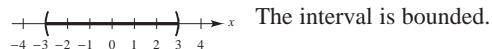
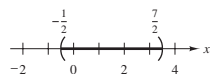
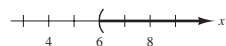
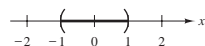
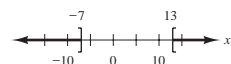
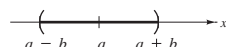
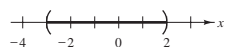
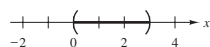
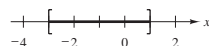
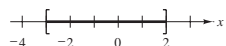


## APPENDIX D

## Section D.1 (page D8)

1. Rational 3. Irrational 5. Rational 7. Rational

9. Rational 11.  $\frac{4}{11}$  13.  $\frac{11}{37}$ 15. (a) True (b) False (c) True (d) False  
(e) False (f) False17.  $x$  is greater than  $-3$  and less than  $3$ .19.  $x$  is no more than  $5$ .21.  $y \geq 4, [4, \infty)$  23.  $0.03 < r \leq 0.07, (0.03, 0.07]$ 25.  $x \geq \frac{1}{2}$ 27.  $-\frac{1}{2} < x < \frac{7}{2}$ 29.  $x > 6$ 31.  $-1 < x < 1$ 33.  $x \geq 13, x \leq -7$ 35.  $a - b < x < a + b$ 37.  $-3 < x < 2$ 39.  $0 < x < 3$ 41.  $-3 \leq x \leq 1$ 43.  $-3 \leq x \leq 2$ 45.  $4, -4, 4$  47. (a)  $-51, 51, 51$  (b)  $51, -51, 51$ 49. 1 51. (a) 14 (b) 10 53.  $|x| \leq 2$ 55.  $|x - 2| > 2$  57. (a)  $|x - 12| \leq 10$  (b)  $|x - 12| \geq 10$ 59.  $x \geq 36$  units 61.  $x \leq 41$  or  $x \geq 59$ 63. (a)  $\frac{355}{112} > \pi$  (b)  $\frac{22}{7} > \pi$  65. b67. False: the reciprocal of 2 is  $\frac{1}{2}$ , which is not an integer.68. True 69. True 70. False:  $|0| = 0$ . 71. True

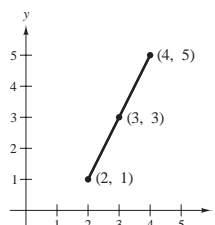
72. True 73. Proof 75. Proof 77. Proof

79. Proof

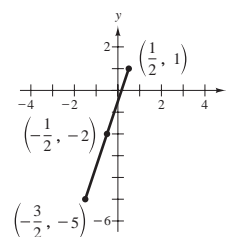
81.  $|-3 - 1| > |-3| - |1|$   
 $|3 - 1| = |3| - |1|$ 

## Section D.2 (page D15)

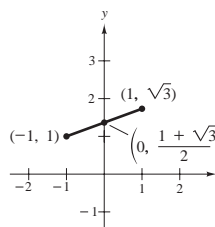
1.  $d = 2\sqrt{5}$



3.  $d = 2\sqrt{10}$



5.  $8\sqrt{8 - 2\sqrt{3}}$

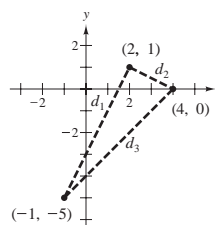
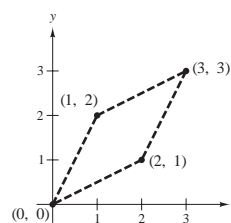


7. Right triangle:

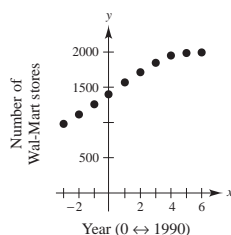
$d_1 = \sqrt{45}, d_2 = \sqrt{5}$

$d_3 = \sqrt{50}$

$(d_1)^2 + (d_2)^2 = (d_3)^2$

9. Rhombus: the length of each side is  $\sqrt{5}$ .

11. Quadrant II 13. Quadrants I and III

15.  $x = 0 \Leftrightarrow 1990$ 

17.  $d_1 = 2\sqrt{5}, d_2 = \sqrt{5}, d_3 = 3\sqrt{5}$

Collinear, because  $d_1 + d_2 = d_3$

19.  $d_1 = \sqrt{2}, d_2 = \sqrt{13}, d_3 = 5$

Not collinear, because  $d_1 + d_2 > d_3$

21.  $x = \pm 3$       23.  $y = \pm \sqrt{55}$

25.  $\left(\frac{3x_1 + x_2}{4}, \frac{3y_1 + y_2}{4}\right) \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$   
 $\left(\frac{x_1 + 3x_2}{4}, \frac{y_1 + 3y_2}{4}\right)$

