

# Unit 5 - Quadratics in Vertex Form

step pattern

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

direction of opening

(h,k) vertex

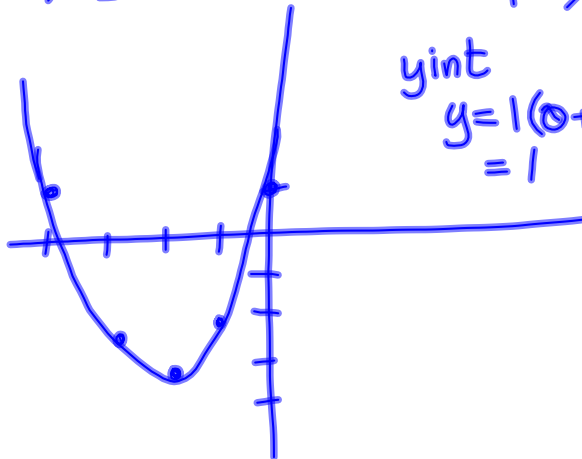
\* h is a liar

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

Ex.  $y = +1(x+2)^2 - 3$

Vertex (2, -3)  
step 1, 4, 9

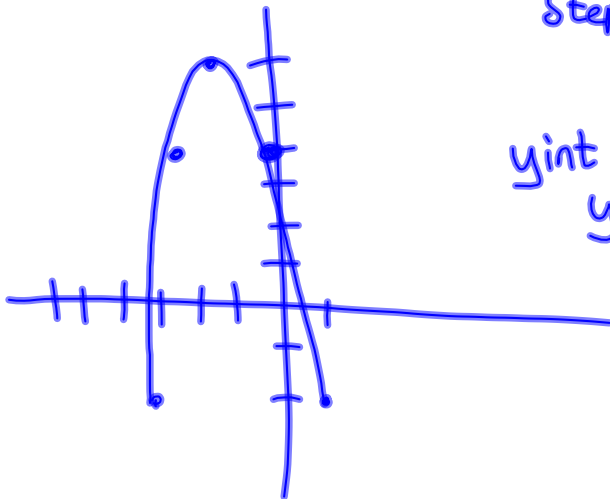
yint  
 $y = 1(0+2)^2 - 3$   
 $= 1$



Ex.2

$$y = -2(x+1)^2 + 6$$

vertex  $(-1, 6)$   
Step 1a, 4a, 9a  
 $-2, -8, -18$



y-int  
 $y = -2(0+1)^2 + 6$   
 $= 4$

| over | down |
|------|------|
| 1    | -2   |
| 2    | -8   |
| 3    | -18  |

### Vertex Form to Standard Form

$$y = 2(x+3)^2 + 7$$

pattern

$$x^2 + 6x + 9$$

$$(x+b)^2 = x^2 + 2bx + b^2$$

FOIL

$$(x+3)(x+3)$$

$$= x^2 + 3x + 3x + 9$$

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

$$y = 2(x^2 + 6x + 9) + 7$$

$$= 2x^2 + 12x + 18 + 7$$

$$y = 2x^2 + 12x + 25$$

Ex.  $y = -0.5(x+8)^2 + 12$   
 $y = -0.5(x^2 + 16x + 64) + 12$   
 $y = -0.5x^2 - 8x - 32 + 12$   
 $y = -0.5x^2 - 8x - 20$

- 1) FOIL center part  $(x+a)^2$
  - 2) Multiply in "a" value
  - 3) Collect like terms.

Standard form to Vertex Form

Completing the Square

Ex.  $y = 2x^2 + 8x + 5$   
 $= 2(x^2 + 4x) + 5$   
 $= 2(x^2 + 4x + 4 - 4) + 5$   
 $= 2(x^2 + 4x + 4) - 8 + 5$   
 $= 2(x^2 + 4x + 4) - 3$   
 $y = 2(x+2)^2 - 3$

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

$$\begin{aligned}
 y &= 3x^2 + 18x + 7 \\
 &= 3(x^2 + 6x) + 7 \\
 &= 3(x^2 + 6x + 9 - 9) + 7 \\
 &= 3(x^2 + 6x + 9) - 27 + 7 \\
 &= 3(x^2 + 6x + 9) - 20 \\
 &= 3(x+3)^2 - 20
 \end{aligned}$$

$$\begin{aligned}
 \frac{b}{2} &= 3 \\
 3^2 &= 9 \\
 &= \frac{(x+3)^2}{(x+3)(x+3)} \\
 &= x^2 + 3x + 3x + 9 \\
 &= \underline{x^2 + 6x + 9}
 \end{aligned}$$

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## Problem Solving with vertex form

Given Equation

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

$(h, K) \rightarrow \text{max/min}$

$(5, 10)$

Given Situation

Soccer Kicked from the ground and lands 6m away and max height is 2m.

$$\begin{aligned}
 y &= a(x-h)^2 + K \\
 y &= a(x-h)^2 + 2 \\
 y &= a(x-3)^2 + 2
 \end{aligned}$$

$$(0, 0) \text{ or } (6, 0)$$

$$\begin{aligned}
 0 &= a(0-3)^2 + 2 \\
 0 &= 9a + 2 \\
 -2 &= 9a & a &= \frac{-2}{9}
 \end{aligned}$$

Pg. 204  
# 1, 3, 7,

Pg. 258  
# 13 a)

Pg. 316  
# 1, 14