

Before we begin, are there any questions from last day's work?

Today's Learning Goal(s):

By the end of the class, I will be able to:

- a) apply the skills learned so far to "real world" applications of quadratic relations.

MBF 3CI

4.5 Interpret Graphs of Quadratic Relations

Date: Apr. 19, 2017

Ex.1: A football player kicks a football held 0.5 m above the ground.
The football reaches a maximum height of 36.5 m,
at a horizontal distance of 18 m from the player.



- a) Determine the equation of a quadratic relation that models the path of the ball.
b) At what horizontal distance from the kicker does the football hit the ground? (round to 2 decimals)

Solution

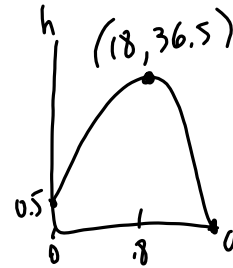
- a) Let y represent the height of the ball above the ground, in m.
Let x represent the horizontal distance from the kicker, in m.
Recall: the equation in vertex form is: $y = a(x - h)^2 + k$
 \therefore the maximum height of the ball is 36.5 m
 \therefore the vertex for the parabola must be (18, 36.5)
so, the new equation is $y = a(x - 18)^2 + 36.5$

What else do we know about this situation?

When the kicker is still holding the ball, it is 0 m away from him,
and 0.5 m above the ground.

(0, 0.5) is a point we can substitute into our "family" equation.

$$\begin{aligned} (x, y) \quad 0.5 &= a(0 - 18)^2 + 36.5 \\ 0.5 &= a(-18)^2 + 36.5 \\ 0.5 &= 324a + 36.5 \\ 0.5 - 36.5 &= 324a \\ \frac{-36}{324} &= \frac{324a}{324} \\ -\frac{1}{9} &= a \\ \therefore y &= -\frac{1}{9}(x - 18)^2 + 36.5 \\ &\text{is the equation.} \end{aligned}$$



- b) ball hits ground
when $y = 0$ (height = 0)

$$\begin{aligned} 0 &= -\frac{1}{9}(x - 18)^2 + 36.5 \\ -36.5 &= -\frac{1}{9}(x - 18)^2 \\ 9(-36.5) &= 9\left(-\frac{1}{9}(x - 18)^2\right) \\ \sqrt{328.5} &= \sqrt{(x - 18)^2} \\ 18.124 &= x - 18 \\ 18.12 + 18 &= x \\ 36.12 &= x \end{aligned}$$

the ball hits the ground 36.12 m from the kicker.

Students must copy these on the back of the handout.

Ex. 2: Find the y-intercept of each relation: For y-intercept, always set $x = 0$.

a) $y = -7x^2 + 3x - 6$

$$\begin{aligned} y &= -7(0)^2 + 3(0) - 6 \\ &= -6 \end{aligned}$$

b) $y = -4(x+2)^2 - 11$

$$\begin{aligned} y &= -4(0+2)^2 - 11 \\ y &= -4(2)^2 - 11 \\ &= -4(4) - 11 \\ &= -16 - 11 \\ &= -27 \end{aligned}$$

c) $y = -1.1(x-3)^2 + 9.9$

$$\begin{aligned} y &= -1.1(0-3)^2 + 9.9 \\ &= -1.1(-3)^2 + 9.9 \\ &= -1.1(9) + 9.9 \\ &= -9.9 + 9.9 \\ &= 0 \end{aligned}$$

Entertainment: p. 216 #9abc

(also on unit outline) pp. 222-225 #1aceg, 2ab, 4, 5
(use graph paper for #5), 7
p. 228 #9