4.1 Graphical Solutions of Quadratic Equations

Definitions:

Quadratic Equations: a Second degree equation with standard form $ax^2 + bx + c = 0$, where $a \neq 0$.

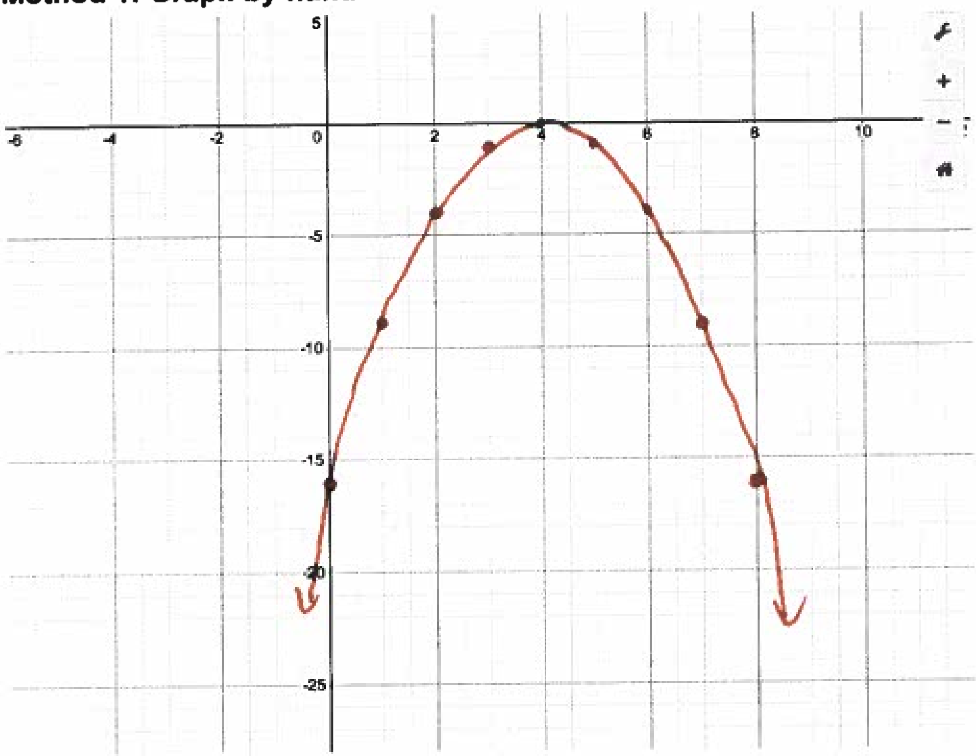
Root(s) of an Equation: the solution(s) to an equation.

Zero(s) of a function: the value of x for which f(x) = 0. Also known as the x-intercepts.

Ex 1) What are the roots of the equation $-x^2 + 8x - 16 = 0$ or $y = -x^2 + 8x - 16$

