C11 - 3.0 - Quadratics

$y = ax^2 + bx + c$
$y = a(x-p)^2 + q$

Max/Min
AOS $V: \left(\frac{-b}{2a}, y\right)$
$V: (p^*, q)$

Domain/Range
$c = q\ ;\ b = 0\ \&\ p = 0$
Up/Down/Left/Right

Graph : $y = x^2$

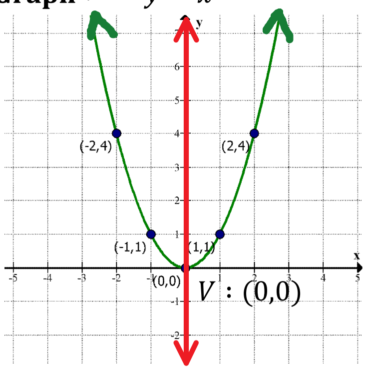


Table of Values

x	y
-2	4
-1	1
0	0
1	1
2	4

Opens Up

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

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

Substitute With Brackets!

Vertex: $V: (0,0)$

Domain : $x \in R$

Shape : $a = 1$

$AOS: x = 0$

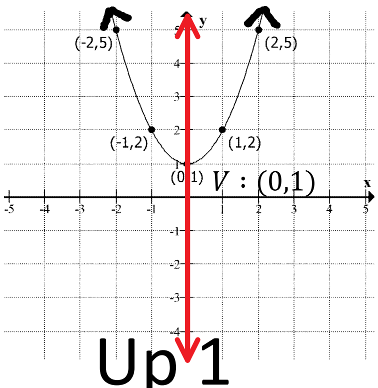
Range : $R: y \geq 0$

$y - int : (0,0)$
$x - int : (0,0)$

Minimum : $y = 0$

Notice: Pattern from Vertex* (0,0) is **symmetrical** on both sides.
Over 1, 1 squared = 1, up 1. Back to the vertex. Over 2, 2 squared = 4, up 4.

$y = x^2 + 1$



$y = x^2 + c$

Shape : $a = 1$

$y = x^2 + 1$
$y = (-2)^2 + 1$
$y = 4 + 1$
$y = 5$

Substitute with Brackets!

x	y
-2	5
-1	2
0	1
1	2
2	5

Domain : $x \in R$

Vertex: $V: (0,1)$

Range : $R: y \geq 1$

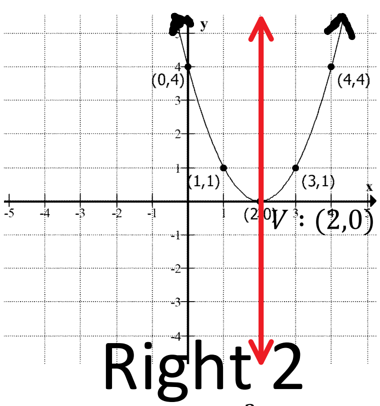
$AOS: x = 0$

Minimum : $y = 1$

$y - int : (0,1)$
$x - int : none$

Notice: $y = x^2 + 1$ is the graph $y = x^2$ shifted Up 1.

$y = (x-2)^2$



$y = (x-p)^2$

Shape : $a = 1$

$y = (x-2)^2$
$y = ((0) - 2)^2$
$y = (0-2)^2$
$y = (-2)^2$
$y = 4$

$y = x^2 - 4x + 4$

FOIL

Domain : $x \in R$

x	y
0	4
1	1
2	0
3	1
4	4

Range : $R: y \geq 0$

Vertex: $V: (2,0)$

Minimum : $y = 0$

Choose values in the Table until this happens!

$AOS: x = 2$

$y - int : (0,4)$
$x - int : (2,0)$

Notice: $y = (x-p)^2$ is the graph $y = x^2$ shifted Right 2. Opposite*.

$y = 1(x+6)^2 + 2$
$y = 1x^2 + 12x + 38$

$V: (-6,2)$

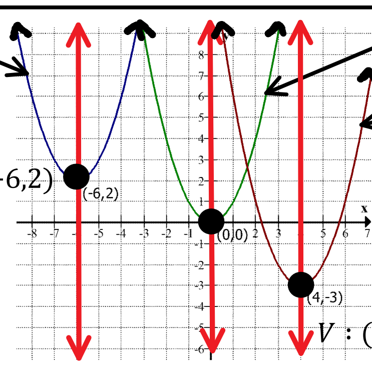
$AOS: x = -6$

Left 6
Up 2

$x \in R$

$R: y \geq 2$

Shape : $a = 1$



$y = 1x^2$
$y = 1(x-0)^2 - 0$

$y = 1(x-4)^2 - 3$
$y = 1x^2 - 8x + 13$

$V: (4,-3)$

Right 4
Down 3

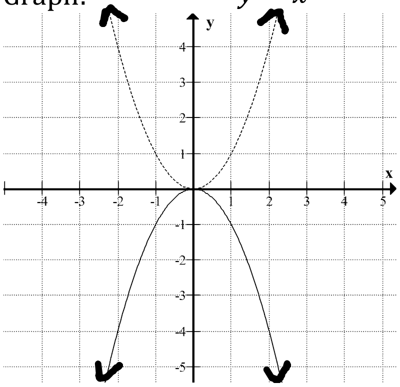
$AOS: x = 4$

$x \in R$

$R: y \geq -3$

C11 - 3.0 - Quadratics "a" Flip/Change Shape Patterns

Graph: $y = x^2$



$y = -x^2$

$y = ax^2$

x	y
-2	-4
-1	-1
0	0
1	-1
2	-4

Opens Down

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

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

Substitute With Brackets!

