

Algebra 1 - Graphing Quadratic Functions and Transformations - Answer Key

Common Core F-IF.C.7a, F-IF.C.8a, F-BF.B.3, A-SSE.B.3b · maths-pdf.fr/en/

Here are full solutions for the quadratic functions worksheet. Read each step, not just the bold answer, and compare it with your own method. Redo any problem you missed, and note which kind of mistake you made so you can avoid it on the test.

Algebra 1 · Common Core State Standards: **F-IF.C.7a, F-IF.C.8a, F-BF.B.3, A-SSE.B.3b**

Exercise 1 - Read vertex form

Compare with $y = a(x-h)^2 + k$: $a=1, h=2, k=3$.

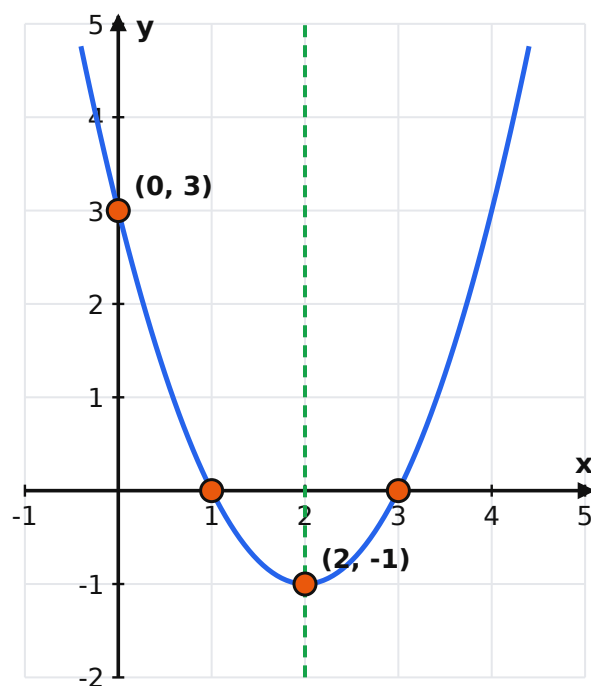
Vertex $(2,3)$; **axis** $x=2$; **opens up**

Exercise 2 - Negative leading coefficient

$x+1 = x - (-1)$, so $h=-1$ and $k=5$. Since $a=-2 < 0$, it opens down.

Vertex $(-1,5)$; **axis** $x=-1$; **opens down; maximum value 5**

Exercise 3 - Graph a quadratic



The graph with its key points.

Axis: $x = -\frac{-4}{2(1)} = 2$. Vertex: $y = 4 - 8 + 3 = -1$, so $(2, -1)$.

y-intercept: $(0, 3)$. x-intercepts: $(x-1)(x-3) = 0$, so 1 and 3.

Vertex $(2, -1)$; intercepts $(1, 0)$, $(3, 0)$, $(0, 3)$

Exercise 4 - Vertex from standard form

$x = -\frac{6}{2(1)} = -3$. Then $y = 9 - 18 + 5 = -4$.

Axis $x = -3$; vertex $(-3, -4)$

Exercise 5 - Zeros and vertex

Factor: $y = -x(x-4)$, so the zeros are 0 and 4.

The vertex is halfway between them at $x = 2$: $y = -4 + 8 = 4$.

Zeros 0 and 4; vertex $(2, 4)$

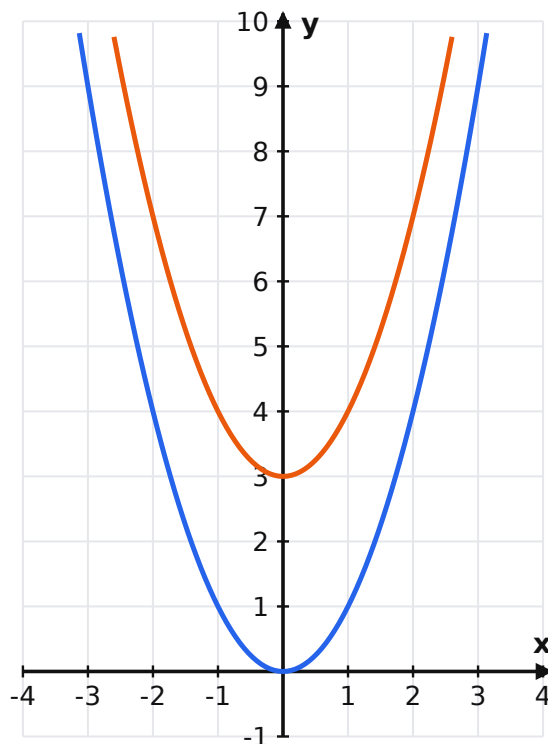
Exercise 6 - Intercepts

y-intercept: $y = -8$ at $(0, -8)$.

