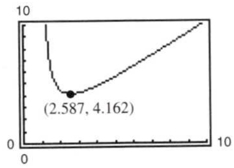
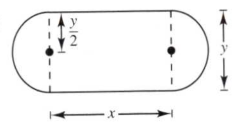
3. $S/2$ and $S/2$ **5.** 21 and 7 **7.** 54 and 27
9. $l = w = 20$ m **11.** $l = w = 4\sqrt{2}$ ft **13.** $(1, 1)$
15. $\left(\frac{7}{2}, \sqrt{\frac{7}{2}}\right)$
17. Dimensions of page: $(2 + \sqrt{30})$ in. $\times$ $(2 + \sqrt{30})$ in.
19. $x = Q_0/2$ **21.** 700×350 m
23. (a) Proof (b) $V_1 = 99$ in.^{3}, $V_2 = 125$ in.^{3}, $V_3 = 117$ in.^{3}
(c) $5 \times 5 \times 5$ in.
25. Rectangular portion: $16/(\pi + 4) \times 32/(\pi + 4)$ ft
27. (a) $L = \sqrt{x^2 + 4 + \dfrac{8}{x - 1} + \dfrac{4}{(x - 1)^2}}, \quad x > 1$
(b)



Minimum when $x \approx 2.587$

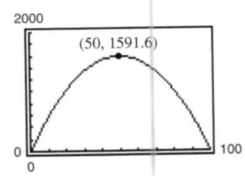
(c) $(0, 0), (2, 0), (0, 4)$
29. Width: $5\sqrt{2}/2$; Length: $5\sqrt{2}$
31. (a)



(b)

Length x	Width y	Area xy
10	$2/\pi(100 - 10)$	$(10)(2/\pi)(100 - 10) \approx 573$
20	$2/\pi(100 - 20)$	$(20)(2/\pi)(100 - 20) \approx 1019$
30	$2/\pi(100 - 30)$	$(30)(2/\pi)(100 - 30) \approx 1337$
40	$2/\pi(100 - 40)$	$(40)(2/\pi)(100 - 40) \approx 1528$
50	$2/\pi(100 - 50)$	$(50)(2/\pi)(100 - 50) \approx 1592$
60	$2/\pi(100 - 60)$	$(60)(2/\pi)(100 - 60) \approx 1528$

The maximum area of the rectangle is approximately 1592 m^2.
(c) $A = 2/\pi(100x - x^2), \quad 0 < x < 100$
(d) $\dfrac{dA}{dx} = \dfrac{2}{\pi}(100 - 2x)$
$= 0$ when $x = 50$
The maximum value is approximately 1592 when $x = 50$.
(e)



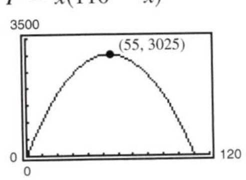
33. $18 \times 18 \times 36$ in. **35.** $32\pi r^3/81$
37. No. The volume changes because the shape of the container changes when squeezed.
39. $r = \sqrt[3]{21/(2\pi)} \approx 1.50$ ($h = 0$, so the solid is a sphere.)
41. Side of square: $\dfrac{10\sqrt{3}}{9 + 4\sqrt{3}}$; Side of triangle: $\dfrac{30}{9 + 4\sqrt{3}}$
43. $w = (20\sqrt{3})/3$ in., $h = (20\sqrt{6})/3$ in. **45.** $\theta = \pi/4$
47. $h = \sqrt{2}$ ft **49.** One mile from the nearest point on the coast
51. Proof

Section 3.7 (page 223)

1. (a) and (b)

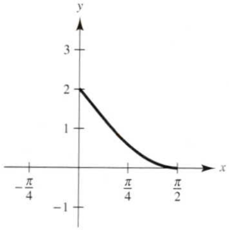
First Number x	Second Number	Product P
10	$110 - 10$	$10(110 - 10) = 1000$
20	$110 - 20$	$20(110 - 20) = 1800$
30	$110 - 30$	$30(110 - 30) = 2400$
40	$110 - 40$	$40(110 - 40) = 2800$
50	$110 - 50$	$50(110 - 50) = 3000$
60	$110 - 60$	$60(110 - 60) = 3000$
70	$110 - 70$	$70(110 - 70) = 2800$
80	$110 - 80$	$80(110 - 80) = 2400$
90	$110 - 90$	$90(110 - 90) = 1800$
100	$110 - 100$	$100(110 - 100) = 1000$

The maximum is attained near $x = 50$ and 60.
(c) $P = x(110 - x)$
(d)



(e) 55 and 55

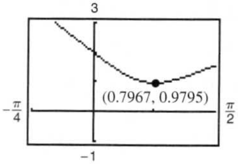
53.



(a) Origin to y-intercept: 2

Origin to x-intercept: $\pi/2$

(b) $d = \sqrt{x^2 + (2 - 2\sin x)^2}$



(c) Minimum distance is 0.9795 when $x \approx 0.7967$.

55. $F = kW/\sqrt{k^2 + 1}$; $\theta = \arctan k$

57. (a)

Base 1	Base 2	Altitude	Area
8	$8 + 16\cos 10°$	$8\sin 10°$	≈ 22.1
8	$8 + 16\cos 20°$	$8\sin 20°$	≈ 42.5
8	$8 + 16\cos 30°$	$8\sin 30°$	≈ 59.7
8	$8 + 16\cos 40°$	$8\sin 40°$	≈ 72.7
8	$8 + 16\cos 50°$	$8\sin 50°$	≈ 80.5
8	$8 + 16\cos 60°$	$8\sin 60°$	≈ 83.1

(b)

Base 1	Base 2	Altitude	Area
8	$8 + 16\cos 70°$	$8\sin 70°$	≈ 80.7
8	$8 + 16\cos 80°$	$8\sin 80°$	≈ 74.0
8	$8 + 16\cos 90°$	$8\sin 90°$	≈ 64.0

The maximum cross-sectional area is approximately 83.1 ft^2.

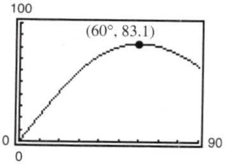
(c) $A = 64(1 + \cos\theta)\sin\theta,\ 0° < \theta < 90°$

(d) $\frac{dA}{d\theta} = 64(2\cos\theta - 1)(\cos\theta + 1)$

$= 0$ when $\theta = 60°, 180°, 300°$

The maximum area occurs when $\theta = 60°$.

(e)



59. 4045 units **61.** $y = \frac{64}{141}x$; $S_1 \approx 6.1$ mi

63. $y = \frac{3}{10}x$; $S_3 \approx 4.50$ mi **65.** Putnam Problem A1, 1986