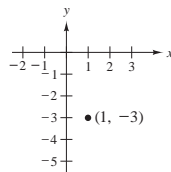
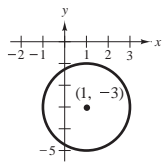
27. c      28. b      29. a      30. d      31.  $x^2 + y^2 - 9 = 0$

33.  $x^2 + y^2 - 4x + 2y - 11 = 0$

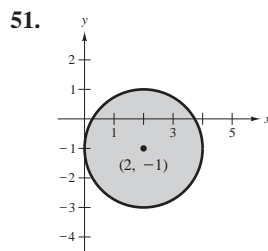
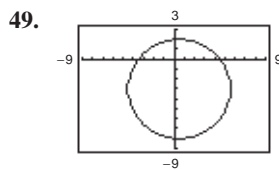
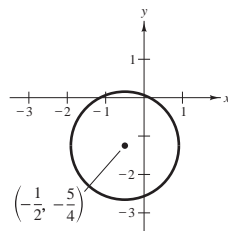
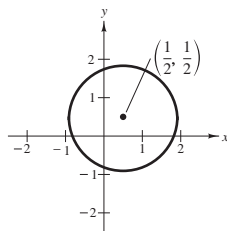
35.  $x^2 + y^2 + 2x - 4y = 0$

37.  $x^2 + y^2 - 6x - 4y + 3 = 0$       39.  $x^2 + y^2 = 26,000^2$

41.  $(x - 1)^2 + (y + 3)^2 = 4$       43.  $(x - 1)^2 + (y + 3)^2 = 0$



45.  $(x - \frac{1}{2})^2 + (y - \frac{1}{2})^2 = 2$       47.  $(x + \frac{1}{2})^2 + (y + \frac{5}{4})^2 = \frac{9}{4}$



53. Proof      55. True      56. False: the distance is  $|2b|$ .

57. True      58. True      59. Proof      61. Proof

### Section D.3 (page D25)

1. (a)  $396^\circ, -324^\circ$       (b)  $240^\circ, -480^\circ$

3. (a)  $\frac{19\pi}{9}, -\frac{17\pi}{9}$       (b)  $\frac{10\pi}{3}, -\frac{2\pi}{3}$

5. (a)  $\frac{\pi}{6}, 0.524$       (b)  $\frac{5\pi}{6}, 2.618$

(c)  $\frac{7\pi}{4}, 5.498$       (d)  $\frac{2\pi}{3}, 2.094$

7. (a)  $270^\circ$       (b)  $210^\circ$       (c)  $-105^\circ$       (d)  $-135.6^\circ$

<b>r</b>	8 ft	15 in.	85 cm	24 in.	$\frac{12,963}{\pi}$ mi
<b>s</b>	12 ft	24 in.	$63.75\pi$ cm	96 in.	8642 mi
<b><math>\theta</math></b>	1.5	1.6	$\frac{3\pi}{4}$	4	$\frac{2\pi}{3}$

11. (a)  $\sin \theta = \frac{4}{5}$        $\csc \theta = \frac{5}{4}$       (b)  $\sin \theta = -\frac{5}{13}$        $\csc \theta = -\frac{13}{5}$   
 $\cos \theta = \frac{3}{5}$        $\sec \theta = \frac{5}{3}$        $\cos \theta = -\frac{12}{13}$        $\sec \theta = -\frac{13}{12}$   
 $\tan \theta = \frac{4}{3}$        $\cot \theta = \frac{3}{4}$        $\tan \theta = \frac{5}{12}$        $\cot \theta = \frac{12}{5}$

13. (a) Quadrant III      (b) Quadrant IV

15.  $\frac{\sqrt{3}}{2}$       17.  $\frac{4}{3}$

19. (a)  $\sin 60^\circ = \frac{\sqrt{3}}{2}$       (b)  $\sin 120^\circ = \frac{\sqrt{3}}{2}$

