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Prof. Lacoste 13/Nov/19

• Solve Applications Involving Quadratic Functions

- The vertex is always a minimum or maximum value

(x, y)

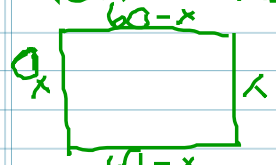
$A(x)$
area

- if $a > 0$, the parabola opens up, so the vertex represent a minimum

- if $a < 0$, the parabola opens down the vertex represent a maximum.

Tip: When a problem you are solving uses a word like minimum, maximum, smallest, largest, maximize, minimize, greatest, least, etc, verify the equation can be written as a quadratic (either $f(x) = ax^2 + bx + c$ or $f(x) = a(x-h)^2 + k$) if it can, the solution to the problem will come from the vertex of the quadratic function.

• ALEKS Problems



A = lenght · width
= $(60-x)x$

$A = 60x - x^2 \rightarrow \boxed{A(x) = -x^2 + 60x}$

(b) 30 meters

(c) 900 square meters

livescribe

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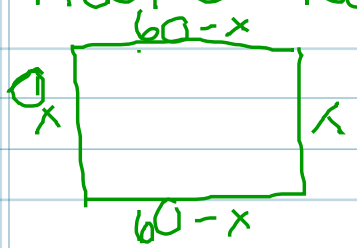

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$= (60-x)x$

$A = 60x - x^2 \rightarrow \boxed{A(x) = -x^2+60x}$

(b) 30 meters

(c) 900 square meters

$x = \frac{-b}{2a}$ $\quad a=-1 \quad b=60 \quad c=0$

$x = \frac{-60}{2(-1)} = 30$

$y = -x^2 + 60x$

$y = -(30)^2 + 60(30)$

$y = -900 + 1800 = 900$

vertex: $(\underset{x}{30}; \underset{y}{900})$

$A(x)$

Area

② What is the maximum height the ball will reach?

$h(t) = -16t^2 + 76t$

$f(x) = ax^2 + bx + c$

$t = x = \frac{-b}{2a} = \frac{-76}{2(-16)} = 2.375$

$h(2.375) = -16(2.375)^2 + 76(2.375)$

$= 90.25$ feet

Write the Equation of a Quadratic Function Given Its Vertex and One Other Point.

To find the equation of a quadratic function from its vertex and one other point, follow these steps:

① Put the vertex (h, k) and the point (x, y) in the vertex form $y = a(x-h)^2 + k$

② Solve for a

③ Put vertex (h, k) and a in the vertex form $y = a(x-h)^2 + k$ (Leave x & y alone)

④ if required, rewrite the equation in standard form.

→ ALEKS Problems

① Put h, k, x, y in vertex form

$y = a(x-h)^2 + k$

$6 = a(-3-(-1))^2 + 2$

$6 = a(-2)^2 + 2$

$6 = 4a + 2$

$-2 \quad -2$

$4 = 4a$

$1 = a$

$\therefore a = 1$

$y = 1(x-(-1))^2 + 2$

$y = 1(x+1)^2 + 2$

vertex form

$y = x^2 + 2x + 1 + 2$

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

standard form

② Vertex: $(1, -4)$ (h, k) Other point $(4, -13)$ (x, y)

$y = a(x-h)^2 + k$

$-13 = a(4-1)^2 + (-4)$

$-13 = a(3)^2 - 4$

$-13 = 9a - 4$

$+4 \quad +4$

$\frac{-9}{-9} = \frac{9a}{-9}$

$-1 = a$

$a = -1$

$y = -1(x-1)^2 + (-4)$

$g(x) = -(x-1)^2 - 4$

9.1 Inverse Functions

- Identify One-to-one function

Definition: A function is <u>one-to-one</u> if, for any two different inputs, ya get two different outputs.

Definition: If every horizontal line intersects the graph of a function f in at most one point, then it passes the <u>horizontal line test</u> and f is one-to-one.