P is a point on the graph of ~~$y = x^2$~~ $y = x^2 - 1$

a) Find the distance from the origin to the point $x = 0$ on the graph.

b) Find the distance from the origin to the point $x = 1$ on the graph.

c) Find the distance from the origin to the point ~~$x = \frac{1}{2}$~~ on the graph. $x = \frac{\sqrt{2}}{2}$

d) Express the distance, d, from P to the origin as a function of x.

e) Use a graphing utility to graph the function $d = d(x)$, $x \geq 0$. Find the values at which d has a local minimum and/or maximum.

a) $f(0) = -1$

$d = \sqrt{(0-0)^2 + (0+1)^2}$

$\boxed{d = 1}$

b) $f(1) = 0$

$d = \sqrt{(0-1)^2 + (0-0)^2}$

$\boxed{d = 1}$

c) $f\left(\frac{\sqrt{2}}{2}\right) = \frac{2}{4} - \frac{4}{4}$

$= -\frac{1}{2}$

$d = \sqrt{\left(\frac{\sqrt{2}}{2}\right)^2 + \left(-\frac{1}{2}\right)^2}$

$= \sqrt{\frac{2}{4} + \frac{1}{4}}$

$= \sqrt{\frac{3}{4}}$

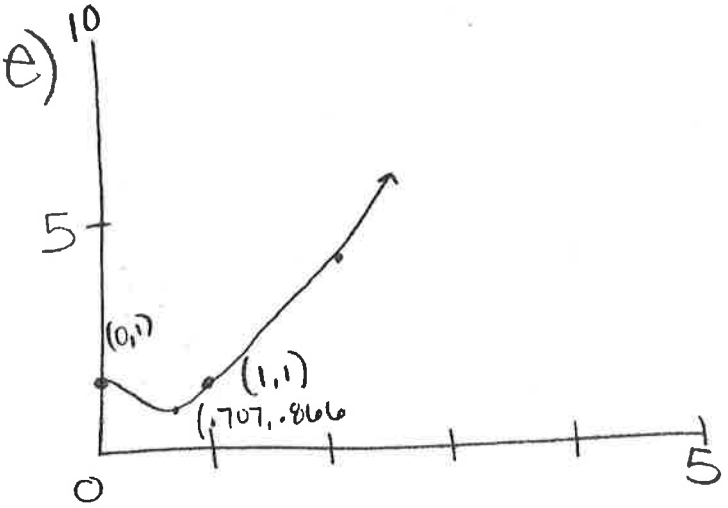
$\boxed{d = \frac{\sqrt{3}}{2}}$

d) $d = \sqrt{x^2 + y^2}$

$d(x) = \sqrt{x^2 + (x^2-1)^2}$

$\boxed{d(x) = \sqrt{x^4 - x^2 + 1}}$

e)



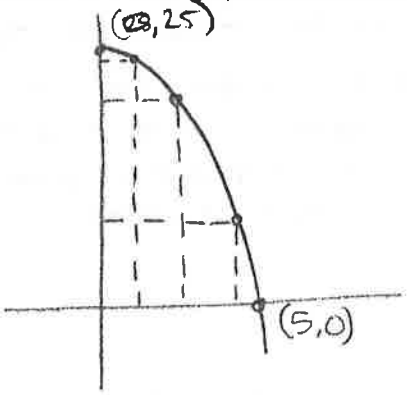
The minimum distance is 0.866 at $x = 0.707$.

$y = 25 - x^2$

A rectangle has one corner in QI 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.

A) Sketch a basic picture of this information
B) Express the area, A, of the rectangle as a function of x.
C) What is the domain of A
D) Graph A=A(x).
E) For what value of x is the area the largest?

A)



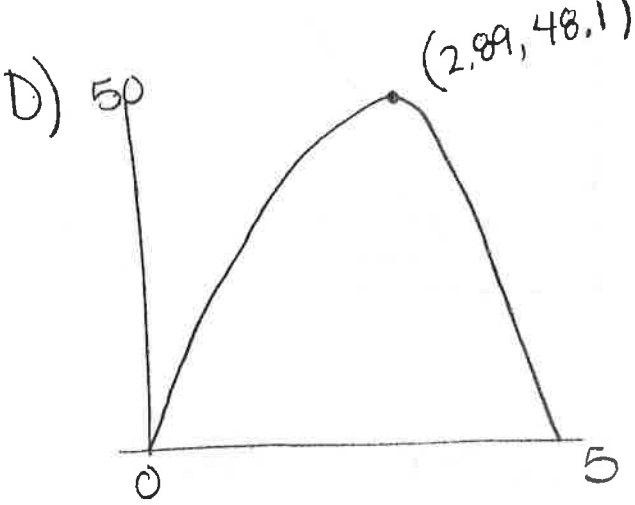
B) $A = x \cdot y$

$A(x) = x\ (25 - x^2)$

$A(x) = 25x - x^3$

C) $D: \{0 < x < 5\}$

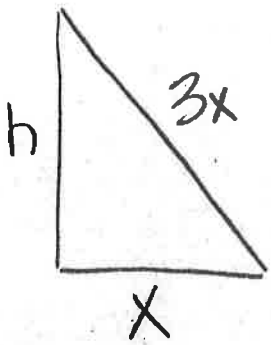
D)



E) The largest area is 48.1 when $x = 2.89$.

