

2. (a) $\{(1, 1, 0)^T, (-1, 0, 1)^T\}$

3. (b) O complemento ortogonal é gerado por $(-5, 3, 1)^T$

4. $\{(-1, 2, 0, 1)^T, (2, -3, 1, 0)^T\}$ é uma base para $S^\perp$

5. (a) $N = (8, -2, 1)^T$, (b) $8x - 2y + z = 7$

9. $\dim N(A) = n - r$, $\dim N(A^T) = m - r$

SEÇÃO 3

1. $\|x\|_2 = 2$, $\|y\|_2 = 6$, $\|x + y\|_2 = 2\sqrt{10}$

2. (a) $\theta = \frac{\pi}{4}$, $p = (\frac{4}{3}, \frac{1}{3}, \frac{1}{3}, 0)^T$

3. (b) $\|x\| = 1$, $\|y\| = 3$

4. (a) 0; (b) 5; (c) 7; (d) $\sqrt{74}$

7. (a) 1, (b) $\frac{1}{\pi}$; (c) $\frac{1}{6}$

8. (a) $\frac{\pi}{6}$; (b) $p = \frac{3}{2}x$

11. (a) $\frac{\sqrt{10}}{2}$; (b) $\frac{\sqrt{34}}{4}$

15. (a) $\|x\|_1 = 7$, $\|x\|_2 = 5$, $\|x\|_\infty = 4$; (b) $\|x\|_1 = 4$, $\|x\|_2 = \sqrt{6}$, $\|x\|_\infty = 2$;
(c) $\|x\|_1 = 3$, $\|x\|_2 = \sqrt{3}$, $\|x\|_\infty = 1$

16. $\|x - y\|_1 = 5$, $\|x - y\|_2 = 3$, $\|x - y\|_\infty = 2$

26. (a) Não é uma norma; (b) é norma; (c) é norma.

SEÇÃO 4

1. (a) $(2, 1)^T$, (c) $(1, 6, 0, 6, 1, 2)^T$

2. (1a) $p = (3, 1, 0)^T$, $r = (0, 0, 2)^T$ (1c)

$p = (3, 4, 0, 2, 0, 6, 2, 8)^T$, $r = (0, 6, -0, 2, 0, 4, -0, 8)^T$

3. (a) $\{(1 - 2\alpha, \alpha)^T \mid \alpha \text{ real}\}$; (b) $\{(2 - 2\alpha, 1 - \alpha, \alpha)^T \mid \alpha \text{ real}\}$

4. (a) $p = (1, 2, -1)^T$, $b - p = (2, 0, 2)^T$,
(b) $p = (3, 1, 4)^T$, $p - b = (-5, -1, 4)^T$

5. (a) $y = 1,8 + 2,9x$

6. $0,55 + 1,65x + 1,25x^2$

SEÇÃO 5

1. (a) e (d)

2. (b) $x = -\frac{\sqrt{2}}{3}x_1 + \frac{5}{3}x_2$, $\|x\| = \left[\left(-\frac{\sqrt{2}}{3}\right)^2 + \left(\frac{5}{3}\right)^2 \right]^{1/2} = \sqrt{3}$

3. $p = (\frac{23}{18}, \frac{41}{18}, \frac{8}{9})^T$, $p - x = (\frac{5}{18}, \frac{5}{18}, -\frac{10}{9})^T$

4. (b) $c_1 = y_1 \cos \theta + y_2 \sin \theta$, $c_2 = -y_1 \sin \theta + y_2 \cos \theta$

6. (a) 15; (b) $\|u\| = 3$, $\|v\| = 5\sqrt{2}$; (c) $\frac{4}{\pi}$

8. (b) (i) 0, (ii) $-\frac{\pi}{2}$, (iii) 0, (iv) $\frac{8}{\pi}$

17. (b) (i) $(2, -2)^T$, (ii) $(5, 2)^T$, (iii) $(3, 1)^T$

18. (a) $P = \begin{pmatrix} \frac{1}{2} & \frac{1}{2} & 0 & 0 \\ \frac{1}{2} & \frac{1}{2} & 0 & 0 \\ \frac{1}{2} & \frac{1}{2} & 0 & 0 \\ \frac{1}{2} & \frac{1}{2} & 0 & 0 \end{pmatrix}$

