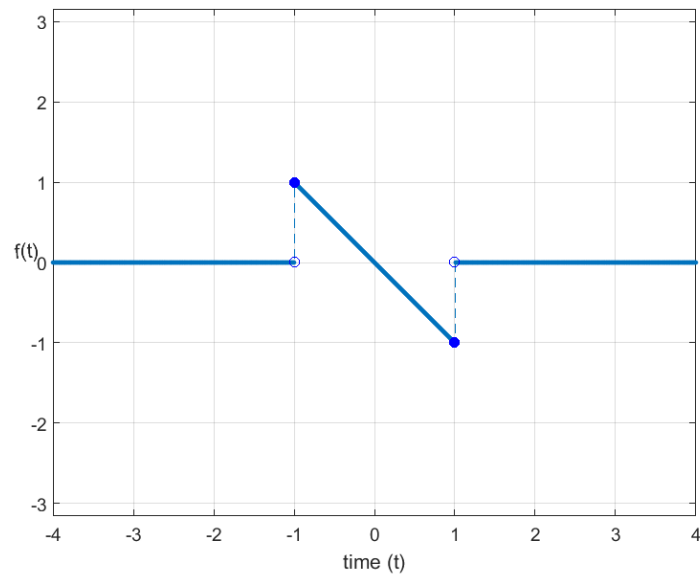

(c) Using your answer to (b), find the Fourier transform of the following function.
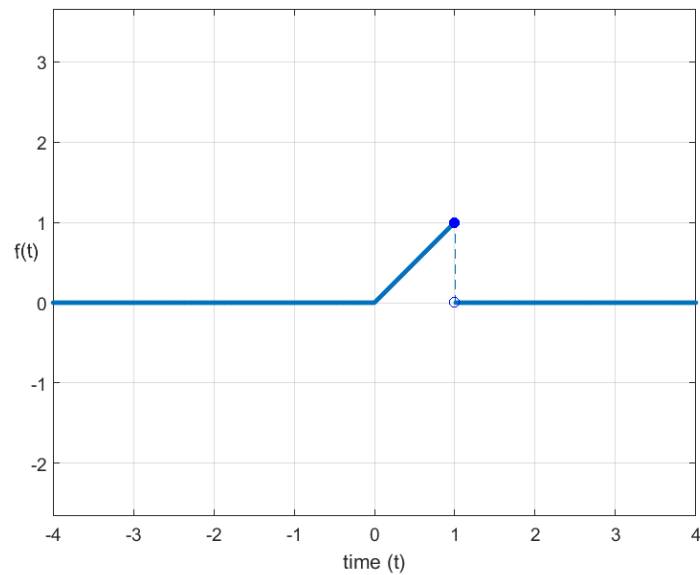
[Hint: Linearity]

(d) Using your answer to (b), find the Fourier transform of the following function.
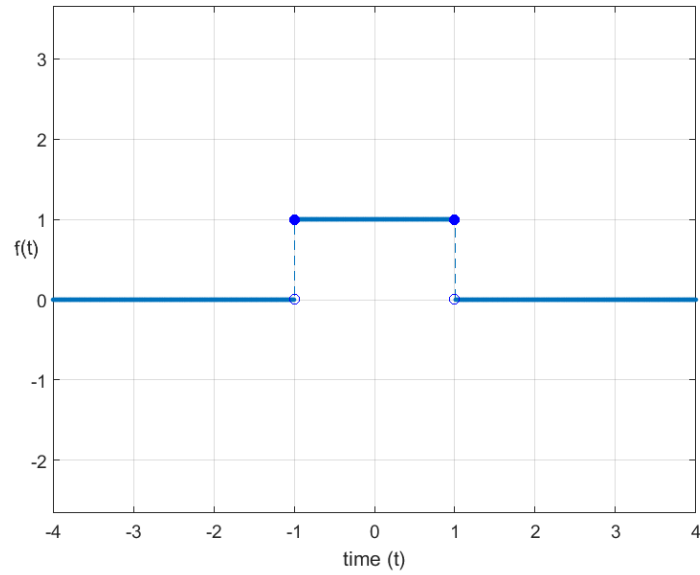
[Hint: Linearity or time-reversal]

