

# Parabola Feature Hunt

*Graph quadratics and read their important points.*

**HIGH SCHOOL • MA.912.AR.3.7**

**MA.912.AR.3.7** "Given a table, equation or written description of a quadratic function, graph that function, and determine and interpret its key features."

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## KEY FEATURES

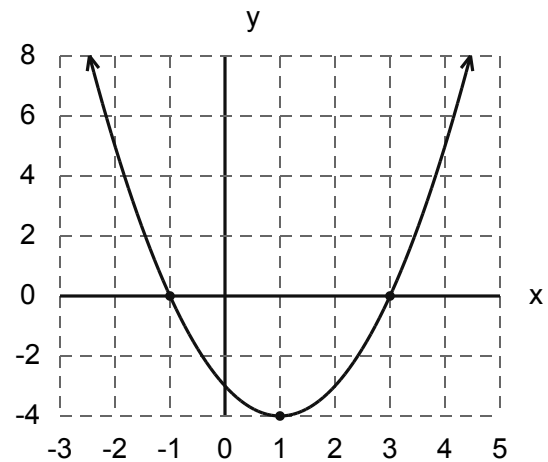
Plot the vertex and symmetric points; draw a smooth parabola. Factor to find zeros, or set the output to zero and solve. Identify the y-intercept at  $x=0$ . Describe where the graph rises, falls, lies above/below the x-axis, and where its ends go. Unless restricted, the domain is all real numbers ( $\mathbb{R}$ ). The grid window is not the domain.

## WORKED EXAMPLE

Graph  $y=(x-1)^2-4$ . State the vertex, symmetry axis, intercepts and range.

1. Vertex  $(1,-4)$ , axis  $x=1$ . Plot matching points on both sides.
2.  $y=(x+1)(x-3)$ , so x-intercepts are  $(-1,0)$ ,  $(3,0)$ .
3. At  $x=0$ ,  $y=-3$ . It opens up; minimum  $-4$ , range  $y \geq -4$ .

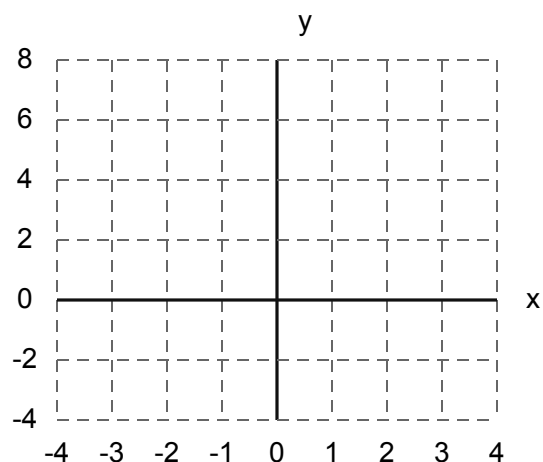
**Answer: Vertex  $(1,-4)$ ; axis  $x=1$ ; x-intercepts  $(-1,0)$ ,  $(3,0)$ ; y-intercept  $(0,-3)$ ; domain  $\mathbb{R}$ ; range  $y \geq -4$ .**



**PRACTICE** 4 problems

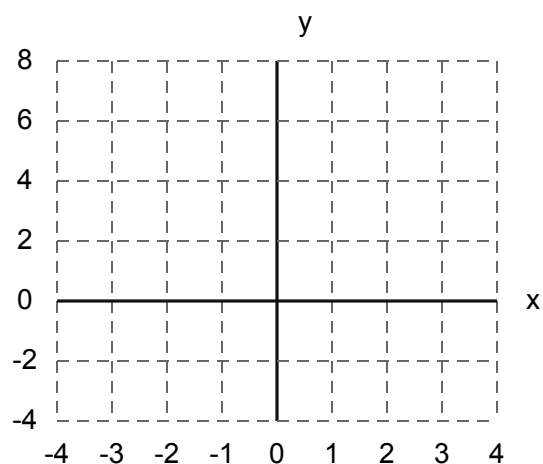
- 1** Graph  $y=(x+1)^2-4$ . State the vertex, symmetry axis, both x-intercepts, y-intercept and range.

