MathQuest: Series

Fourier Series

1. Find the Fourier series on the interval $[-\pi, \pi]$ for the function $y = 2x + 3$.

   (a) $2\sin x - \sin 2x + \frac{2}{3}\sin 3x - \frac{1}{2}\sin 4x + \cdots$

   (b) $3 + 4\sin x - 2\sin 2x + \frac{4}{3}\sin 3x - \sin 4x + \cdots$

   (c) $3 + 2\sin x - \cos x + \frac{2}{3}\sin 2x - \frac{1}{2}\cos 4x + \cdots$

   (d) $3 + 2\cos x - \cos 2x + \frac{2}{3}\cos 3x - \frac{1}{2}\cos 4x + \cdots$

   (e) It is not possible to create this Fourier series.

2. The Fourier Series for $f = x^3$ on the interval $[-\pi, \pi]$ contains

   (a) only sines.

   (b) only cosines.

   (c) both sines and cosines.

   (d) This is impossible.

3. The Fourier Series for $f = 3e^x$ on the interval $[-\pi, \pi]$ contains

   (a) only sines.

   (b) only cosines.

   (c) both sines and cosines.

   (d) This is impossible.

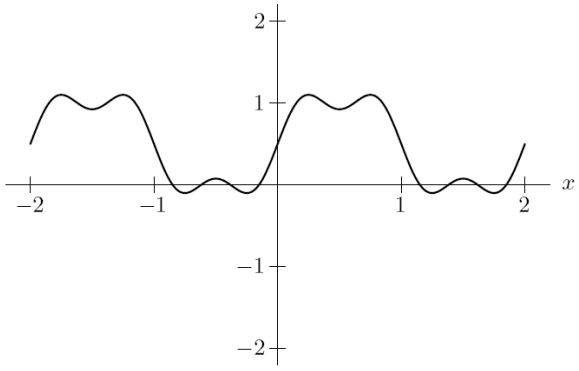
4. The figure below contains the graph of the first three terms of the Fourier series of which of the following functions?

   (a) $f(x) = \begin{cases} 0, & -1 < x < 0 \\ 1, & 0 < x < 1 \end{cases}$ and $f(x+2) = f(x)$

   (b) $f(x) = \begin{cases} -1, & -1 < x < 0 \\ 1, & 0 < x < 1 \end{cases}$ and $f(x+2) = f(x)$

   (c) $f(x) = |x|$ on $-1 < x < 1$ and $f(x+2) = f(x)$

(d) $f(x) = \begin{cases} 1+x, & -1 < x < 0 \\ 1, & 0 < x < 1 \end{cases}$ and $f(x+2) = f(x)$



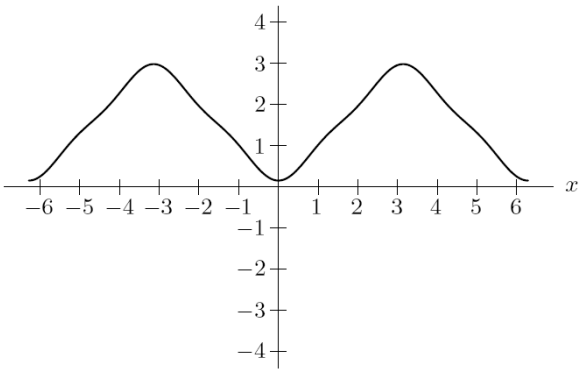
5. The figure below contains the graph of the first three terms of the Fourier series of which of the following functions?

   (a) $f(x) = 3(x/\pi)^3$ on $-\pi < x < \pi$ and $f(x+2\pi) = f(x)$

   (b) $f(x) = |x|$ on $-\pi < x < \pi$ and $f(x+2\pi) = f(x)$

   (c) $f(x) = \begin{cases} -3, & -\pi < x < 0 \\ 3, & 0 < x < \pi \end{cases}$ and $f(x+2\pi) = f(x)$

   (d) $f(x) = \begin{cases} \pi + x, & -\pi < x < 0 \\ \pi - x, & 0 < x < \pi \end{cases}$ and $f(x+2\pi) = f(x)$



6. The figure below contains the graph of the first three non-zero terms of the Fourier series of which of the following functions?

   (a) $f(x) = 3(x/\pi)^3$ on $-\pi < x < \pi$ and $f(x+2\pi) = f(x)$

   (b) $f(x) = |x|$ on $-\pi < x < \pi$ and $f(x+2\pi) = f(x)$

   (c) $f(x) = \begin{cases} -3, & -\pi < x < 0 \\ 3, & 0 < x < \pi \end{cases}$ and $f(x+2\pi) = f(x)$

(d) $f(x) = \begin{cases} \pi + x, & -\pi < x < 0 \\ \pi - x, & 0 < x < \pi \end{cases}$ and $f(x + 2\pi) = f(x)$