Vertex: $V: (0,0)$

$AOS: x = 0$

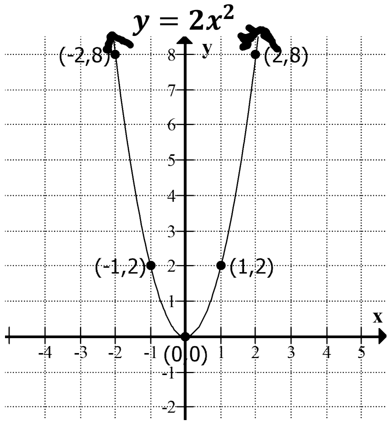
Domain : $x \in R$

Range : $R: y \leq 0$

Maximum : $y = 0$

Shape : $a = 1^*$

$y = 2x^2$



$y = ax^2$

x	y
-2	8
-1	2
0	0
1	2
2	8

$y = 2x^2$
$y = 2(-2)^2$
$y = 2(4)$
$y = 8$

$y = 2x^2$
$y = 2(2)^2$
$y = 2(4)$
$y = 8$

Shape : $a = 2$

Vertex: $V: (0,0)$

$AOS: x = 0$

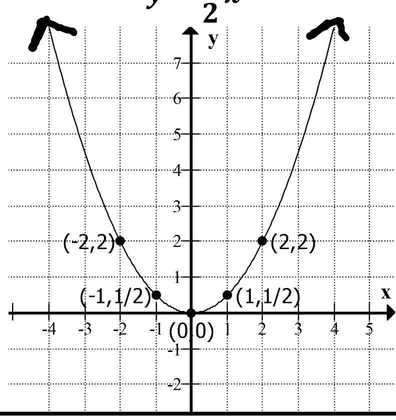
Domain : $x \in R$

Range : $R: y \geq 0$

Minimum : $y = 0$

Notice: Pattern from Vertex (0,0) is Symmetrical on Both Sides.
Over 1, 1 squared = 1, 1 TIMES 2 = 2, up 2. Back to the vertex. Over 2, 2 squared = 4, 4 TIMES 2 = 8, up 8.
In the last two steps, we are multiplying by 2 because $a = 2$.

$y = \frac{1}{2}x^2$



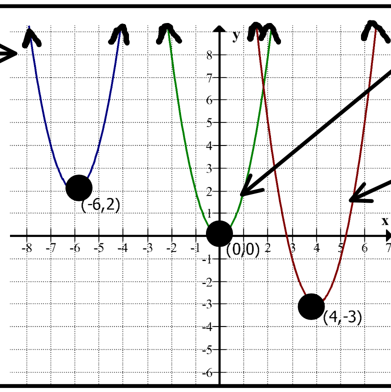
x	y
-2	2
-1	$\frac{1}{2}$
0	0
1	$\frac{1}{2}$
2	2

$y = \frac{1}{2}x^2$
$y = \frac{1}{2}(-2)^2$
$y = \frac{1}{2}(4)$
$y = 2$

Notice: Pattern from Vertex (0,0) is Symmetrical on Both Sides.
Over 1, 1 squared = 1,
1 TIMES $\frac{1}{2}$ = $\frac{1}{2}$, up $\frac{1}{2}$.
Back to the vertex.
Over 2, 2 squared = 4,
4 TIMES $\frac{1}{2}$ = 2, up 2.
In the last two steps, we are multiplying by $\frac{1}{2}$ because $a = \frac{1}{2}$.

$y = 2(x + 6)^2 + 2$
$y = 2x^2 + 24x + 74$

FOIL



$y = 2x^2$
$y = 2(x - 0)^2 - 0$

$y = 2(x - 4)^2 - 3$
$y = 2x^2 - 16x + 29$

FOIL

C11 - 3.0 - Completing the Square $a = 1$ $a \neq 1$ Notes

Check by FOIL!

Standard form → *Vertex form* *Vertex* $= (p, q)$

$y = ax^2 + bx + c$ → $y = a(x - p)^2 + q$

$y = x^2 + 6x + c$

$\left(\frac{b}{2}\right)^2 = \left(\frac{6}{2}\right)^2 = (3)^2 = 9$

$y = x^2 + 6x + 9$

"b" divided by 2 all squared:

$y = (x + 3)(x + 3)$

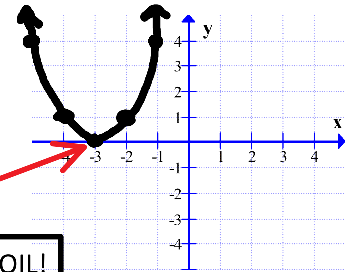
Factor

$y = (x + 3)^2$

Vertex form: Vertex = $(-3, 0)$

$(x + 3)^2$
$(x + 3)(x + 3)$
$x^2 + 6x + 9$

Check by FOIL!