**ANSWER** \_\_\_\_\_  
\_\_\_\_\_



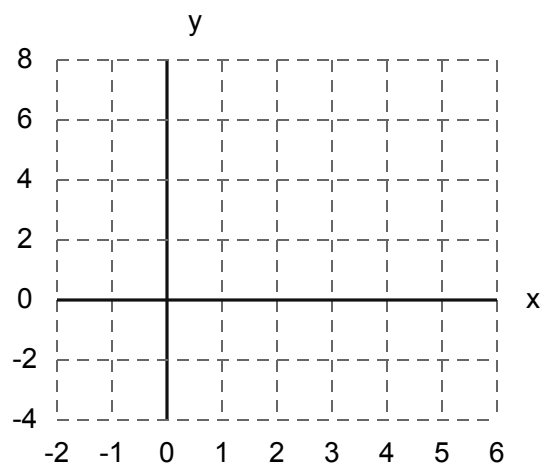
- 2** Graph  $y=-(x+1)(x-3)$ . State the vertex, maximum, range, and x-intervals where it increases and decreases.

**ANSWER** \_\_\_\_\_  
\_\_\_\_\_



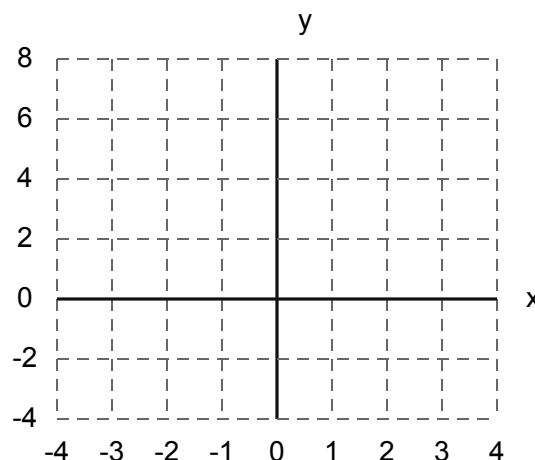
- 3** Graph  $y=x^2-4x+3$ . State zeros, the intervals where y is positive/negative, and end behavior.

**ANSWER** \_\_\_\_\_  
\_\_\_\_\_



- 4 A quadratic has vertex  $(0,1)$  and passes through  $(-2,5)$ ,  $(2,5)$ . Write and graph it. Give domain, range and any x-intercepts.

ANSWER \_\_\_\_\_  
\_\_\_\_\_



### APPLY IT Show your work

- 1 The following table belongs to an unrestricted quadratic:  $x = -2, -1, 0, 1, 2$  and  $y = 0, 3, 4, 3, 0$ . Write and graph the function. Give its vertex, axis and range.

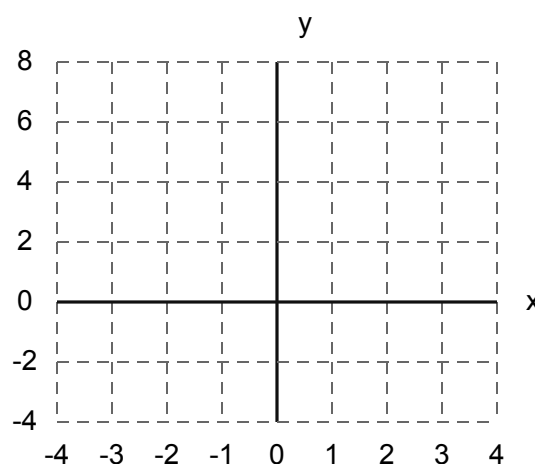
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**2**

A parabolic arch has height  $y = -(x-3)^2 + 9$  feet at horizontal position  $x$  feet, for  $0 \leq x \leq 6$ . Graph only the arch. Give maximum height, span, domain and range.