$\cos 60^\circ = \frac{1}{2}$        $\cos 120^\circ = -\frac{1}{2}$

$\tan 60^\circ = \sqrt{3}$        $\tan 120^\circ = -\sqrt{3}$

(c)  $\sin \frac{\pi}{4} = \frac{\sqrt{2}}{2}$       (d)  $\sin \frac{5\pi}{4} = -\frac{\sqrt{2}}{2}$

$\cos \frac{\pi}{4} = \frac{\sqrt{2}}{2}$        $\cos \frac{5\pi}{4} = -\frac{\sqrt{2}}{2}$

$\tan \frac{\pi}{4} = 1$        $\tan \frac{5\pi}{4} = 1$

21. (a)  $\sin 225^\circ = -\frac{\sqrt{2}}{2}$       (b)  $\sin(-225^\circ) = \frac{\sqrt{2}}{2}$

$\cos 225^\circ = -\frac{\sqrt{2}}{2}$        $\cos(-225^\circ) = -\frac{\sqrt{2}}{2}$

$\tan 225^\circ = 1$        $\tan(-225^\circ) = -1$

(c)  $\sin \frac{5\pi}{3} = -\frac{\sqrt{3}}{2}$       (d)  $\sin \frac{11\pi}{6} = -\frac{1}{2}$

$\cos \frac{5\pi}{3} = \frac{1}{2}$        $\cos \frac{11\pi}{6} = \frac{\sqrt{3}}{2}$

$\tan \frac{5\pi}{3} = -\sqrt{3}$        $\tan \frac{11\pi}{6} = -\frac{\sqrt{3}}{3}$

23. (a) 0.1736      (b) 5.759      25. (a) 0.3640      (b) 0.3640

27. (a)  $\theta = \frac{\pi}{4}, \frac{7\pi}{4}$       (b)  $\theta = \frac{3\pi}{4}, \frac{5\pi}{4}$

29. (a)  $\theta = \frac{\pi}{4}, \frac{5\pi}{4}$       (b)  $\theta = \frac{5\pi}{6}, \frac{11\pi}{6}$

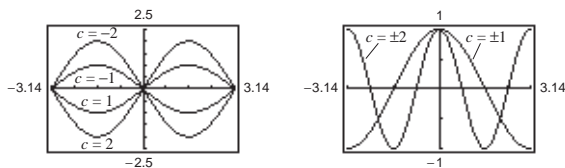
31.  $\theta = \frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{7\pi}{4}$       33.  $\theta = 0, \frac{\pi}{4}, \pi, \frac{5\pi}{4}$

35.  $\theta = \frac{\pi}{3}, \frac{5\pi}{3}$       37.  $\theta = 0, \frac{\pi}{2}, \pi$       39. 5099 feet

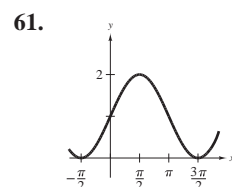
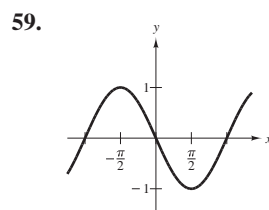
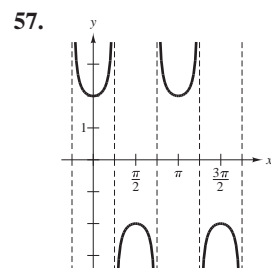
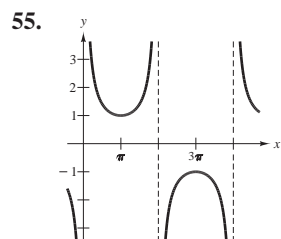
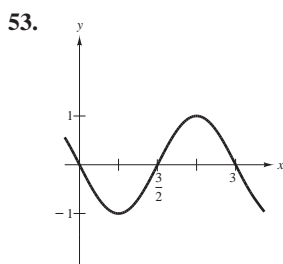
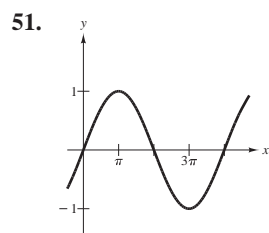
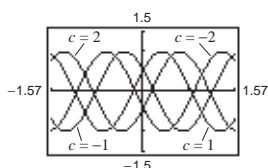
41. (a) Period:  $\pi$  (b) Period: 2      43. Period:  $\frac{1}{2}$   
 Amplitude: 2      Amplitude:  $\frac{1}{2}$       Amplitude: 3