$a = 1$

Group x terms

$y = x^2 - 4x + 3$

$y = (x^2 - 4x) + 3$

$\left(\frac{b}{2}\right)^2 = \left(\frac{-4}{2}\right)^2 = (-2)^2 = 4$

"b" divided by 2 all squared:

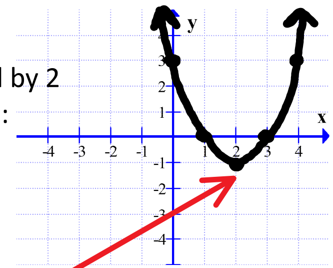
$y = (x^2 - 4x + 4 - 4) + 3$ — Add and subtract inside brackets

$y = (x^2 - 4x + 4) - 4 + 3$ — Remove number not contributing to the perfect square $(-ve)$

$y = (x - 2)(x - 2) - 1$ — Factor brackets, simplify outside

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

Vertex form: Vertex = $(2, -1)$



$(x - 2)(x - 2) - 1$
$x^2 - 4x + 3$

Check by FOIL!

$a \neq 1$

Group x terms

Check by FOIL!

OR $\left(\frac{-b}{2a}, y\right)$

$y = 2x^2 - 8x + 3$

$y = (2x^2 - 8x) + 3$

Factor out coefficient of x^2

$\left(\frac{-(-8)}{2(2)}, y\right)$

x	y
2	-5

$y = 2(x^2 - 4x) + 3$

$\left(\frac{b}{2}\right)^2 = \left(\frac{-4}{2}\right)^2 = (-2)^2 = 4$

New "x" coefficient divided by 2 all squared:

$(2, y)$
$(2, -5)$

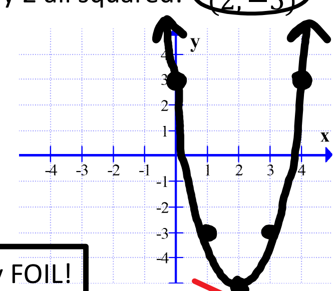
x2

$y = 2(x^2 - 4x + 4 - 4) + 3$ — Add and subtract inside brackets

$y = 2(x^2 - 4x + 4) - 8 + 3$ — Remove number not contributing to perfect square $(-ve)$

Don't forget to multiply by "a"

$y = 2(x - 2)(x - 2) - 5$ — Factor brackets, simplify outside



Check by FOIL!

$y = 2(x - 2)^2 - 5$

Vertex form: Vertex = $(2, -5)$

$y = \left(\frac{1}{2}x^2 + \frac{1}{4}x\right) + 2$

Remember: $\frac{b^*}{2}$ is the number that goes inside the brackets with x. *vertex*: $\left(\frac{-b}{2a}, y\right)$

$y = \frac{1}{2}\left(x^2 + \frac{1}{2}x\right) + 2$ Remove GCF

$\frac{1}{4} \div \frac{1}{2} = \frac{1}{4} \times \frac{2}{1} = \frac{1}{2}$

Divide Fractions

Check by FOIL!

$y = \frac{1}{2}\left(x^2 + \frac{1}{2}x + \frac{1}{16} - \frac{1}{16}\right) + 2$

$\left(\frac{b}{2}\right)^2 = \left(\frac{\frac{1}{2}}{\frac{2}{1}}\right)^2 = \left(\frac{1}{4}\right)^2 = \frac{1}{16}$

$\frac{1}{2} \div \frac{2}{1} = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

$y = \frac{1}{2}\left(x^2 + \frac{1}{2}x + \frac{1}{16}\right) - \frac{1}{32} + 2$

$-\frac{1}{16} \times \frac{1}{2} = -\frac{1}{32}$

Multiply Fractions

$y = \frac{1}{2}\left(x^2 + \frac{1}{2}x + \frac{1}{16}\right) + \frac{63}{32}$

$-\frac{1}{32} + 2 = -\frac{1}{32} + \frac{2}{1} \times \frac{32}{32} = -\frac{1}{32} + \frac{64}{32} = \frac{63}{32}$

$y = \frac{1}{2}\left(x + \frac{1}{4}\right)^2 + \frac{63}{32}$

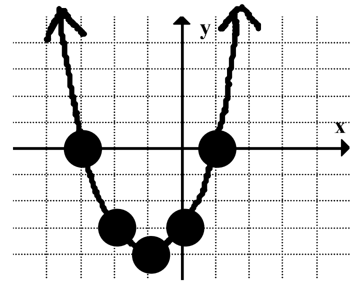
Vertex From: Vertex : $\left(-\frac{1}{4}, \frac{63}{32}\right)$