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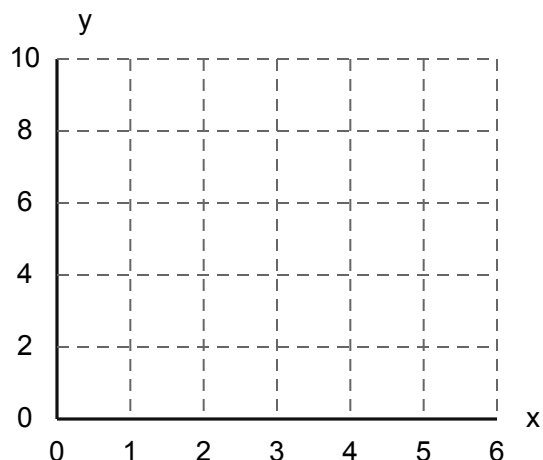
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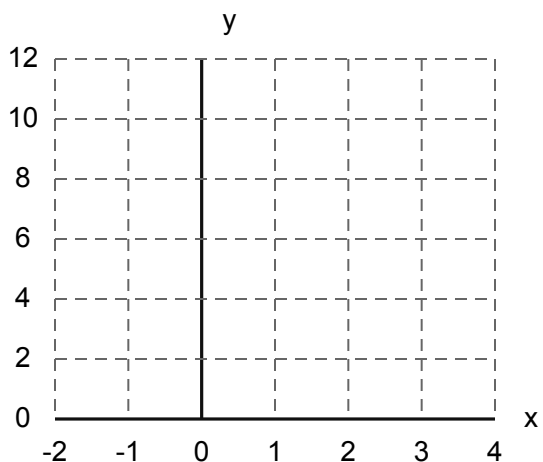
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## CHALLENGE One step up

Graph  $y = 2(x-1)^2$ . Describe its domain, range, zero, symmetry, increasing/decreasing intervals, sign and end behavior. Explain why a single zero does not mean a line.

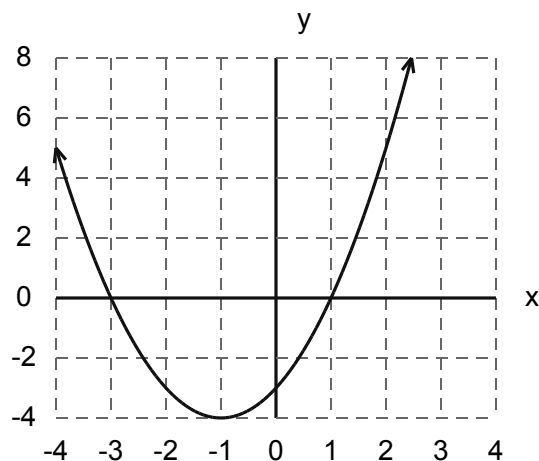
WORK SPACE AND ANSWER



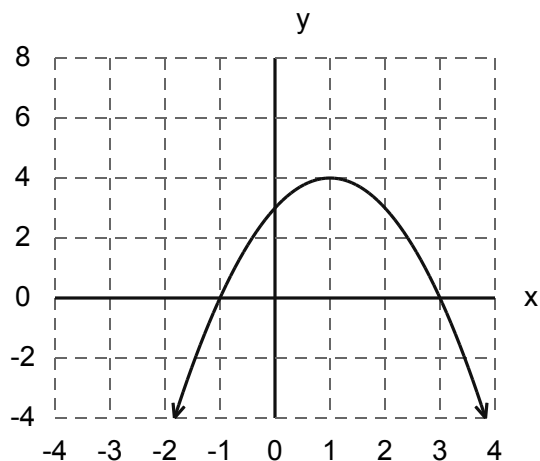
Graphs must be smooth parabolas, not joined straight data segments. Require the requested features; zeros have  $y=0$  and are excluded from strictly positive/negative intervals. For unrestricted functions, domains extend beyond the window. For the arch, use only the given closed domain. R denotes all real numbers.

**PRACTICE 1**

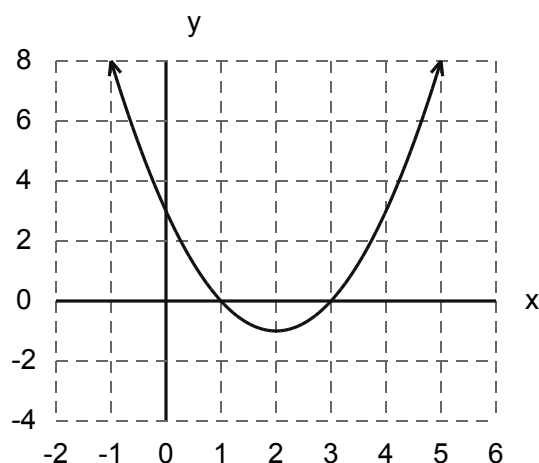
**$V=(-1,-4)$ ; axis  $x=-1$ ; x-intercepts  $(-3,0),(1,0)$ ; y-intercept  $(0,-3)$ ; range  $y \geq -4$ .**