45. Period:  $\frac{\pi}{2}$       47. Period:  $\frac{2\pi}{5}$

49. (a) Change in amplitude      (b) Change in period

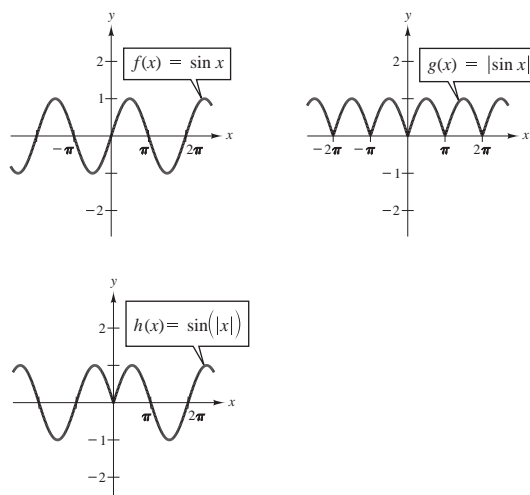


- (c) Horizontal translation

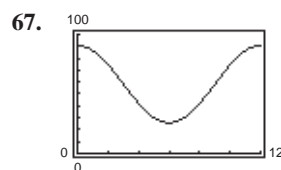


63.  $a = 3, b = \frac{1}{2}, c = \frac{\pi}{2}$

- 65.

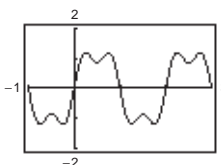


The graph of  $|f(x)|$  will reflect any parts of the graph of  $f(x)$  below the  $x$ -axis about the  $x$ -axis. The graph of  $f(|x|)$  will reflect the part of the graph of  $f(x)$  left of the  $y$ -axis about the  $y$ -axis.



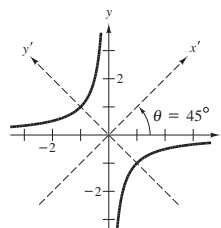
January, November, December

69.  $f(x) = \frac{4}{\pi} \left( \sin \pi x + \frac{1}{3} \sin 3\pi x + \frac{1}{5} \sin 5\pi x + \cdots \right)$

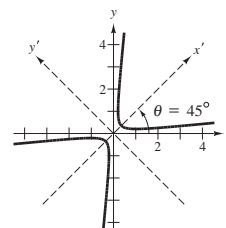


## APPENDIX E (page E6)

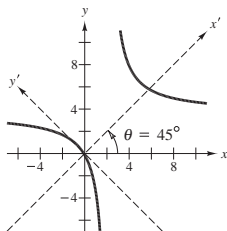
1.  $\frac{(y')^2}{2} - \frac{(x')^2}{2} = 1$



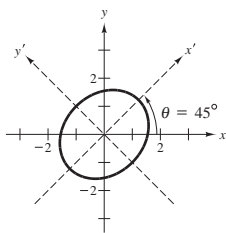
3.  $\frac{(x')^2}{1/4} - \frac{(y')^2}{1/6} = 1$



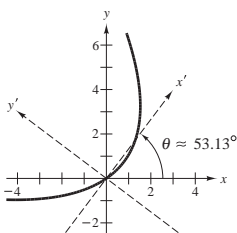
5.  $\frac{(x' - 3\sqrt{2})^2}{16} - \frac{(y' - \sqrt{2})^2}{16} = 1$



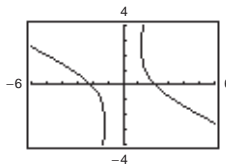
7.  $\frac{(x')^2}{3} + \frac{(y')^2}{2} = 1$



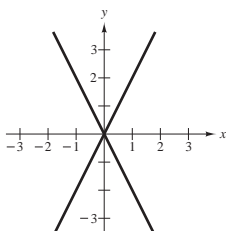
11.  $y' = \frac{(x')^2}{6} - \frac{x'}{3}$



