

Modelling Quadratic Functions

1. Using Desmos, graph the following functions. For each, state the domain and range.

a) $y = 2(x - 4)^2 + 3$

b) $y = -0.4(x + 3)^2 + 9$

$D: \{x \in \mathbb{R}\}$

$R: \{y \in \mathbb{R} \mid 3 \leq y\}$

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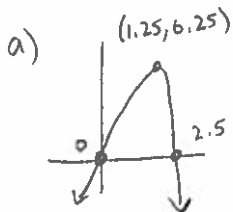
$R: \{y \in \mathbb{R} \mid y \leq 9\}$

2. The path of a soccer ball is given by $y = -4x^2 + 10x$, where x is the time the since the ball is kicked, and y is the height of the ball above the ground in metres.

a) Graph the function.

b) Find the zeros, vertex, and y -intercept, and explain what their coordinates tell you in terms of the problem.

c) State the domain and range for this function.



b) $(0, 0), (2.5, 0)$

↑
soccer ball starts on the ground

↑
lands again after 2.5 sec

$V(1.25, 6.25)$

After 1.25 sec, the ball reaches a maximum height of 6.25 m

c) $D: \{x \in \mathbb{R} \mid 0 \leq x \leq 2.5\}$

↑
time can't be negative

↑
once it lands the problem is over

$R: \{y \in \mathbb{R} \mid 0 \leq y \leq 6.25\}$

↑
can't have negative heights

3. Amy dives off a springboard. Her height above the surface of the water, y , in meters, is related to her horizontal distance from the end of the board, x , in meters, by the function $y = -x^2 + 3x + 4$.

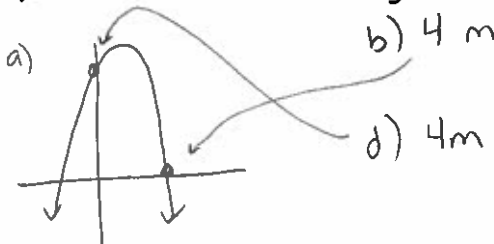
a) Graph the function.

b) How far from the board does Amy land?

c) What is the maximum height that Amy reaches? How far from the board is she at this point?

d) When Amy first steps onto the board, how high above the water is she?

e) State the domain and range.



b) 4 m

d) 4 m

c) 6.25 m and is 1.5 m from the board

e) $D: \{x \in \mathbb{R} \mid 0 \leq x \leq 4\}$

$R: \{y \in \mathbb{R} \mid 0 \leq y \leq 6.25\}$

4. Alex is tossing pinecones from the side of an old quarry. The pinecones fall into the water-filled hole below. The height, in meters, of the pinecone above the surface of the water is approximately given by $h(t) = -5t^2 + 15t + 20$, where t is the time in seconds since Alex tossed the pinecone.

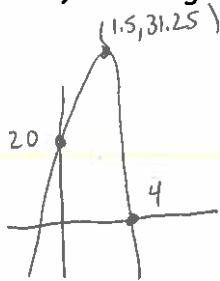
a) Graph the function.

b) Determine the zeros and explain what they mean.

c) What is the maximum height reached by the pinecone?

d) Determine the height of the pinecone after 1 second.

e) How long is the pinecone above 21 meters?



b) $(4, 0)$ - when the pinecone hits the water
 $(-1, 0)$ - a theoretical time (-1 sec) which is inadmissible

c) 31.25 m

d) $x = 1$, $h(1) = 30$ m

e) $y = 21$ from 0.068 to 2.932 sec
 which is $2.932 - 0.068$
 $= 2.864$ sec