Name: _____ Date: _____

CURVE SKETCHING QUADRATIC GRAPHS
ALGEBRA 2 WITH TRIGONOMETRY

We have now seen algebraic methods for finding important features of any quadratic, namely the *x*-intercepts and the *y*-intercept. Along with the turning point, whose formula is given below, these features allow a student to create a curve sketch, i.e. a graph that is not exact, but shows the most important properties of the function.

TURNING POINT FORMULA

For any quadratic function of the form $f(x) = ax^2 + bx + c$ the turning point occurs at $\left(\frac{-b}{2a},\ f\left(\frac{-b}{2a}\right)\right)$.

***Exercise* #1:** Consider the simple quadratic function $y = x^2 + 4x - 45$.

(a) Determine the *y*-intercept of this function algebraically. Show work to justify your response.

(b) Determine the *x*-intercepts of this function algebraically. Show work to justify your response.

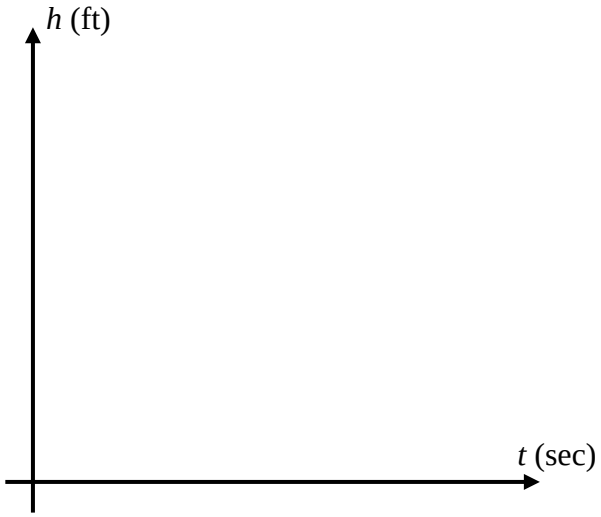
(c) Find the turning point of the quadratic algebraically. Show the calculations that lead to your answer.

(d) Sketch the graph of the quadratic below. Label all the points you found in the above parts.

***Exercise* #2:** Given the quadratic function $y = -2x^2 + 16x + 40$, determine the intercepts and turning point algebraically. Then create a sketch of the parabola to the right. Clearly label all of your work.

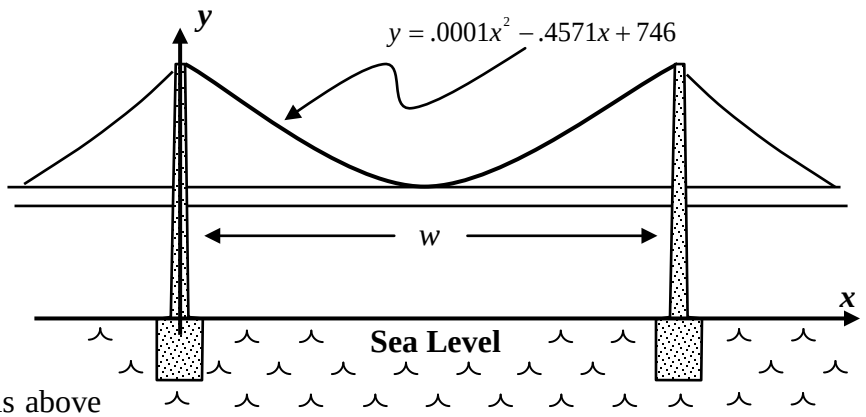
Quadratics arise in many applied settings, especially in the context of **projectile motion** or the motion of an object moving in space. Being able to curve sketch is essential when solving these types of applied problems.

***Exercise* #3:** An object is fired upward from the ground with an initial velocity of 88 feet per second. Its height, in feet above the ground, as a function of time, in seconds, is given by $h = -16t^2 + 88t$. Sketch a graph of this object's height for all times, $t \geq 0$, at which $h \geq 0$. Label the object's maximum height, the time it reaches this height, and the time at which it returns to the ground.



***Exercise* #4:** An engineering class models the height of a suspension cable using the equation $y = .0001x^2 - .4571x + 746$, where y represents the height, in feet, of the cable above sea level and x represents the horizontal distance, in feet, from the left-most main tower.

(a) Assuming the turning point is at the midpoint of the stretch connecting the towers, how wide, w, is the bridge between the two towers?



(b) What is the minimum distance the cable is above sea level? Round your answer to the nearest foot.

(c) How high does the cable start above sea level?

Name: _____ Date: _____

CURVE SKETCHING OF QUADRATICS
ALGEBRA 2 WITH TRIGONOMETRY - HOMEWORK

SKILLS

1. Consider the quadratic function whose equation is $y = x^2 + 6x - 27$. Show work to justify all answers.

   (a) Determine this quadratic's *y*-intercept algebraically.

   (b) Determine this quadratic's *x*-intercepts algebraically.

   (c) Find the turning point of this quadratic algebraically. Show work to justify your answer.

   (d) Sketch a graph of the quadratic below labeling all intercepts and turning points.

2. Given the quadratic function $y = -2x^2 - 5x + 25$, determine the intercepts and turning point algebraically. Then create a sketch of the parabola below. Clearly label all of your work.

APPLICATIONS

3. Physics students fired a ball off of the top of a building and tracked its height above the ground. They then modeled the height, in meters, above the ground as a function of time, in seconds, since it was fired. The equation they determined was $h(t) = -10t^2 + 15t + 25$.

   (a) Calculate $h(0)$ with proper units. What does this quantity represent about the height of this ball?

   (b) Algebraically determine the greatest height the ball reaches and the time it reaches this height. Show work to justify your answer.

   (c) Algebraically determine the time when the object hits the ground. Show work to justify.

   (d) Sketch a graph of the ball's height versus time for the time that it is in the air.

REASONING

4. Consider the quadratic function whose equation is $y = x^2 - 14x + 24$.

   (a) Determine the *x*-intercepts of this quadratic.

   (b) Using $x = -\frac{b}{2a}$, determine the axis of symmetry of this quadratic.

   (c) How could you use your answers in (a) to calculate (b) without using $x = -\frac{b}{2a}$?

   (d) If the sum of the intercepts (roots) of a quadratic is equal to 8, what is the equation for its axis of symmetry?