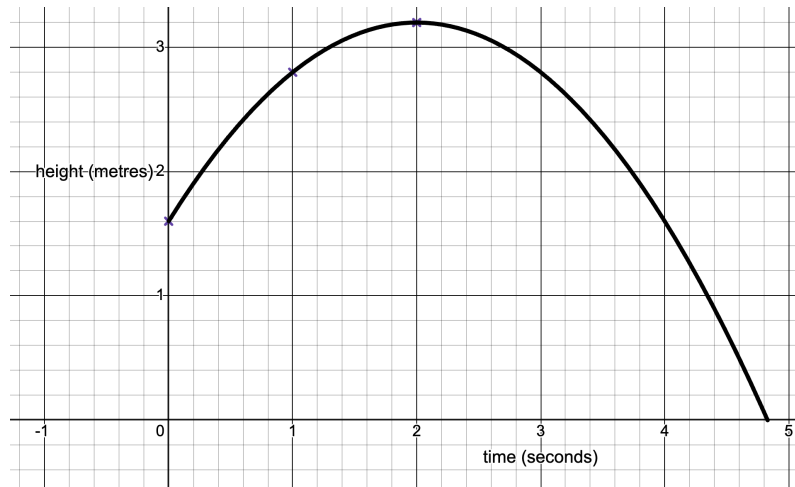




Modelling functions: quadratics and cubics

Name.....

1. A basketball player takes a video of her shot. She measures the height of the ball in metres over time in seconds. She gets the following graph:



The basketball passes through the following coordinates:

$$A(0,1.6), \quad B(1,2.8), \quad C(2,3.2)$$

- (a) How high was the basketball when she initially took the shot?

$$1.6m$$

- (b) The motion of the ball can be modelled by the equation $h = at^2 + bt + c$. Find an equation for the height of the basketball, h in terms of time t .

$$\begin{aligned} 1.6 &= c \\ 2.8 &= a + b + 1.6 \\ 3.2 &= 4a + 2b + 1.6 \\ a + b &= 1.2 \\ 4a + 2b &= 1.6 \\ h &= -0.4t^2 + 1.6t + 1.6 \end{aligned}$$

- (c) What was the maximum height reached by the basketball?

$$3.2m$$



(d) After how many seconds had the basketball hit the floor?

4.83 s

(e) State an appropriate domain for this model.

$0 \leq t \leq 4.83$

2. A baseball player throws a ball and finds that the vertical, y and horizontal distance, x in metres travelled from an origin $(0,0)$ can be given by: $y = -0.3375x^2 + 4.025x + 1.3$.

(a) Find the maximum height reached by the ball.

13.3m

(b) Find the distance travelled by the ball when it hits the floor.

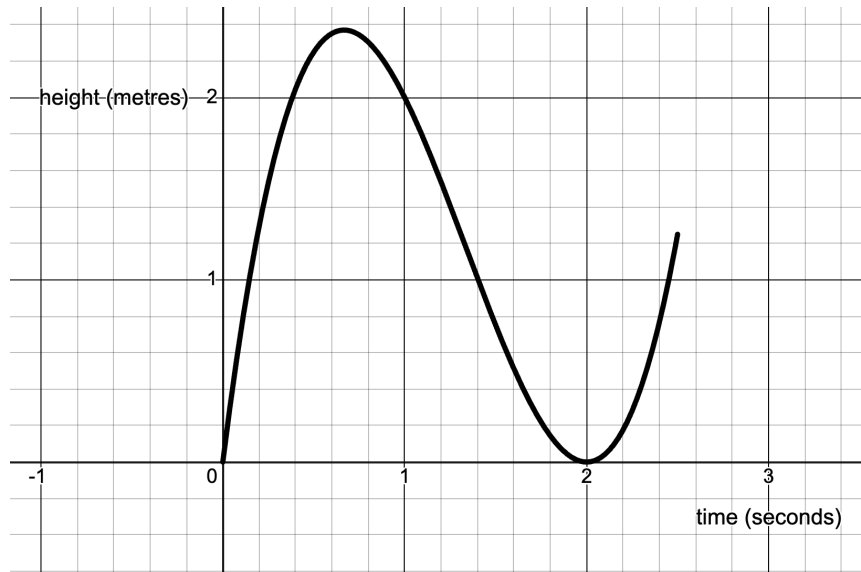
12.2s

(c) State an appropriate domain for this model.

$0 \leq t \leq 12.2$



3. A ball is thrown in the air and its height, h in metres is measured over time t , for the first 2.5 seconds. The motion of the ball can be modelled by the equation $h = at^3 - bt^2 + ct$. This is shown below:



The ball passes through the following points $A(1, 2)$, $B(1.5, 0.75)$, $C(1.8, 0.144)$.

- (a) Find an equation for the height of the ball, h in terms of time t .

$$2 = a - b + c$$

$$0.75 = 3.375a + 2.25b + 1.5c$$

$$0.144 = 8.832a + 3.24b + 1.8c$$

$$h = 2t^3 - 8t^2 + 8t$$

- (b) What was the maximum height reached by the ball?

$$2.37m$$

- (c) Explain what is happening to the ball when $t = 2$.

It is hitting the ground (and bouncing)

- (d) After how many seconds was the ball 1 metre high?

$$2t^3 - 8t^2 + 8t = 1$$

$$0.145, 1.40, 2.45$$



(e) Why is it not appropriate to use this model to predict the height of the ball after 4 seconds?

A bouncing ball will not keep rising forever – it will fall back to the ground

4. The height, h of a javelin above the ground in metres after t seconds is given by:
 $h = -4.5t^2 + 9t + 1.7$.

(a) What is the initial height of the javelin?

1.7m

(b) After how many seconds has the javelin reached its maximum height?

1s

(c) When does the javelin first reach 5 metres in height?

0.484s

(d) After how many seconds does the javelin hit the ground?

2.17s