(e) Using your answer to (a) and (b), find the Fourier transform of the following function.
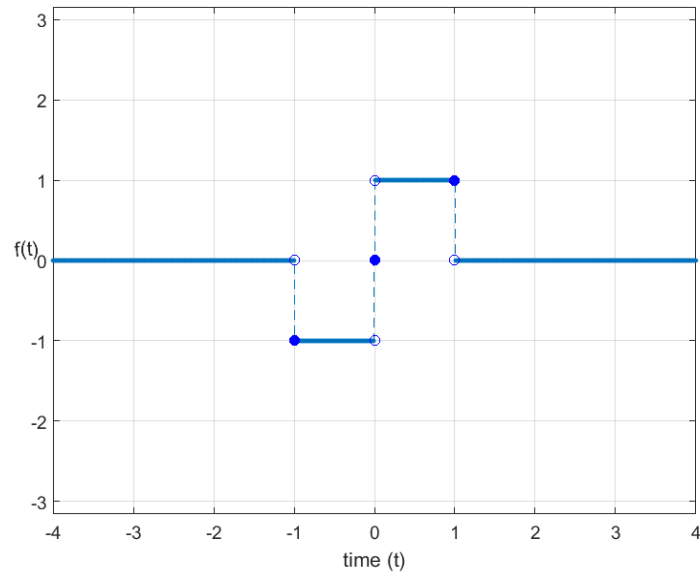
[Hint: Linearity]

(f) Using your answer to (b), find the Fourier transform of the following function.
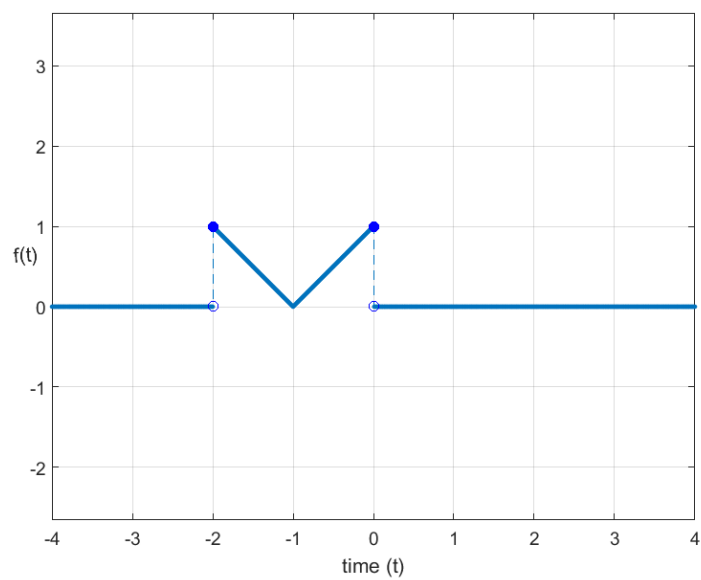[Hint: Differentiation]

(g) Using your answer to (a), find the Fourier transform of the following function.
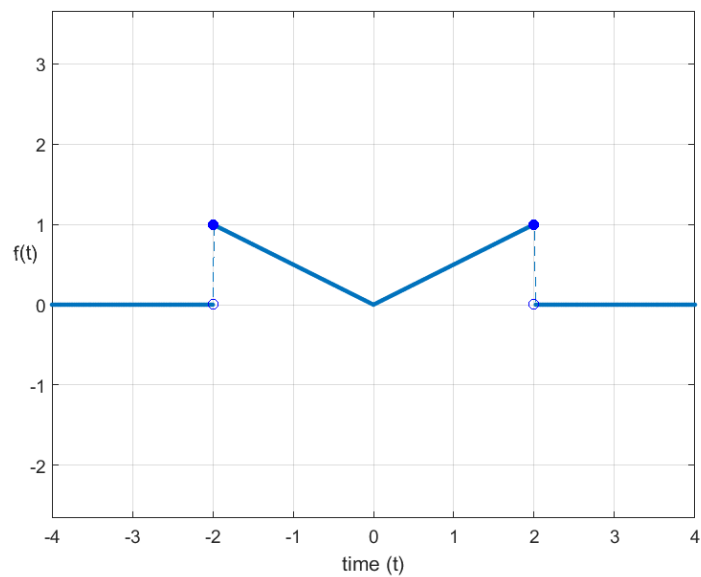[Hint: Differentiation]