19. (b) $Q = \begin{pmatrix} \frac{1}{2} & -\frac{1}{2} & 0 & 0 \\ \frac{1}{2} & \frac{1}{2} & 0 & 0 \\ \frac{1}{2} & \frac{1}{2} & 0 & 0 \\ \frac{1}{2} & \frac{1}{2} & 0 & 0 \end{pmatrix}$

23. (b) $\|1\| = \sqrt{2}$, $\|x\| = \frac{\sqrt{6}}{3}$, (c) $l(x) = \frac{7}{9}x$

SEÇÃO 6

1. (a) $\left\{ \begin{pmatrix} -\frac{\sqrt{2}}{1} & \frac{\sqrt{2}}{1} \end{pmatrix}^T, \begin{pmatrix} \frac{\sqrt{2}}{1} & \frac{\sqrt{2}}{1} \end{pmatrix}^T \right\}$ (b) $\left\{ \begin{pmatrix} \frac{\sqrt{5}}{2} & \frac{\sqrt{5}}{1} \end{pmatrix}^T, \begin{pmatrix} -\frac{\sqrt{5}}{1} & \frac{\sqrt{5}}{2} \end{pmatrix}^T \right\}$

2. (a) $\begin{pmatrix} -\frac{\sqrt{2}}{1} & \frac{\sqrt{2}}{1} \\ \frac{\sqrt{2}}{1} & \frac{\sqrt{2}}{1} \end{pmatrix} \begin{pmatrix} \sqrt{2} & 0 \\ \sqrt{2} & 4\sqrt{2} \end{pmatrix}$

(b) $\begin{pmatrix} \frac{\sqrt{5}}{2} & \frac{\sqrt{5}}{1} \\ \frac{1}{2} & -\frac{\sqrt{5}}{1} \end{pmatrix} \begin{pmatrix} \sqrt{5} & 0 \\ \sqrt{5} & 4\sqrt{5} \end{pmatrix}$

3. $\left\{ \begin{pmatrix} \frac{3}{2} & \frac{3}{2} \end{pmatrix}^T, \begin{pmatrix} -\frac{3}{2} & \frac{3}{2} \end{pmatrix}^T, \begin{pmatrix} \frac{3}{2} & \frac{3}{2} \end{pmatrix}^T, \begin{pmatrix} -\frac{3}{2} & \frac{3}{2} \end{pmatrix}^T \right\}$

4. $u_1(x) = \frac{1}{\sqrt{2}}, u_2(x) = \frac{\sqrt{6}}{2}x, u_3(x) = \frac{4}{3\sqrt{10}}x^2 - \frac{1}{3}$

5. (a) $\left\{ \frac{3}{1} \begin{pmatrix} 2 & 1 & 2 \end{pmatrix}^T, \frac{6}{\sqrt{2}} \begin{pmatrix} -1 & 4 & -1 \end{pmatrix}^T \right\}$

(b) $Q = \begin{pmatrix} \frac{3}{2} & \frac{3}{1} & \frac{3}{2} \\ \frac{1}{2} & \frac{1}{1} & \frac{1}{2} \\ -\frac{\sqrt{2}}{2} & \frac{2\sqrt{2}}{1} & -\frac{\sqrt{2}}{2} \end{pmatrix}, R = \begin{pmatrix} 0 & \frac{3}{\sqrt{2}} & \frac{3}{5} \\ \frac{3}{2} & \frac{3}{1} & \frac{3}{5} \\ -\frac{3}{9} & \frac{3}{5} & \frac{3}{5} \end{pmatrix}$