

Graphing Parabolas and Key Features

Grade 9 – Algebra 1 math · Worksheet · Standards: F-IF.C.7a, F-IF.C.8a, F-IF.B.4, A-SSE.B.3b

Name: _____ Date: _____ Class: _____

These 20 problems train standards F-IF.C.7a, F-IF.C.8a, F-IF.B.4 and A-SSE.B.3b. They start with reading features from vertex, standard and factored forms, then complete the square, graph parabolas and compare functions.

The last six problems model a launched ball, a fenced pen and a T-shirt sale, and write equations from given points.

Standards: F-IF.C.7a, F-IF.C.8a, F-IF.B.4, A-SSE.B.3b · **Level:** Grade 9 Algebra 1

Problem 1 Read the Vertex Form, Opening Up (easy)

Look at $y = 2(x - 3)^2 + 5$. Does its parabola open upward or downward? Name the turning point, the mirror line and the lowest or highest value of y .

Problem 2 Read the Vertex Form, Opening Down (easy)

The rule $y = -(x + 4)^2 - 2$ describes a parabola. Decide its direction of opening and name its turning point and its extreme value.

Problem 3 Axis from Standard Form (easy)

Locate the mirror line and the turning point of $y = x^2 - 18x + 50$.

Problem 4 Complete a Table of Values (easy)

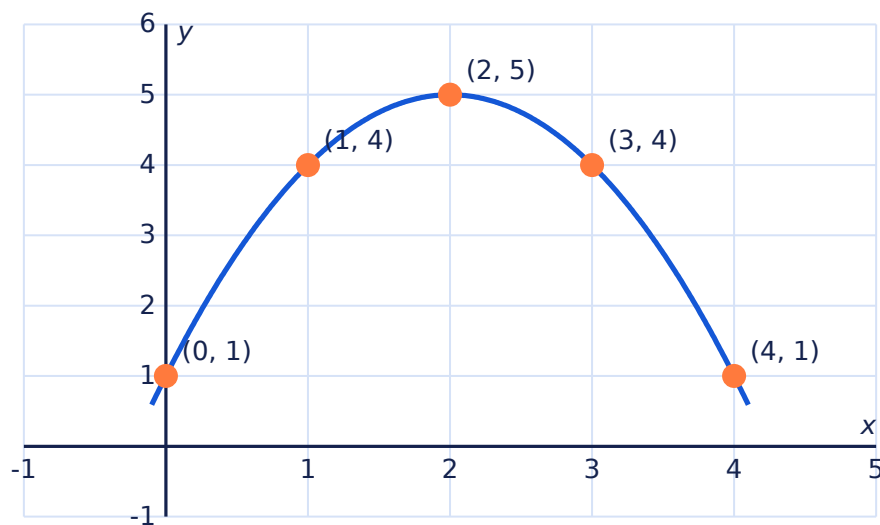
Build a table of values for $y = x^2 - 6x + 5$ using $x = 0, 1, 2, 3, 4, 5, 6$. Use the table to name the turning point and the point on the y -axis.

Problem 5 Read the Factored Form (easy)

The function $y = (x - 2)(x + 6)$ is in factored form. Read off where its graph meets the x -axis, then find the mirror line and the turning point.

Problem 6 Read a Parabola Graph (easy)

Study the parabola drawn below. Give its highest point, its mirror line, its largest y-value and where it meets the y-axis.



Points on a parabola.

Problem 7 Vertex Form to Standard Form (medium)

Write $y = 3(x - 1)^2 - 4$ in standard form.

Problem 8 Vertex of a Downward Parabola (medium)

Find the highest point of the parabola $y = -2x^2 + 12x - 7$ and state its greatest y-value.

Problem 9 Complete the Square, Easy Case (medium)

Rewrite $y = x^2 + 10x + 16$ as $y = a(x - h)^2 + k$ and read the turning point. Then find where the graph meets the x-axis.

Problem 10 Completing the Square, No Zeros (medium)

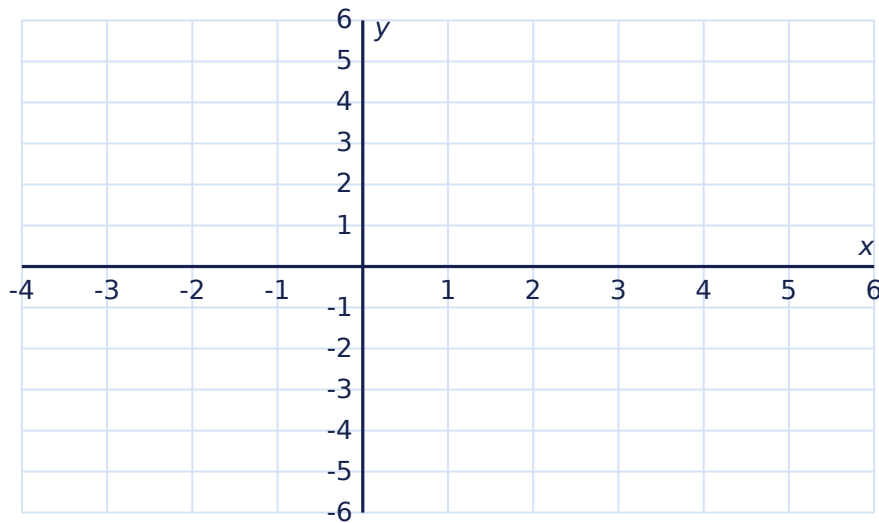
Rewrite $y = x^2 - 8x + 19$ as a square plus a constant. Explain why its graph stays above the x-axis.