→ zeros = x-intercepts

Method 1: Graph by hand



x	y
0	−16
2	−4
3	−1
4	0
5	−1
6	−4
7	−8
8	−16

one distinct zero

$x=1: -(1)^2 + 8(1) - 16 = -1 + 8 - 16 = 7 - 16 = -9$

$x=2: -(2)^2 + 8(2) - 16 = -4 + 16 - 16 = -4$

$x=3: -(3)^2 + 8(3) - 16 = -9 + 24 - 16 = -1$

$x=4: -(4)^2 + 8(4) - 16 = -16 + 32 - 16 = 0$

$x=5: -(5)^2 + 8(5) - 16 = -25 + 40 - 16 = -1$

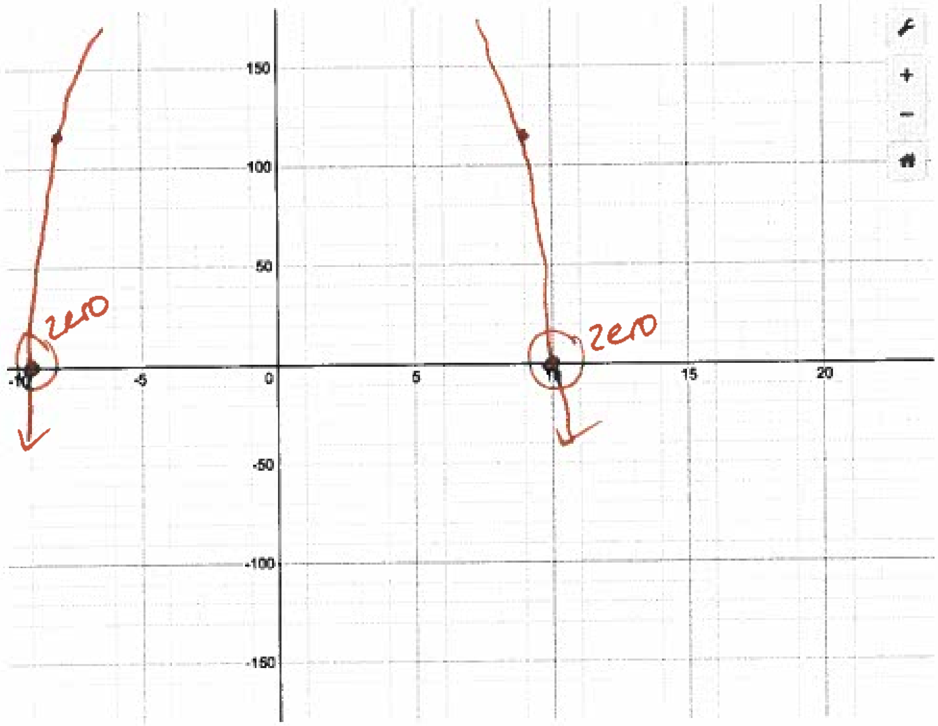
Method 2: Using a graphing calculator $\boxed{\text{2nd}} \to \boxed{\text{trace}} \to \boxed{\text{zero}} \to$ Leftbound $\to \boxed{\text{Enter}} \to$ Rightbound $\to \boxed{\text{enter}} \to \boxed{\text{enter}}$

Zero: (4, 0)

Ex 2) The manager at Suzie's Fashion Store has determined that the function $R(x) = 600 - 6x^2$ models the expected weekly revenue, R, in dollars, from sweatshirts as the price changes, where x is the change in price, in dollars. What price increase or decrease will result in no revenue?

Method 1: Graph by hand $0 = 600 - 6x^2$

When there is no revenue, R(x) = 0. → this means we are finding the zeros



x	y
-10	0
-9	114
⋮	
9	

zeros: (-10,0) and (10,0)

$x=-9$: $600-6(-9)^2$
$= 600 - 486$
$= 114$

$x=-8$: $600-6(-8)^2$
$= 600-6(64)$
$= 216$

$x=9$: $600-6(9)^2$
$= 114$

$x=10$: $600-6(10)^2$
$= 0$

Method 2: Use a graphing calculator $\boxed{\text{2nd}}$ → $\boxed{\text{Trace}}$ → $\boxed{\text{zero}}$ → left bound → $\boxed{\text{enter}}$ → right bound → $\boxed{\text{enter}}$ → $\boxed{\text{enter}}$

zeros: (-10,0) and (10,0)

Ex 3) Solve $3m^2 - m = -2$ by graphing. (graphing calc) 2nd → trace → zero.

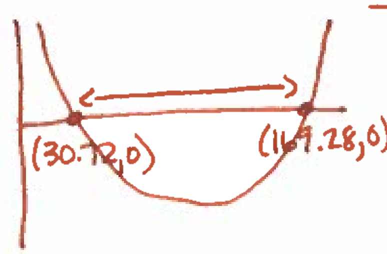
$+2 \quad +2$

$3m^2 - m + 2 = 0$. ↗ $y = 0$, so we are finding the x-intercepts.

Zoom in on your graph,
There are no x-intercepts.

Ex 4) Suppose the cable of a suspension bridge is modelled by the function $h(d) = 0.0025(d-100)^2 - 12$. What is the horizontal distance between the two towers? Express your answer to the nearest tenth of a metre.

vertex form:
vertex: $(100, -12)$
$a = 0.0025$
Opens up, wide



Window:
$X_{min} = -2$
$X_{max} = 210$
$y_{min} = -20$
$y_{max} = 10$

Zeros: $(30.72, 0)$ $(169.28, 0)$

horizontal distance: $169.28 - 30.72 = 138.56 \approx \underline{138.6\text{m}}$

The distance between the two towers is 138.6m.

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