

# Mathematics 10D

## Q.06 – Solving From Vertex Form

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First of all, and most importantly, what is solving?

Solving is to find the value or values of a variable that make the equation true.

Ex1:  $3x - 8 = 13$

$$\frac{3x}{3} = \frac{21}{3}$$

$$x = 7$$

Ex2:  $2x^2 + 3 = 21$

$$\frac{2x^2}{2} = \frac{18}{2}$$

$$\sqrt{x^2 = 9}$$

$$x = 3 \text{ and } x = -3$$

$$x = \pm 3$$

However, how would you solve:  $3x^2 - 8x + 4 = 2x + 3$

*we can't do this one using the above technique.*

In the world of quadratics, solving means to find the x-intercepts or the zeros, hence we need to substitute 0 into y, or rewrite the equation so that it equals 0 (which is why I say to solve for the zeros, meaning find the value(s) of x so that  $y=0$ )

Solve!

from vertex form

$$y = 2(x-3)^2 - 18$$

Annotations:   
 -  $y$  is circled in blue.   
 -  $x$  is circled in green.   
 -  $(x-3)^2$  is labeled "shirt" in green.   
 -  $-18$  is labeled "socks" in green.   
 - An arrow points from  $(x-3)^2$  to  $y$  with the label "you" in green.   
 - An arrow points from  $(x-3)^2$  to  $-18$  with the label "underwear" in green.

evaluate

$$\begin{array}{c|c|c} -3 & +3 \\ \hline ( )^2 & \pm\sqrt{\phantom{x}} \\ \hline \times 2 & \div 2 \\ \hline -18 & +18 \end{array}$$

Annotations:   
 - A red arrow points down from the top row to the bottom row, labeled "evaluate".   
 - A red arrow points up from the bottom row to the top row, labeled "undo".

$$\frac{18}{2} = \frac{2(x-3)^2}{2}$$

$$\sqrt{9} = \sqrt{(x-3)^2}$$
$$\pm 3^{+3} = x - 3^{+3}$$

$$\pm 3 + 3 = x$$

Two Solutions.

$$\oplus \quad x = +3 + 3$$
$$\underline{x = 6}$$

$$\ominus \quad x = -3 + 3$$
$$\underline{x = 0}$$

Solve another!

$$0 = -5(x + 6)^2 + 70$$

$$\frac{-70}{-5} = \frac{-5(x+6)^2}{-5}$$

$$\sqrt{14} = \sqrt{(x+6)^2}$$

$$\pm 3.74 = x + 6$$

$$\pm 3.74 - 6 = x$$

$$\oplus \quad x = +3.74 - 6$$

$$x = -2.26$$

$$\ominus \quad x = -3.74 - 6$$

$$x = -9.74$$

The first two were neat and tidy, how about one that isn't!

$$0 = -7(x-12)^2 + 19$$

$$\begin{array}{c} -19 = \frac{-7(x-12)^2}{-7} \end{array}$$

$$\sqrt{2.71} = \sqrt{(x-12)^2}$$

$$\pm 1.65 = x - 12$$

$$\pm 1.65 + 12 = x$$

$$\oplus \quad x = 1.65 + 12$$

$$x = 13.65$$

$$\ominus \quad x = -1.65 + 12$$

$$x = 10.35$$

Are there always 2 answers?

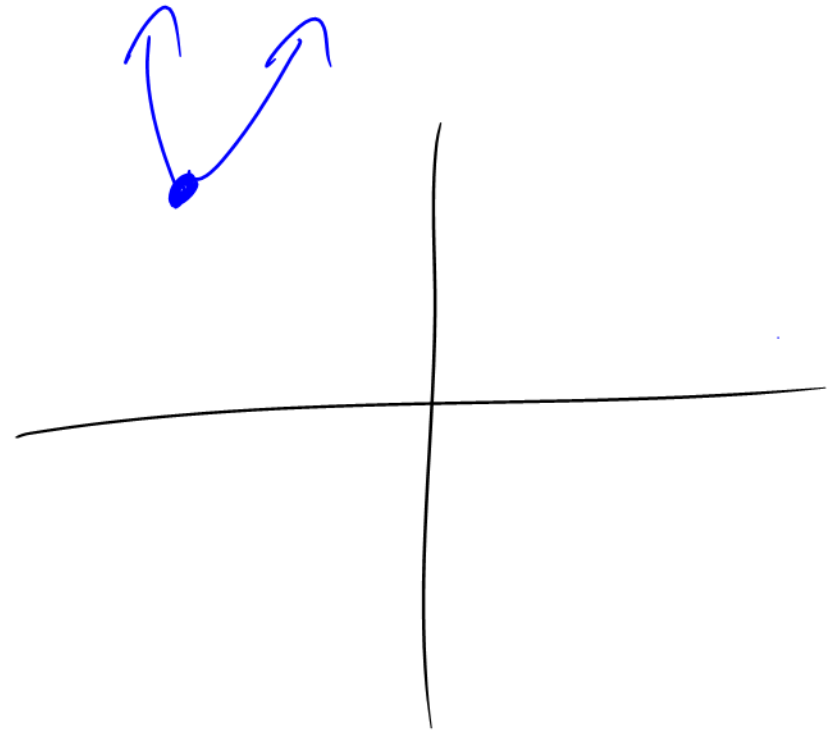
$$0 = 4(x + 8)^2 + 6$$

$$\frac{-6}{4} = \frac{4(x + 8)^2}{4}$$

$$\sqrt{-1.5} = \sqrt{(x + 8)^2}$$

Cannot square root a negative!!

$\therefore$  No solutions



$$0 = -3(x+4)^2$$

$-3$        $-3$

$$\sqrt{0} = \sqrt{(x+4)^2}$$

$$0 = x+4$$

$$-4 = x$$