Factor: $(x-4)(x+2) = 0$.

$(0, -8)$; $(4, 0)$ and $(-2, 0)$

Exercise 7 - Shift up



Both graphs.

Adding 3 to every output moves each point up 3 units.

Shifted up 3 units; vertex moves from $(0, 0)$ to $(0, 3)$

Exercise 8 - Shift right

Replacing x with $x-4$ shifts the graph to the right by 4. The vertex is $(4, 0)$.

Shifted right 4 units

Exercise 9 - Stretch and reflect

x	x^2	$-x^2$	$3x^2$	$x^2/2$
2	4	-4	12	2

Outputs at $x = 2$.

$y = -x^2$ is reflected over the x -axis (opens down). $y = 3x^2$ is narrower (vertical stretch by 3).
 $y = \frac{1}{2}x^2$ is wider (vertical shrink).

Reflection; narrower; wider

Exercise 10 - Write a transformation

Left 2: replace x with $x+2$. Down 5: subtract 5.

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

Exercise 11 - Complete the square

Take half of 6 and square it: 9. $y = (x^2 + 6x + 9) - 9 + 5$.

$$y = (x+3)^2 - 4; \text{ vertex } (-3, -4)$$

Exercise 12 - Vertex form with a harder constant

Half of -8 is -4 , and its square is 16: $y = (x^2 - 8x + 16) - 16 + 10$.

$$y = (x-4)^2 - 6; \text{ vertex } (4, -6)$$

Exercise 13 - Compare minimum values

The minimum of f is $k=2$. For g : $x=-2$, so $g(-2) = 4 - 8 + 1 = -3$.

f (minimum 2 versus -3)

Exercise 14 - Domain and range

The vertex is at $x=3$: $y=-9+18-5=4$. The parabola opens down.

Domain: all real numbers. Range: $y \leq 4$.

Domain: all real numbers; range $y \leq 4$

Exercise 15 - Symmetric points

x	1	3	5
f(x)	3	-1	3

Equal outputs at 1 and 5.

$$f(1)=1-6+8=3 \text{ and } f(5)=25-30+8=3.$$

Equal outputs at equal distances from 3 mean the axis is $x=3$.

3 and 3; axis $x=3$

Exercise 16 - Ball height

$$\text{Time: } t = -\frac{64}{2(-16)} = 2 \text{ seconds.}$$

$$\text{Height: } h(2) = -16(4) + 64(2) + 5 = -64 + 128 + 5 = 69.$$

At 2 seconds; 69 feet

Exercise 17 - Maximum revenue

$$\text{Price: } p = -\frac{100}{2(-5)} = 10.$$

$$\text{Revenue: } R(10) = -500 + 1000 = 500.$$

\$10; \$500

Exercise 18 - Fence for a pen

$$A = -x^2 + 20x. \text{ Vertex: } x = -\frac{20}{2(-1)} = 10.$$

$$A(10) = 10 \cdot 10 = 100.$$

10 feet by 10 feet; 100 square feet

Exercise 19 - Arch

The vertex is $(6, 4)$, so the greatest height is 4 feet.

Set $y = 0$: $(x - 6)^2 = 36$, so $x - 6 = \pm 6$ and $x = 0$ or $x = 12$.

Height 4 ft; ground at $x = 0$ and $x = 12$

Exercise 20 - Maximum profit

Items must be whole numbers, so test 12 and 13, which are equally close to 12.5.

$$P(12) = -288 + 600 - 100 = 212 \text{ and } P(13) = -338 + 650 - 100 = 212.$$

\$212 with 12 or 13 items

Exercise 21 - Describe all the changes

Start with x^2 . Replace x by $x - 1$ (right 1). Multiply by -2 (stretch by 2 and reflect over the x -axis). Add 3 (up 3).

Right 1, stretch by 2, reflect, up 3; vertex $(1, 3)$