

1. (b)  $\left\{ \frac{1}{\sqrt{2}}(1, 0, 1), \frac{1}{\sqrt{3}}(-1, 1, 1) \right\}$
2. (b)  $\left\{ \frac{1}{\sqrt{2}}(1, 1, 0, 0), \frac{1}{\sqrt{6}}(-1, 1, 2, 0), \frac{1}{2\sqrt{3}}(1, -1, 1, 3) \right\}$  (d)  $\left(\frac{3}{2}, \frac{3}{2}, \frac{7}{2}, \frac{7}{2}\right), 1$
3. (a) 5 (b) 3 (c) 9
4. Take the inner product with each  $\mathbf{v}_i$  and use elementary properties of the inner product and orthogonality.
5. (a)  $\sqrt{2\pi}$  (b)  $\sqrt{\pi}$  (f)  $\sqrt{2\pi}$
6. (a)  $\left\{ \frac{1}{\sqrt{2}}(-1, 1, 0, 0), \frac{1}{\sqrt{3}}(-1, -1, 1, 0), \frac{1}{\sqrt{42}}(1, 1, 2, 6) \right\}$  (c)  $(-1, 1, -1, -2), \sqrt{7}$
7.  $\left\{ \frac{1}{\sqrt{2}}, \frac{\sqrt{3}x}{\sqrt{2}}, \frac{\sqrt{5}}{2\sqrt{2}}(3x^2 - 1), \frac{\sqrt{7}}{2\sqrt{2}}(5x^3 - 3x) \right\}$
8. (a)  $2\left( \sin x - \frac{\sin 2x}{2} + \frac{\sin 3x}{3} - \frac{\sin 4x}{4} + \dots + \frac{(-1)^{k-1} \sin kx}{k} \right)$
9. (b)  $\frac{\pi^2}{3} + \sum_{n=1}^{\infty} \frac{4}{n^2} (-1)^n \cos nx$   
 (c)  $\pi^2 = f(\pi) = \frac{\pi^2}{3} + \sum_{n=1}^{\infty} \frac{4}{n^2}$ , and rearrange.