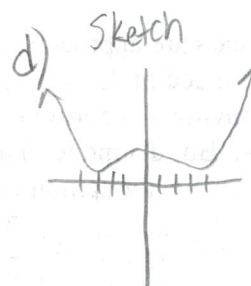


3.6 Practice Problems

1. Let $P=(x, y)$ be a point on the graph of $y=x^2-10$
- Express the distance from P to the origin as a function of x .
 - What is d if $x=0$?
 - What is d if $x=3$?
 - Use a graphing utility to graph $d=d(x)$
 - For what values of x is d the smallest?



a) $d = \sqrt{(x-0)^2 + (y-0)^2}$
 $= \sqrt{(x)^2 + (x^2-10)^2}$
 $= \sqrt{x^2 + x^4 - 20x + 100}$
 $= \sqrt{x^4 - 19x + 100}$

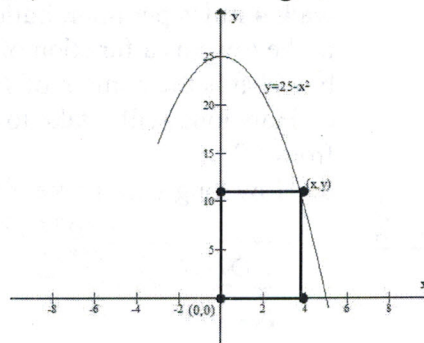
b) $d = \sqrt{0^2 - 19(0) + 100}$
 $= \sqrt{100}$
 $= 10$

c) $d = \sqrt{3^2 - 19(3) + 100}$
 $= \sqrt{9 - 57 + 100}$
 $= \sqrt{52} = \sqrt{4 \cdot 13} = 2\sqrt{13} \approx 7.2$

e) use min feature in calc
 $x \approx 3.08$
 $x \approx -3.08$

2. A rectangle has one corner in quadrant I on the graph of $y=25-x^2$, another at the origin, a third on the positive y-axis, and a fourth on the positive x-axis.

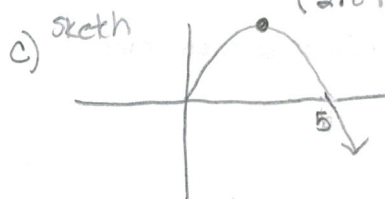
- Express the area of the rectangle as a function of x .
- What is the domain of A ?
- Graph $A=A(x)$. For what value of x is A largest?



a) $A = \ell w$
 $= x y$
 $= x(25 - x^2)$
 $= 25x - x^3$

d) for $x=2.89$
 the area is the largest

b) $(0, 5)$



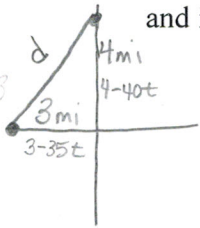
3. A wire of length x is bent into the shape of a square.
- Express the perimeter p of the square as a function of x .
 - Express the area A of the circle as a function of x

a) $P = x$

b) $A = \left(\frac{x}{4}\right)^2 = \frac{x^2}{16}$

4. Two cars are approaching an intersection. One is 3 miles west of the intersection and is moving at a constant speed of 35 miles per hour. At the same time, the other car is 4 miles north of the intersection and is moving at a constant speed of 40 miles per hour.

- a. Build a model that expresses the distance d between the cars as a function of time.
 b. Use a graphing utility to graph $d = d(t)$. for what value of t is d the smallest.



	distance	Rate	Time
a) Car West	$3-35t$	35mph	t
Car North	$4-40t$	40mph	t

$$d = \sqrt{2825x^2 - 530x + 25}$$

b) $t = .09$ hours

using pythagorean theorem

$$d^2 = (4-40t)^2 + (3-35t)^2$$

$$d = \sqrt{(4-40t)^2 + (3-35t)^2}$$

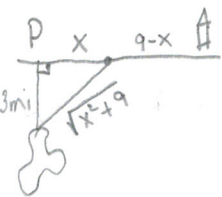
5. An island is 3 miles from the nearest point P on a straight shoreline. A town is 9 miles down the shore from P .

a. If a person can row a boat at an average speed of 2 miles per hour and the same person can walk 4 miles per hour, build a model that expresses the time T that it takes to go from the island to the town as a function of the distance x from P to where the person lands the boat.

b. What is the domain of T ?

c. How long will it take to travel from the island to town if the person lands the boat 2 miles from P ?

d. How long will it take if the person lands the boat 6 miles from P ?



	distance	Rate	Time
Rowing	$\sqrt{x^2+9}$	2	$\frac{\sqrt{x^2+9}}{2}$
Walking	$9-x$	4	$\frac{9-x}{4}$

a) $T(x) = \frac{\sqrt{x^2+9}}{2} + \frac{9-x}{4}$

b) $[0, 9]$

c) $x=2$

$$T(2) = \frac{\sqrt{2^2+9}}{2} + \frac{9-2}{4}$$

$$= \frac{\sqrt{13}}{2} + \frac{7}{4} \approx 1.8 + 1.75 \approx 3.6 \text{ hours}$$

d) $T(6) = \frac{\sqrt{6^2+9}}{2} + \frac{9-6}{4}$
 $= \frac{\sqrt{45}}{2} + \frac{3}{4}$
 $\approx 3.35 + .75$
 ≈ 4.1

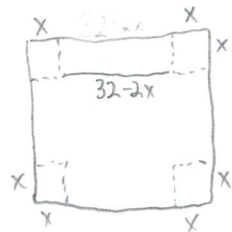
6. An open box with a square base is to be made from a piece of cardboard 32 inches on a side by cutting out a square from each corner and turning up the sides.

a. Express the volume V of a box as a function of the length x of the side of the square cut from each corner.

b. What is the volume if a 2-inch square is cut out?

c. What is the volume if a 8-inch square is cut out?

d. Graph $V = V(x)$. For what value of x is V the largest?



a) $V = lwh$
 $= (32-2x)(32-2x)(x)$
 $= 4x^3 - 128x^2 + 1024x$

c) $V(8) = 4(8)^3 - 128(8)^2 + 1024(8)$
 $= 4(512) - 128(64) + 8192$
 $= 2048 - 8192 + 8192$
 $= 2048$

d) $x \approx 5.33$

b) $V = 4(2)^3 - 128(2)^2 + 1024(2)$
 $= 4(8) - 128(4) + 2048$
 $= 32 - 512 + 2048$
 $= 1568 \text{ in}^3$