

### 3.5 Word Problems – Vertex Form

- The equation  $h = -0.025(d - 20)^2 + 10$  shows the height of a soccer ball,  $h$  meters in relation to its horizontal distance,  $d$  meters the ball travels until it hits the ground. The ball is kicked when it is on the ground.
  - What is the maximum height of the ball?
  - What is the horizontal distance of the ball from the kicker when it reaches its maximum height?
  - What is the height of the ball when it is 10 m horizontally from the kicker?
  - At what other horizontal distance from the kicker is the ball at the same height?
  - If the player was 34 m away from the kicker and positioned under the ball, would they be able to head the ball? Explain.
- A touch football quarterback passed the ball to a receiver 40 m downfield. The path of the ball can be modelled by the following equation  $h = -0.01(d - 20)^2 + 6$ .
  - What was the maximum height of the ball?
  - What was the horizontal distance of the ball from the quarterback when it reached its maximum height?
  - What was the height of the ball when it was thrown?
- The path of a firework is described by the equation:  $h = -4.9(d - 5)^2 + 124$ , where  $h$  is the height of the firework, in meters, and  $t$  is the time in seconds since the launch.
  - Sketch the pathway of the firework. Is it launched from the ground or a platform??
  - Determine the maximum height of the firework.
  - How many seconds does it take for the firework to reach the maximum height.
  - Determine the height 3.5 seconds after the firework is launched.
- The Gateway arch in St. Louis has a shape that approximates a parabola. The curve can be modelled by the following equation:  $h = -0.02d^2 + 192$ , where  $h$  is the height in meters and  $d$  is the horizontal distance from the center of the arch.
  - Sketch and label a graph of the arch.
  - Determine the maximum height of the arch.
  - Determine the height of the arch 20 m from the centre.
  - Determine the overall width of the arch. \*Challenge\*

Answers: 1a) 10m b) 20m c) 7.5m d) 30m from kicker e) 5.1m 2a) 6m b) 20m c) 2m  
3b) 124m c) 5s d) ~113m 4b) 192m c) 184m d) ~196m