**PRACTICE 2**

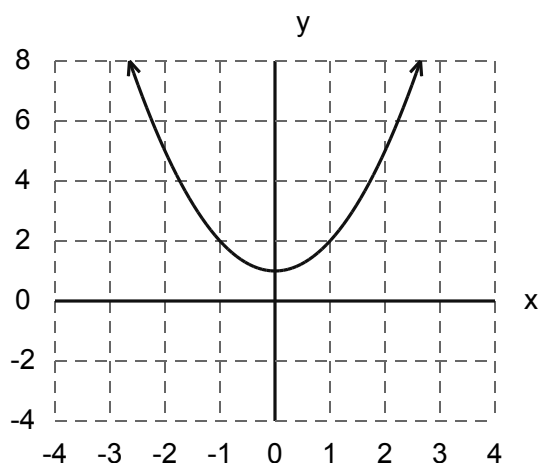
**$V=(1,4)$ ; maximum 4; range  $y \leq 4$ ; increasing  $x < 1$ , decreasing  $x > 1$ .**

**PRACTICE 3**

**Zeros 1,3. Positive:  $x < 1$  or  $x > 3$ ; negative:  $1 < x < 3$ . Both ends rise without bound.**

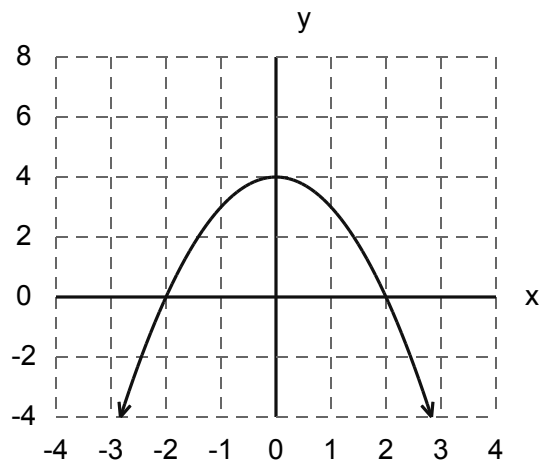
**PRACTICE 4**

**$y=x^2+1$ ; domain R; range  $y \geq 1$ ; no x-intercepts.**



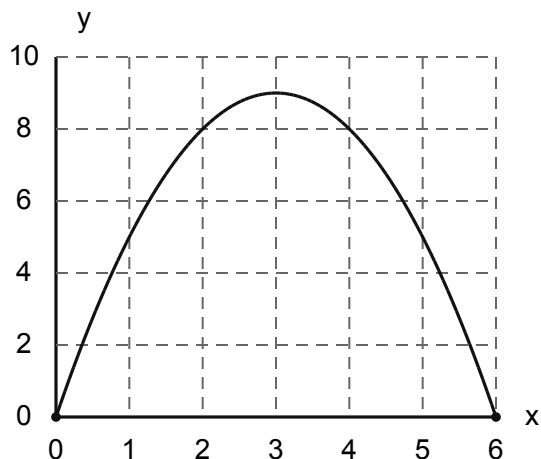
### APPLY IT 1

$y = -x^2 + 4$ ;  $V = (0, 4)$ ; axis  $x = 0$ ; range  $y \leq 4$ .  
Equal outputs surround the maximum at  $x = 0$ .



### APPLY IT 2

Maximum 9 ft at  $x = 3$ ; span 6 ft;  $0 \leq x \leq 6$  and  $0 \leq y \leq 9$ .  
Its bases are  $(0, 0)$ ,  $(6, 0)$ ; the arch ends there.



### CHALLENGE

$D = \mathbb{R}$ ;  $y \geq 0$ ; zero 1; axis  $x = 1$ . Decreasing  $x < 1$ , increasing  $x > 1$ . Positive except at 1; never negative. Both ends rise.  
Its curved graph touches the  $x$ -axis only at its vertex.