Add/Subtract Fractions

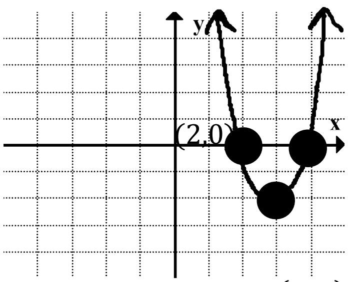
C11 - 3.0 - Quad Find Eq. V&Pt/2Hor*Pts&3rd Pt/WP

$\boldsymbol{V}: (-1,-4)$ (p,q)
$\boldsymbol{Pt}: (-2,-3)$ (x,y)

$y = a(x-p)^2 + q$	Vertex Form
$y = a(x-(-1))^2 - 4$	Substitute Vertex (p,q)
$y = a(x+1)^2 - 4$	
$-3 = a(-2+1)^2 - 4$	Substitute Pt. $(2,-3)$
$-3 = a(-1)^2 - 4$	
$-3 = 1a - 4$	BEDMAS
$+4 \qquad +4$	
$a = 1$	Solve for a.
$y = 1(x+1)^2 - 4$	Sub 'a' into Vertex Form



(x,y) (p,q)
$(-2,-3)$ $(-1,-4)$



(p,q) (x,y)
$(3,-2)$ $(4,0)$

$$y = a(x-p)^2 + q$$
$$y = a(x-(3))^2 - 2$$
$$y = a(x-3)^2 - 2$$
$$0 = a(4-3)^2 - 2$$
$$0 = a(1)^2 - 2$$
$$0 = 1a - 2$$
$$+2 \qquad +2$$
$$\frac{2}{1} = \frac{1a}{1}$$
$$a = 2 \qquad y = 2(x-3)^2 - 2$$

$x - int: (2,0)$ & $(4,0)$
$Minimum: y = -2$

$$y = a(x-p)^2 + q$$
$$y = a(x-3)^2 - 2$$
$$0 = a(4-3)^2 - 2$$
$$0 = 1a - 2$$
$$a = 2 \qquad y = 2(x-3)^2 + 2$$

AOS/p : Average Two Horizontal Points $(x - int's)$

$$x = \frac{(2) + (4)}{2}$$

$x = 3$ AOS :

Vertex : $(3,q)$

Check on Graphing Calculator/Table of Values

2 Horizontal Pt's & 3rd Pt

$(1,-2)$ & $(3,-2)$ & $(4,4)$

$$q = \frac{3+1}{2} = 2$$

$V: (2,y)$

Don't put in 2nd horizonal point
$-2 = a(3-2)^2 + q$
$-2 = 1a + q$
$q = -2 - a$

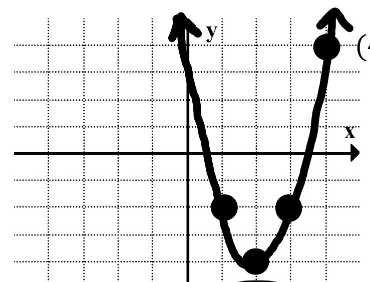
$(1,-2)$

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

Vertex : $(2,-4)$

$(4,4)$

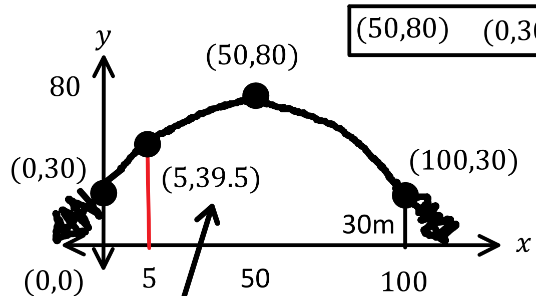
$$y = a(x-p)^2 + q$$
$$y = a(x-2)^2 + q$$
$$4 = a(4-2)^2 + q$$
$$4 = 4a + (q)$$
$$4 = 4a + (-2 - a)$$
$$4 = 3a - 2$$
$$6 = 3a$$
$$a = 2$$
$$y = 2(x-2)^2 - 4$$



$(1,-2)$ $V: (2,y)$ $(3,-2)$

A parabolic bridge has pillars 30 m tall and are 100 m apart. The maximum at the center of the bridge is 80 m tall. Find the equation of the parabolic bridge. What is the height 5 m away from each pillar.

$(50,80)$ $(0,30)$

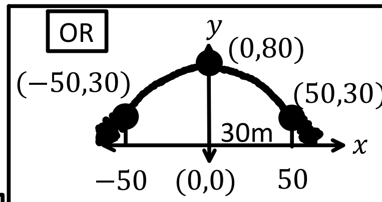


$$y = -\frac{1}{50}(x-50)^2 + 80$$
$$y = -\frac{1}{50}(5-50)^2 + 80$$
...
$y = 39.5$ $\quad x = 5$

$$y = a(x-p)^2 + q$$
$$y = a(x-50)^2 + 80$$
$$30 = a(0-50)^2 + 80$$
$$30 = a(50)^2 + 80$$
$$-80 \qquad -80$$
$$-\frac{50}{2500} = \frac{2500a}{-2500}$$
$$a = -\frac{1}{50}$$
$$y = -\frac{1}{50}(x-50)^2 + 80$$

$(50,80)$
$(0,30)$

OR



$$y = -\frac{1}{50}(x-0)^2 + 80$$

C11 - 3.0 - Quadratics #'s WPs

If you see the word max/min/biggest etc.
Complete the square CH3. If not Factor* Ch4.

