3.

	$n = 5$	$n = 10$	$n = 100$	$n = 1000$
Solve $A\mathbf{x} = \mathbf{b}$ by Gauss–Jordan elimination	+: 50 ×: 65	+: 375 ×: 430	+: 383,250 ×: 343,300	+: 333,283,500 ×: 334,333,000
Solve $A\mathbf{x} = \mathbf{b}$ by Gaussian elimination	+: 50 ×: 65	+: 375 ×: 430	+: 383,250 ×: 343,300	+: 333,283,500 ×: 334,333,000
Find A^{-1} by reducing $[A \mid I]$ to $[I \mid A^{-1}]$	+: 80 ×: 125	+: 810 ×: 1000	+: 980,100 ×: 1,000,000	+: 998,001,000 ×: 1,000,000,000
Solve $A\mathbf{x} = \mathbf{b}$ as $\mathbf{x} = A^{-1}\mathbf{b}$	+: 100 ×: 150	+: 900 ×: 1100	+: 990,000 ×: 1,010,000	+: 999,000,000 ×: 1,001,000,000
Find $\det(A)$ by row reduction	+: 30 ×: 44	+: 285 ×: 339	+: 328,350 ×: 333,399	+: 332,833,500 ×: 333,333,999
Solve $A\mathbf{x} = \mathbf{b}$ by Cramer's Rule	+: 180 ×: 264	+: 3135 ×: 3729	+: 33,163,350 ×: 33,673,399	+: $33,316,633 \times 10^4$ ×: $33,366,733 \times 10^4$

4.

	$n = 5$ Execution Time (sec)	$n = 10$ Execution Time (sec)	$n = 100$ Execution Time (sec)	$n = 1000$ Execution Time (sec)
Solve $A\mathbf{x} = \mathbf{b}$ by Gauss–Jordan elimination	1.55×10^{-4}	1.05×10^{-3}	.878	836
Solve $A\mathbf{x} = \mathbf{b}$ by Gaussian elimination	1.55×10^{-4}	1.05×10^{-3}	.878	836
Find A^{-1} by reducing $[A \mid I]$ to $[I \mid A^{-1}]$	2.84×10^{-4}	2.41×10^{-3}	2.49	2499
Solve $A\mathbf{x} = \mathbf{b}$ as $\mathbf{x} = A^{-1}\mathbf{b}$	3.50×10^{-4}	2.65×10^{-3}	2.52	2502
Find $\det(A)$ by row reduction	1.03×10^{-4}	8.21×10^{-4}	.831	833
Solve $A\mathbf{x} = \mathbf{b}$ by Cramer's Rule	6.18×10^{-4}	90.3×10^{-4}	83.9	834×10^3

Exercise Set 9.9 (page 517)

1. $x_1 = 2,\ x_2 = 1$ **3.** $x_1 = 3,\ x_2 = -1$ **5.** $x_1 = -1,\ x_2 = 1,\ x_3 = 0$

7. $x_1 = -1,\ x_2 = 1,\ x_3 = 0$ **9.** $x_1 = -3,\ x_2 = 1,\ x_3 = 2,\ x_4 = 1$

11. (a) $A = LU = \begin{bmatrix} 2 & 0 & 0 \\ -2 & 1 & 0 \\ 2 & 1 & 1 \end{bmatrix} \begin{bmatrix} 1 & \frac{1}{2} & -\frac{1}{2} \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix}$

(b) $A = L_1 DU = \begin{bmatrix} 1 & 0 & 0 \\ -1 & 1 & 0 \\ 1 & 1 & 1 \end{bmatrix} \begin{bmatrix} 2 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & \frac{1}{2} & -\frac{1}{2} \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix}$

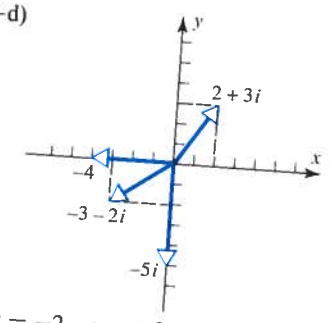
(c) $A = L_2 U_2 = \begin{bmatrix} 1 & 0 & 0 \\ -1 & 1 & 0 \\ 1 & 1 & 1 \end{bmatrix} \begin{bmatrix} 2 & 1 & -1 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix}$