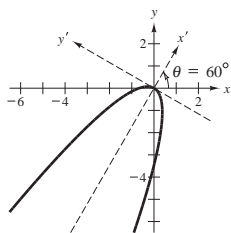
15.  $\theta \approx 26.57^\circ$



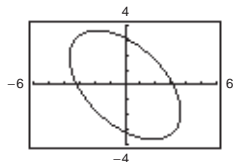
19. Parabola      21. Ellipse



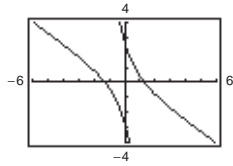
9.  $x' = -(y')^2$



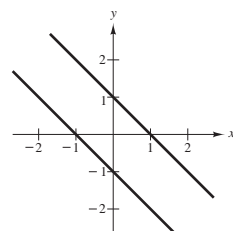
13.  $\theta = 45^\circ$



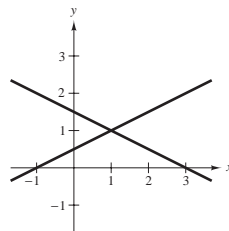
17.  $\theta \approx 31.72^\circ$



23. Hyperbola      25. Parabola  
27. Two lines      29. Two parallel lines



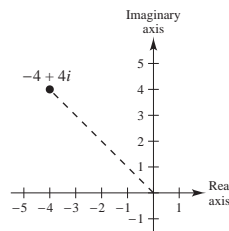
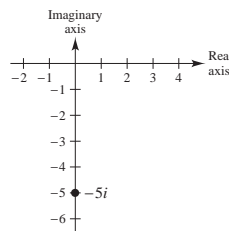
31. Two lines



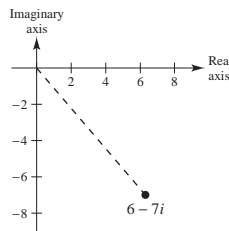
33. Proof

## APPENDIX F (page F10)

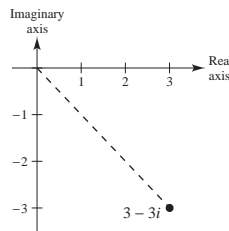
1.  $11 - i$       3.  $4$       5.  $3 - 3\sqrt{2}i$       7.  $-14 + 20i$   
 9.  $\frac{1}{6} + \frac{7}{6}i$       11.  $-2\sqrt{3}$       13.  $-10$       15.  $5 + i$   
 17.  $12 + 30i$       19.  $24$       21.  $-9 + 40i$       23.  $-10$   
 25.  $34$       27.  $9$       29.  $400$       31.  $8$       33.  $-6i$   
 35.  $\frac{16}{41} + \frac{20}{41}i$       37.  $\frac{3}{5} + \frac{4}{5}i$       39.  $-7 - 6i$   
 41.  $-\frac{9}{1681} + \frac{40}{1681}i$       43.  $-\frac{1}{2} - \frac{5}{2}i$       45.  $\frac{62}{949} + \frac{297}{949}i$   
 47.  $1 \pm i$       49.  $-2 \pm \frac{1}{2}i$       51.  $-\frac{5}{2}, -\frac{3}{2}$       53.  $\frac{1}{8} \pm \frac{\sqrt{11}}{8}i$   
 55.  $-1 + 6i$       57.  $-5i$       59.  $-375\sqrt{3}i$       61.  $i$   
 63.  $5$       65.  $4\sqrt{2}$



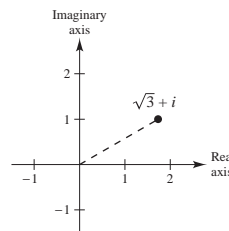
67.  $\sqrt{85}$



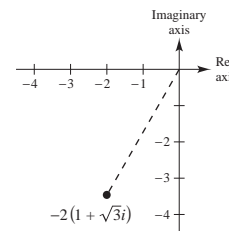
69.  $3\sqrt{2} \left( \cos \frac{7\pi}{4} + i \sin \frac{7\pi}{4} \right)$



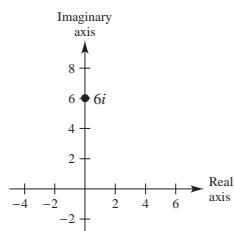
71.  $2 \left( \cos \frac{\pi}{6} + i \sin \frac{\pi}{6} \right)$



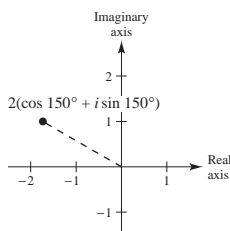
73.  $4 \left( \cos \frac{4\pi}{3} + i \sin \frac{4\pi}{3} \right)$