The difference between two numbers is 10 if their product is a minimum.

Let statements/Diagram
2 Equations
Isolate/Substitute
Distribute* (Algebra)
Complete the Square/Vertex
Substitute/Solve
Answer/Check/Test

Let $a = 1st\ \#$
Let $b = 2nd\ \#$

let $y = minimum$

$a - b = 10$
$a - b = 10$
$+b \quad +b$
$a = (10 + b)$

$a \times b = minimum$
$a \times b = \cancel{minimum}\ y$
$y = a \times b$
$y = a \times b$
$y = (10 + b) \times b$
$y = 10b + b^2$
$y = b^2 + 10b$
$y = b^2 + 10b$
$y = (b^2 + 10b + 25 - 25)$
$y = (b^2 + 10b + 25) - 25$
$y = (b + 5)^2 - 25$

$\left(\frac{b}{2}\right)^2 =$
$\left(\frac{10}{2}\right)^2 =$
$(5)^2 = 25$

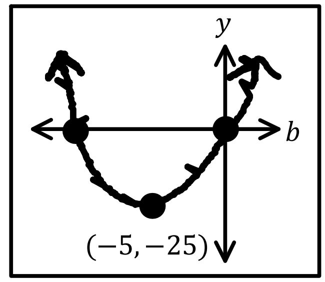
$a = 10 + b$
$a = 10 + (-5)$
$a = 5$

$1st\ \# = 5$
$2nd\ \# = -5$

The minimum product is -25.

Vertex : $(-5, -25)$

b   Minimum



$a - b = 10$
$5 - (-5) = 10$

$min = a \times b$
$= 5 \times -5$
$= -25$

$0 \times 10 = 0 \qquad -1 \times 9 = -9 \qquad -4 \times 6 = -24 \qquad -5 \times 5 = -25 \qquad -10 \times -20 = -200$

Find Two numbers who differ by 10 if The product of the larger # and twice the smaller # is a minimum.

Let $a = 1st\ \#$
Let $b = 2nd\ \#$

$a - b = 10$
$a = (10 + b)$

$a \times 2b = minimum$
$a \times 2b = \cancel{minimum}\ y$
$y = a \times 2b$
$y = (10 + b) \times 2b$
$y = 20b + 2b^2$
$y = 2b^2 + 20b$
$y = 2(b^2 + 10b + 25 - 25)$
$y = 2(b^2 + 10b + 25) - 50$
$y = 2(b + 5)^2 - 50$

Vertex : $(-5, -50)$

$a = 10 + (-5)$
$a = 5$

$a = 5$
$b = -5$

The minimum product is -50.

$b = -5$

Find Two numbers who sum to 8 and the sum of their squares is a minimum.

Let $a = 1st\ \#$
Let $b = 2nd\ \#$

$a + b = 8$
$-b \quad -b$
$a = 8 - b$
$a = (8 - b)$

$a^2 + b^2 = minimum$
$a^2 + b^2 = \cancel{minimum}\ y$
$y = a^2 + b^2$
$y = a^2 + b^2$
$y = (8 - b)^2 + b^2$
$y = 64 - 16b + b^2 + b^2$
$y = 2b^2 - 16b + 64$
$y = 2(b^2 - 8b) + 64$
$y = 2(b^2 - 8b + 16 - 16) + 64$
$y = 2(b^2 - 8b + 16) + 64 - 32$
$y = 2(b - 4)^2 + 32$

$a = 8 - (4)$
$a = 4$

$a = 4$
$b = 4$

Vertex : $(4, 32)$

The minimum product is 32.

Find two numbers whose sum of twice one # and six times another # is sixty if their product is a maximum.

Let $a = 1st\ \#$
Let $b = 2nd\ \#$

$2a + 6b = 60$
$\frac{2a}{2} + \frac{6b}{2} = \frac{60}{2}$
$a + 3b = 30$
$a = 30 - 3b$

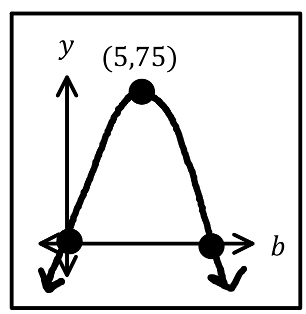
$a = 15$
$b = 5$

$a = 30 - 3(5)$
$a = 15$

The maximum product is 75

$a \times b = maximum$
$a \times b = \cancel{maximum}\ y$
$y = a \times b$
$y = (30 - 3b) \times b$
$y = 30b - 3b^2$
$y = -3b^2 + 30b$
$y = -3b^2 + 30b$
$y = -3(b^2 - 10b + 25 - 25)$
$y = -3(b^2 - 10b + 25) + 75$
$y = -3(b - 5)^2 + 75$

Vertex : $(5, 75)$



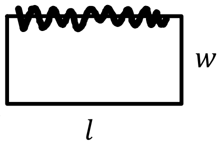
$2 \times 15 + 6 \times 5 = 60$
$5 \times 15 = 75$

C11 - 3.0 - Quadratics Rectangles WPs

Find the largest 3-sided rectangular enclosure (area) bounded on the side of a river with total 8m of fencing.

