

MATH 445 MIDTERM EXAM 1 SOLUTIONS
Fall 2009
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(1)(a) 8π , (b) (ii).

(2) $b_n = 0$ for all $n \geq 1$, and

$$a_n = \frac{1 - \cos((n+2)\pi/2)}{(n+2)\pi} + \frac{\cos((n-2)\pi/2) - 1}{(n-2)\pi},$$

except for $n = 2$ the second term is omitted. Also $a_0 = \frac{1}{\pi}$. Thus

$$f(x) = \frac{1}{\pi} + \frac{4}{3\pi} \cos \pi x - \frac{4}{5\pi} \cos 3\pi x - \frac{2}{3\pi} \cos 4\pi x + \dots$$

(3)(a)

$$\hat{h}(w) = \sqrt{\frac{2}{\pi}} \frac{aw \sin aw + \cos aw - 1}{w^2}.$$

(b)

$$h(x) = \frac{1}{\pi} \int_{-\infty}^{\infty} \frac{aw \sin aw + \cos aw - 1}{w^2} e^{iwx} dw.$$

(c) $g(x) = \frac{1}{\sqrt{2\pi}} e^{-4x}$, $x \geq 0$.

(4)(a) 0