Problem 11 Completing the Square, a = 2 (medium)

Complete the square for $y = 2x^2 - 12x + 13$ and name the turning point.

Problem 12 Graph from Zeros and Vertex (medium)

Sketch $y = x^2 - 2x - 3$ on the grid. Before plotting, find where it meets each axis and where it turns.



Grid for graphing.

Problem 13 Vertex from Factored Form (medium)

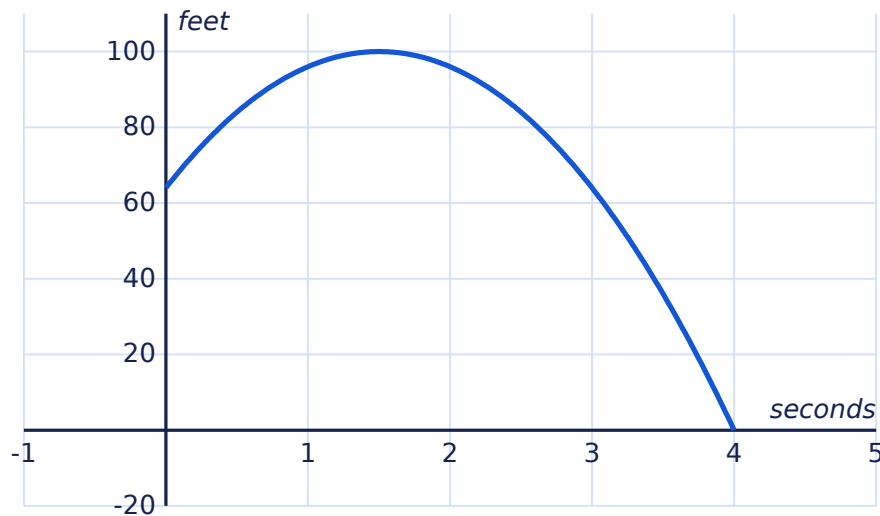
Where does $y = -2(x + 1)(x - 5)$ turn? Decide whether that point is a maximum or a minimum.

Problem 14 Compare Three Parabolas (medium)

Compare the graphs of $y = x^2$, $y = 3x^2$ and $y = -0.5x^2$. Which is narrowest, which opens down and which is widest?

Problem 15 Ball Launched from a Roof (hard)

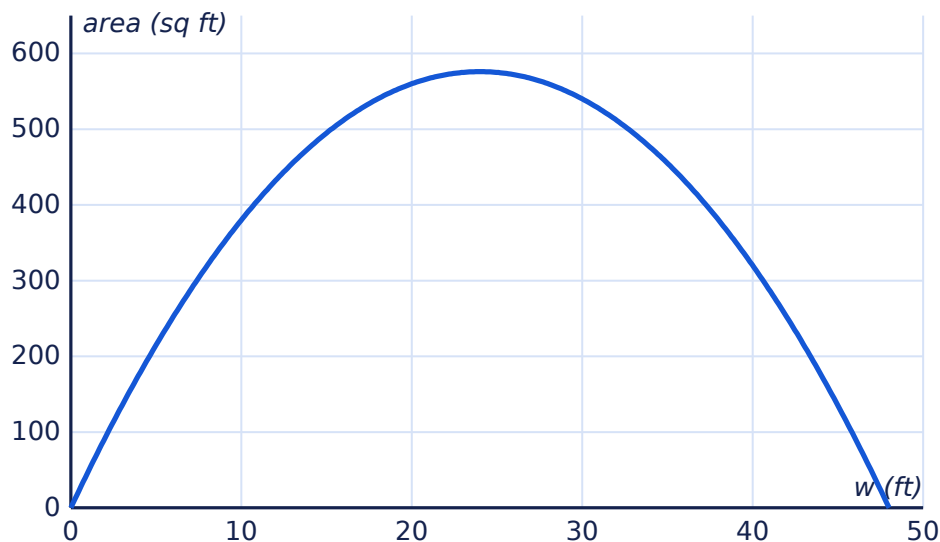
From a rooftop, a water balloon is tossed upward. After t seconds its height is $h(t) = -16t^2 + 48t + 64$ feet. Find where it starts, how high it climbs and when it lands.



Height of a launched ball.

Problem 16 Largest Rectangular Pen (hard)

Dana encloses a rectangular dog run with 96 feet of fence. With width w , the enclosed area is $A(w) = w(48 - w)$. Which width encloses the most ground, and how much is that?



Area of a rectangle with perimeter 96 feet.

Problem 17 Best Ticket Price (hard)

A drama club sells T-shirts at p dollars each and takes in $R(p) = p(250 - 5p)$ dollars. Which price brings in the most money? How much is that, and at which prices does the club take in nothing?

Problem 18 Equation from Vertex and a Point (hard)

A parabola turns at $(-1, 6)$ and also contains the point $(2, -3)$. Express it as $y = a(x - h)^2 + k$

and then in standard form.

Problem 19 Equation from Zeros and a Point (hard)

A parabola meets the x -axis at -2 and 4 and contains the point $(0, -16)$. Give its equation in the form $y = a(x - p)(x - q)$.

Problem 20 Compare Two Quadratic Functions (hard)

Let $f(x) = x^2 - 6x + 11$. A second function g has the table below.

x	-1	0	1	2	3
$g(x)$	9	3	1	3	9

Which of the two functions dips lower, and at which x does each reach its lowest point?