Let $w = width$
Let $l = length$

River

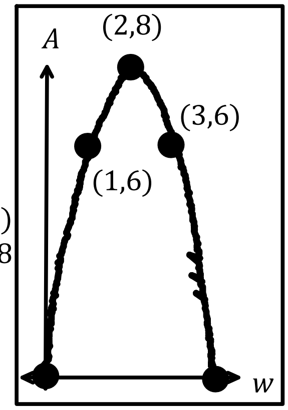


$width = 2\text{ m}$
$length = 4\text{ m}$

$Maximum\ Area = 8\ m^2$

$2w + l = P$ $\quad$ $P = 8$
$2w + l = 8$
$-2w \qquad -2w$
$l = (8 - 2w)$

$A = l \times w$
$A = (8 - 2w) \times w$
$A = 8w - 2w^2$
$A = -2w^2 + 8w$
$A = -2(w^2 - 4w)$
$A = -2(w^2 - 4w + 4 - 4)$
$A = -2(w^2 - 4w + 4) + 8$
$A = -2(w - 2)^2 + 8$



$l = 8 - 2w$
$l = 8 - 2(2)$
$l = 4$

Vertex : $(2,8)$

$w = 2$ $\quad$ $A = 8$

$P = 8$ $\quad$ $A = 6$ $\quad$ $w = 1$
$l = 6$

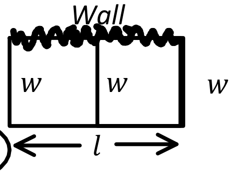
$P = 8$
$A = 3$
$w = 3$
$l = 1$

$P = w + w + l$ $\qquad$ $A = lw$
$8 = 2 + 2 + 4$ $\qquad$ $8 = 2(4)$

Find the maximum area of rectangular fence is split in half is against a wall with a total fencing length is 42 m.

Let $w = width$
Let $l = length$

Wall



$length = 21m$
$width = 7m$

$Max\ area = 147\ m^2$

$P = l + 3w$
$42 = l + 3w$
$-3w \qquad -3w$
$42 - 3w = l$
$l = 42 - 3w$

$l = 42 - 3(7)$
$l = 21$

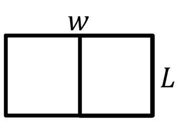
$A = l \times w$ $\qquad$ $let\ y = Area$
$y = (42 - 3w) \times w$
$y = 42w - 3w^2$
$y = -3w^2 + 42w$
$y = -3(w^2 - 14w)$
$y = -3(w^2 - 14w + 49 - 49)$
$y = -3(w^2 - 14w + 49) + 147$
$y = -3(w - 7)^2 + 147$

Vertex : $(7,147)$

$w = 7$ $\quad$ $A = 147$

$P = w + w + w + l$ $\qquad$ $A = lw$
$42 = 7 + 7 + 7 + 21$ $\qquad$ $147 = 21(7)$

A rectangular fence enclosure with total fencing of 60 meters is cut in half. Find the maximum area.



$P = 60m$

$P = 2w + 3L$
$60 = 2w + 3L$
$3L = 60 - 2w$
$L = 20 - \frac{2}{3}w$
$L = 20 - \frac{2}{3}(15)$
$L = 10m$

$A = lw$
$A = \left(20 - \frac{2}{3}w\right)w$
$A = -\frac{2}{3}w^2 + 20w$
$A = -\frac{2}{3}(w^2 - 30w)$
$A = -\frac{2}{3}(w^2 - 30w + 225 - 225)$
$A = -\frac{2}{3}(w^2 - 30w + 225) + 150$
$A = -\frac{2}{3}(w - 15)^2 + 150$

$V : (15,150)$

$w = 15m$ $\quad$ $Max\ Area = 150m^2$

$20 \div -\frac{2}{3} =$
$20 \times -\frac{3}{2} = -30$

$-225 \times -\frac{2}{3} = +150$

$\left(\frac{b}{2}\right)^2 =$
$\left(\frac{-30}{2}\right)^2 =$
$(-15)^2 = 225$

$P = w + w + l + l + l$
$60 = 15 + 15 + 10 + 10 + 10$

$A = lw$
$A = 15 \times 10$
$A = 150$

C11 - 3/4/8/9.0 - Quadratics Projectiles/Calc WP's

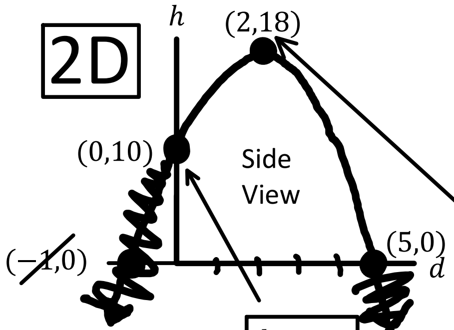
$h \; vs. \, t$ (1D/2D)
$h \; vs. \, d$ (2D)

The height vs distance of a bow and arrow shot off a cliff is represented by following equation:

$$h = -2d^2 + 8d + 10$$

What is the maximum height and the distance it took to get there?