13. (b) $\begin{bmatrix} a & b \\ c & d \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ \frac{c}{a} & 1 \end{bmatrix} \begin{bmatrix} a & b \\ 0 & \frac{ad - bc}{a} \end{bmatrix}$

18. $A = PLU = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} 3 & 0 & 0 \\ 0 & 2 & 0 \\ 3 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & -\frac{1}{3} & 0 \\ 0 & 1 & \frac{1}{2} \\ 0 & 0 & 1 \end{bmatrix}$

Exercise Set 10.1 (page 526)

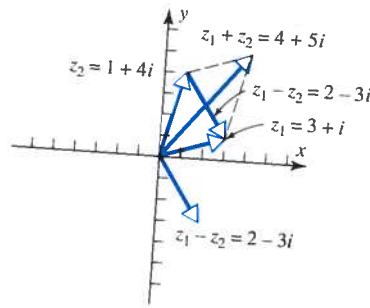
1. (a–d)



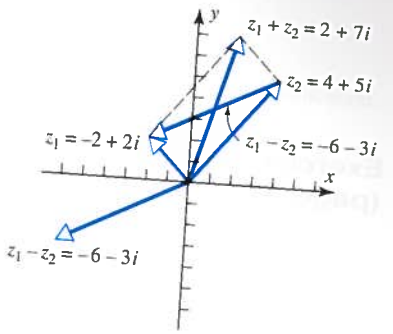
3. (a) $x = -2,\ y = -3$ (b) $x = 2,\ y = 1$

5. (a) $2 + 3i$ (b) $-1 - 2i$ (c) $-2 + 9i$

6.



(a)



(b)

9. (a) $z_1 z_2 = 3 + 3i,\ z_1^2 = -9,\ z_2^2 = -2i$

(b) $z_1 z_2 = 26,\ z_1^2 = -20 + 48i,\ z_2^2 = -5 - 12i$

(c) $z_1 z_2 = \frac{11}{3} - i,\ z_1^2 = \frac{4}{9}(-3 + 4i),\ z_2^2 = -6 - \frac{5}{2}i$

11. $76 - 88i$ **12.** $26 - 18i$ **16.** $(2 + \sqrt{2}) + i(1 - \sqrt{2})$ **18.** $-24i$

20. (a) $\begin{bmatrix} 13 + 13i & -8 + 12i & -33 - 22i \\ 1 + i & 0 & i \\ 7 + 9i & -6 + 6i & -16 - 16i \end{bmatrix}$ (b) $\begin{bmatrix} 6 + 2i & -11 + 19i \\ -1 + 6i & -9 - 5i \end{bmatrix}$

(c) $\begin{bmatrix} 6i & 1 + i \\ -6 - i & 5 - 9i \end{bmatrix}$ (d) $\begin{bmatrix} 22 - 7i & 2 + 10i \\ -5 - 4i & 6 - 8i \\ 9 - i & -1 - i \end{bmatrix}$

22. (a) $z = -1 \pm i$ (b) $z = \frac{1}{2} \pm \frac{\sqrt{3}}{2}i$

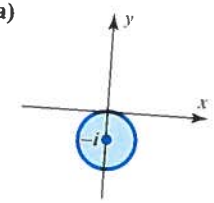
Exercise Set 10.2 (page 531)

1. (a) $2 - 7i$ (b) $-3 + 5i$ (c) $-5i$ (d) i (e) -9 (f) 0

5. (a) $-i$ (b) $\frac{1}{26} + \frac{5}{26}i$ (c) $7i$ **7.** $\frac{1}{2} + \frac{1}{2}i$ **9.** $-\frac{7}{625} - \frac{24}{625}i$

11. $\frac{1-\sqrt{3}}{4} + \frac{1+\sqrt{3}}{4}i$ **15.** (a) $-1 - 2i$ (b) $-\frac{3}{25} - \frac{4}{25}i$

18. (a)



(b)