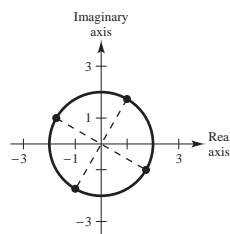
75.  $6\left(\cos \frac{\pi}{2} + i \sin \frac{\pi}{2}\right)$



77.  $-\sqrt{3} + i$

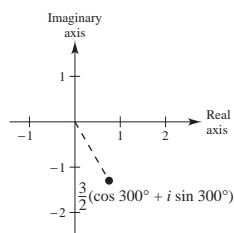


(b)

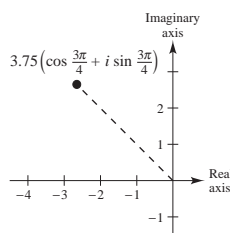


(c)  $1 + \sqrt{3}i, -\sqrt{3} + i, -1 - \sqrt{3}i, \sqrt{3} - i$

79.  $\frac{3}{4} - \frac{3\sqrt{3}}{4}i$



81.  $\frac{-15\sqrt{2}}{8} + \frac{15\sqrt{2}}{8}i$



83.  $12\left(\cos \frac{\pi}{2} + i \sin \frac{\pi}{2}\right)$

85.  $\frac{10}{9}(\cos 200^\circ + i \sin 200^\circ)$

87.  $-4 - 4i$

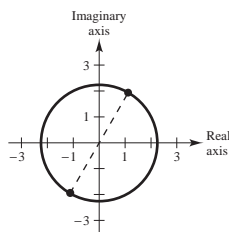
89.  $-32i$

91.  $-128\sqrt{3} - 128i$

93.  $i$

95. (a)  $\sqrt{5}(\cos 60^\circ + i \sin 60^\circ)$   
 $\sqrt{5}(\cos 240^\circ + i \sin 240^\circ)$

(b)



(c)  $\frac{\sqrt{5}}{2} + \frac{\sqrt{15}}{2}i, -\frac{\sqrt{5}}{2} - \frac{\sqrt{15}}{2}i$

97. (a)  $2\left(\cos \frac{\pi}{3} + i \sin \frac{\pi}{3}\right)$

$2\left(\cos \frac{5\pi}{6} + i \sin \frac{5\pi}{6}\right)$

$2\left(\cos \frac{4\pi}{3} + i \sin \frac{4\pi}{3}\right)$

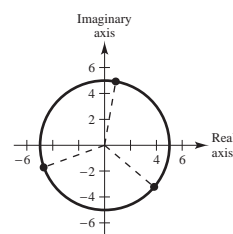
$2\left(\cos \frac{11\pi}{6} + i \sin \frac{11\pi}{6}\right)$

99. (a)  $5\left(\cos \frac{4\pi}{9} + i \sin \frac{4\pi}{9}\right)$

$5\left(\cos \frac{10\pi}{9} + i \sin \frac{10\pi}{9}\right)$

$5\left(\cos \frac{16\pi}{9} + i \sin \frac{16\pi}{9}\right)$

(b)

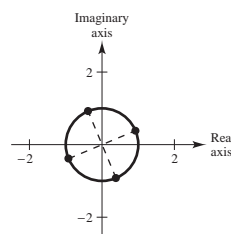


101.  $\cos \frac{\pi}{8} + i \sin \frac{\pi}{8}$

$\cos \frac{5\pi}{8} + i \sin \frac{5\pi}{8}$

$\cos \frac{9\pi}{8} + i \sin \frac{9\pi}{8}$

$\cos \frac{13\pi}{8} + i \sin \frac{13\pi}{8}$



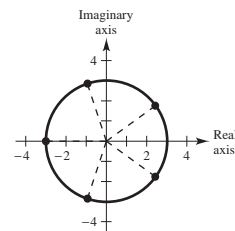
103.  $3\left(\cos \frac{\pi}{5} + i \sin \frac{\pi}{5}\right)$

$3\left(\cos \frac{3\pi}{5} + i \sin \frac{3\pi}{5}\right)$

$3(\cos \pi + i \sin \pi)$

$3\left(\cos \frac{7\pi}{5} + i \sin \frac{7\pi}{5}\right)$

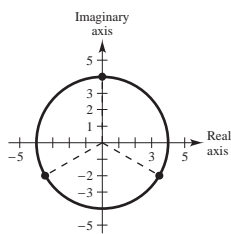
$3\left(\cos \frac{9\pi}{5} + i \sin \frac{9\pi}{5}\right)$