2D



$h - int$
$d = 0$

$h = -2d^2 + 8d + 10$
$h = (-2d^2 + 8d) + 10$
$h = -2(d^2 - 4d) + 10$
$h = -2(d^2 - 4d + 4 - 4) + 10$
$h = -2(d^2 - 4d + 4) + 8 + 10$
$h = -2(d - 2)^2 + 18$

$V: (2,18)$

$d = 2 \quad h = 18$

$D: [0,5] \; or \; 0 \le x \le 5$
$R: [0,18] \; or \; 0 \le y \le 18$

2nd | Calc | Value/Max/Zero/Int

Calculator

What was the height of the cliff?

$h = -2d^2 + 8d + 10$
$h = -2(0)^2 + 8(0) + 10$
$h = 10$

Chapter 4

How far did the arrow go before it hit the ground? $h = 0$

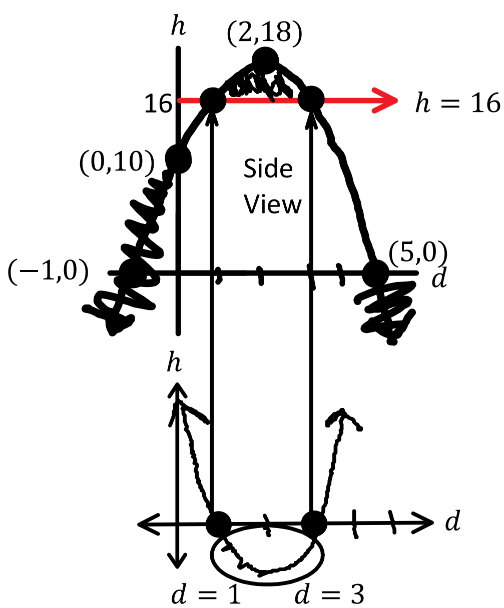
$h = -2(d - 2)^2 + 18$ CH.4
$0 = -2(d - 2)^2 + 18$
$9 = (d - 2)^2$
$d - 2 = \pm 3$

Square Root Method!

~~$d = -1$~~ $d = 5$ OR

$h = -2(d^2 - 4d - 5)$
$0 = -2(d - 5)(d + 1)$
$d - 5 = 0 \quad$ ~~$d + 1 = 0$~~
$d = 5 \quad$ ~~$d = -1$~~

Or Quadform Reject



Chapter 4

At what distance is the height 16 m ? $h = 16$

$h = -2d^2 + 8d + 10$

$h = -2d^2 + 8d + 10$
$16 = -2d^2 + 8d + 10$
$-16 \qquad\qquad -16$
$0 = -2d^2 + 8d - 6$
$\frac{0}{-2} = \frac{-2d^2 + 8d - 6}{-2}$
$0 = d^2 - 4d + 3$
$0 = (d - 3)(d - 1)$
$d = 3 \quad d = 1$

Chapter 9

At what distance is the height greater than 16m?

$h \ge 16 \quad h = -2d^2 + 8d + 10$

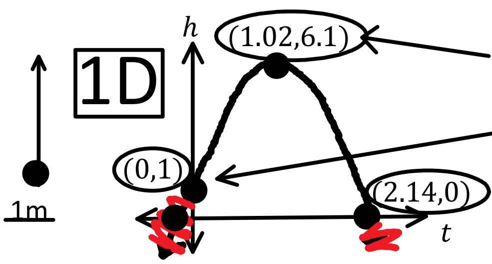
$-2d^2 + 8d + 10 \ge 16$
$\qquad -16 \quad -16$
$-2d^2 + 8d - 6 \ge 0$
$\frac{-2d^2 + 8d - 6}{-2} \ge \frac{0}{-2}$
$d^2 - 4d + 3 \le 0$
$(d - 3)(d - 1) \le 0$

$1 \le d \le 3$

A Rock thrown straight up with a velocity of 10 $\frac{m}{s}$ from a stand of height of 1m. Find Max Height and Time to max height and time in Flight. Find height of stand.

$h = -4.9t^2 + 10t + 1$

1D



2nd | Calc | Max

Left/Right Bound

Max height = 6.1m

Time to max height = 2.14s

$y - int$:

2nd | Calc | Value $x = 0$

Stand height = 1m

$x - int$:

Chapter 4 2nd | Calc | Zero

OR $y_2 = 0$

2nd | Calc | Int

Time in flight = 2.14s

Reject $-0.096s$

Quadform

$$t = \frac{-10 \pm \sqrt{119.6}}{-9.8}$$
$$t = -0.096, 2.14 \; s$$

C11 - 3/4/8/9.0 - Quadratics Max Revenue WPs

A student sells candy to their friends each day.
Candy sells for 6 dollars, and 10 friends buy the candy.
If they increase the price by 1 dollar, 1 less friend decides not to buy the candy.
What is the price and quantity that will maximize revenue?