(h) Using your answer to (a), find the Fourier transform of the following function.
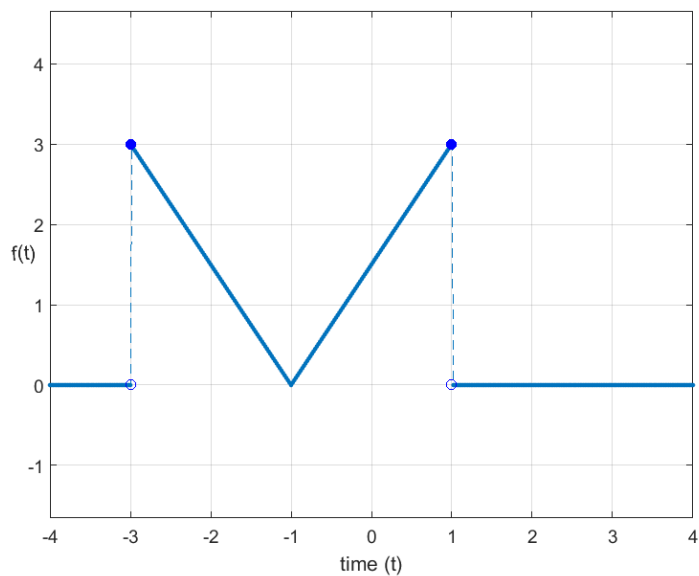
[Hint: Time shift]

(i) Using your answer to (a), find the Fourier transform of the following function.
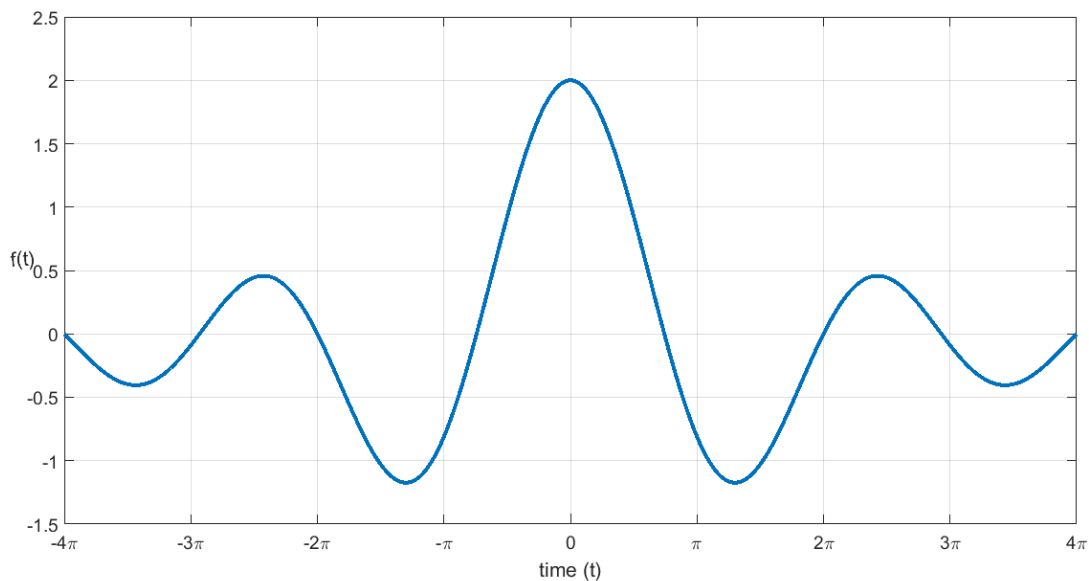
[Hint: Time scaling]

(j) Using your answer to (a), find the Fourier transform of the following function.
[Hint: Various properties]

(k) Using your answer to (a), find the Fourier transform of the following function.
[Hint: Duality and Linearity]

Problem 2

Use Parseval's theorem (and maybe duality) to evaluate the following integral

$$\int_{-\infty}^{\infty} \frac{\sin^4 4t}{t^4} dt$$