105.  $4\left(\cos \frac{\pi}{2} + i \sin \frac{\pi}{2}\right)$

$4\left(\cos \frac{7\pi}{6} + i \sin \frac{7\pi}{6}\right)$

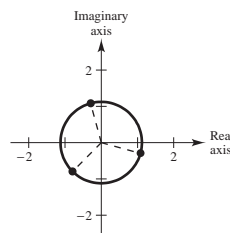
$4\left(\cos \frac{11\pi}{6} + i \sin \frac{11\pi}{6}\right)$



107.  $\sqrt[9]{2}(\cos 105^\circ + i \sin 105^\circ)$

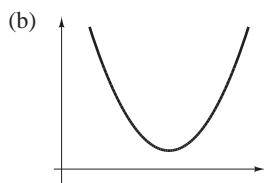
$\sqrt[9]{2}(\cos 225^\circ + i \sin 225^\circ)$

$\sqrt[9]{2}(\cos 345^\circ + i \sin 345^\circ)$



## APPENDIX G (page G5)

1. (a) Fixed cost



(c) Yes, it occurs when production costs are increasing at their slowest rate.

3. 4500      5. 300      7. 200      9. 200

11.  $x = 30$       13.  $x = 1500$       15.  $x = 3$       17. Proof

$p = 60$        $p = 35$

19. (a)

Order

size, $x$	Price	Profit, $P$
102	$90 - 2(0.15)$	$102[90 - 2(0.15)] - 102(60) = 3029.40$
104	$90 - 4(0.15)$	$104[90 - 4(0.15)] - 104(60) = 3057.60$
106	$90 - 6(0.15)$	$106[90 - 6(0.15)] - 106(60) = 3084.60$
108	$90 - 8(0.15)$	$108[90 - 8(0.15)] - 108(60) = 3110.40$
110	$90 - 10(0.15)$	$110[90 - 10(0.15)] - 110(60) = 3135.00$
112	$90 - 12(0.15)$	$112[90 - 12(0.15)] - 112(60) = 3158.40$

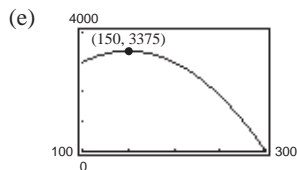
(b)

Order

size, $x$	Price	Profit, $P$
146	$90 - 46(0.15)$	$146[90 - 46(0.15)] - 146(60) = 3372.60$
148	$90 - 48(0.15)$	$148[90 - 48(0.15)] - 148(60) = 3374.40$
150	$90 - 50(0.15)$	$150[90 - 50(0.15)] - 150(60) = 3375.00$
152	$90 - 52(0.15)$	$152[90 - 52(0.15)] - 152(60) = 3374.40$
154	$90 - 54(0.15)$	$154[90 - 54(0.15)] - 154(60) = 3372.60$
...	...	...

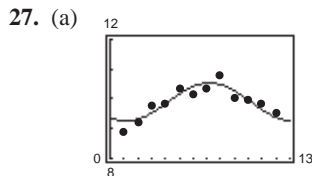
(c)  $P = x[90 - (x - 100)(0.15)] - x(60) = x(45 - 0.15)x$ ,  
 $x \geq 100$

(d) 150 units



21. Line should run from the power station to a point across the river  $3/(2\sqrt{7})$  mile downstream.

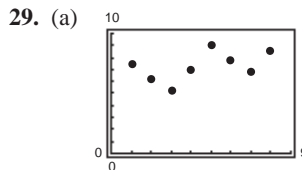
23.  $x \approx 40$  units      25. \$30,000



(b) Maximum sales  $x = 7.18$  (July)

(c) The cosine factor; 9.90

(d)  $0.02t$  would mean a steady growth of consumption over time. In this case, the maximum consumption in 2000 (that is, on  $73 \leq t \leq 84$ ) would be 12.1 billion gallons.



(b)  $y = 6.2 + 0.25x + 1.5 \sin\left(\frac{\pi}{2}x\right)$

31.  $\eta = -\frac{17}{3}$ , elastic      33.  $\eta = -\frac{1}{2}$ , inelastic