No Price Change
$p = 6, q = 10$
$R = p \times q$
$R = 6 \times 10$
$R = \$60$

$Let\ p = price, Let\ q = quantity, Let\ R = revenue$

$Let\ x = \#\ of\ price\ increases$

$x = 2$ price increases

$Revenue = price \times quantity$

$p = 6 + 1x$ If they raise the price by 1 dollar x times.

$q = 10 - 1x$ One less friend buys candy each time they increases the price x times.

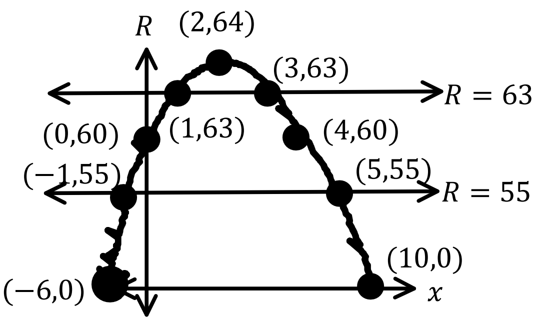
$R = p \times q$
$R = (6 + 1x)(10 - 1x)$
$R = 60 - 6x + 10x - x^2$
$R = -x^2 + 4x + 60$ Complete Square
$R = -(x^2 - 4x) + 60$
$R = -(x^2 - 4x + 4 - 4) + 60$
$R = -(x^2 - 4x + 4) + 60 + 4$
$R = -(x - 2)^2 + 64$

$Max\ Revenue = \$64$

Vertex : $(2, 64)$ $x = 2$

$p = 6 + 1(2)$
$p = 6 + 2$
$p = 8$ $price = 8$

$q = 10 - 1(2)$
$q = 10 - 2$
$q = 8$ $quantity = 8$



P	Q	x	R
0	16	−6	0
...			
5	11	−1	55
6	10	0	60
7	9	1	63
8	8	2	64
9	7	3	63
10	6	4	60
11	5	2	55
...			
16	4	6	0

Chapter 4

What is the price and quantity that revenue is \$63? $R = 63$

$R = -x^2 + 4x + 60$
$63 = -x^2 + 4x + 60$
$0 = x^2 - 4x + 3$
$0 = (x - 3)(x - 1)$
$x = 3$ $x = 1$

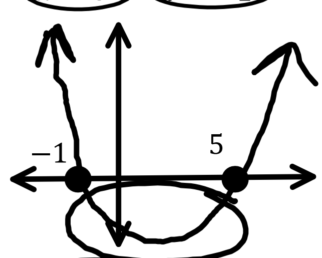
$p = 9$, $q = 7$

$p = 7$, $q = 9$

Chapter 9

What is the Domain of Prices that Revenue ≥ \$55? $R \geq 55$

$-x^2 + 4x + 60 \geq 55$
$\frac{-x^2}{-1} + \frac{4x}{-1} + \frac{5}{-1} \geq \frac{0}{-1}$
$x^2 - 4x - 5 \leq 0$
$(x - 5)(x + 1) \leq 0$
$x = 5$ $x = -1$



$-1 \leq x \leq 5$ $5 \leq p \leq 11$

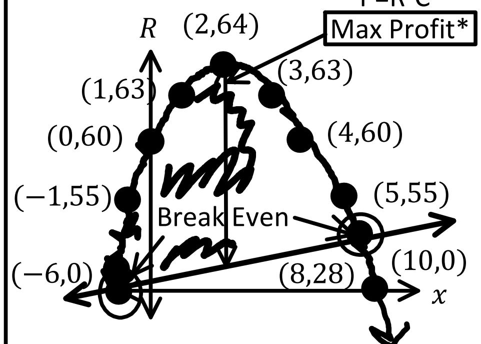
If we lower the price by 1 dollar or don't change the price or raise the price between zero and five times, revenue will be greater than \$55.

Chapter 8

If the cost of each candy is \$2/candy, what is the break even points ($R = C$), and domain of the number of price increases to be profitable ($R - C = 0$)? Shade the region.

$y = mx + b$ $Let\ c = cost$
$C = 2x + 12$ $6 \times 2 = 12$
$R = -x^2 + 4x + 60$

$R = C$
$-x^2 + 4x + 60 = 2x + 12$
$-x^2 + 2x + 48 = 0$
$x^2 - 2x - 48 = 0$
$(x - 8)(x + 6) = 0$
$x = 8$ $x = -6$



$C = 2x + 12$

If we increase the price 8 times or decrease the price 6 times revenue will equal cost will break even.

$C = 2x + 12$
$C = 2(8) + 12$
$C = 28$ (8,28)

$C = 2x + 12$
$C = 2(-6) + 12$
$C = 0$ (−6,0)

If x is negative, decrease the price*
If $x = 0$ then don't change the price*