The hypotenuse of a right triangle is three times the length of its shorter leg.

(a) Find a function that models the area of the right triangle in terms of the length of the shorter leg.
(b) What is the domain of the A(x) function.
(c) If the shorter leg is 5 centimeters long, what is the area of the triangle?
(d) If the shorter leg is 8 centimeters long, what is the area of the triangle?
(e) Graph A = A(x) function. Find any local minima/maxima.



$x^2 + h^2 = (3x)^2$

$h^2 = 8x^2$

$\boxed{h = 2x\sqrt{2}}$

$A = \frac{1}{2} \cdot x \cdot h$

$A(x) = \frac{1}{2} \cdot x \cdot 2x\sqrt{2}$

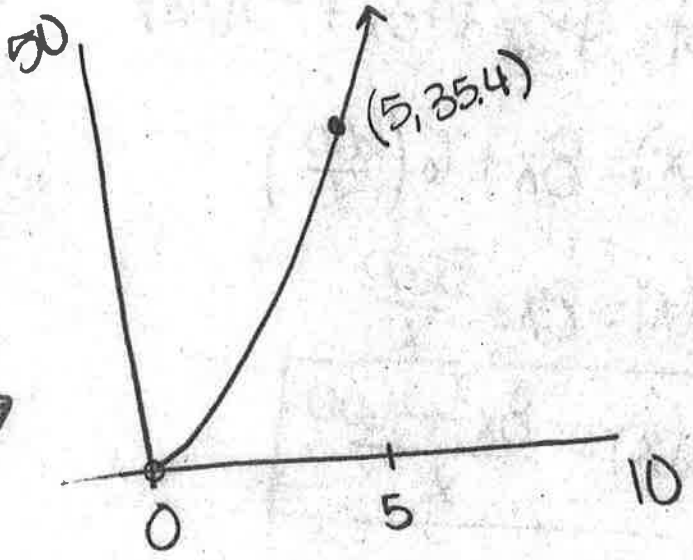
a) $\boxed{A(x) = x^2 \cdot \sqrt{2}}$

b) D: $\{x \mid x > 0\}$

c) $A(5) = 25\sqrt{2} \approx 35.4$

d) $A(8) = 64\sqrt{2} \approx 90.5$

e)



There are no local minima or maxima

Farmer Varner needs to build a rectangular pen next to his driveway. Its area must be 600 square meters. The fence for the driveway side of the pen costs $5 per meter, and the fence for the other three sides costs only $3 per meter.

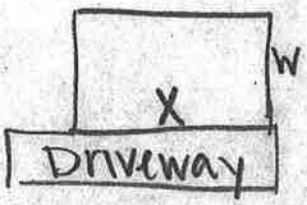
(a) Find a function that models the cost of the fence in terms of the length of the driveway side.

(b) What is the domain of this cost function?

(c) How much will the pen cost if the driveway side is 30 meters long?

(d) How much will the pen cost if the driveway side is 40 meters long?

(e) Graph C = C(x) using a graphing utility. Identify any local minima/maxima.



$600 = x \cdot w$

$\frac{600}{x} = w$

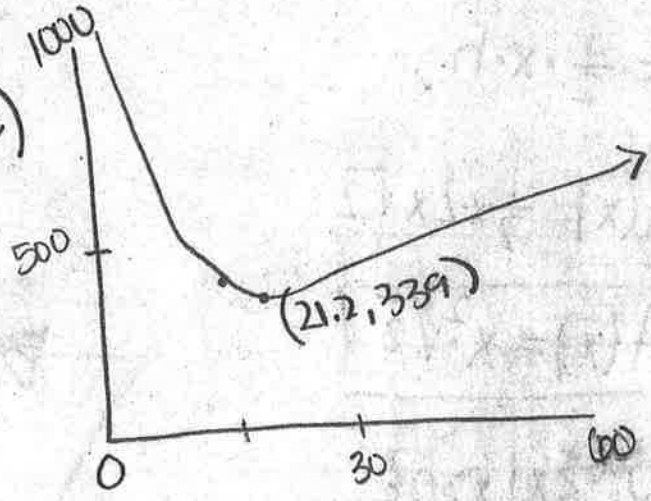
$\text{Cost} = \$5x + \$3x + \$3(2w)$

$C(x) = 8x + 6\left(\frac{600}{x}\right)$

$C(x) = 8x + \frac{3600}{x}$

a) $\boxed{C(x) = \frac{8x^2 + 3600}{x}}$

e)



b) $\{x \mid x > 0\}$ (But some of these are not realistic)

c) $C(30) = \$360$

d) $C(40) = \$410$

The minimum cost is $339 when $x = 21.2$ meters.