



## Year 10 Mathematics Problem Solver Clash of the High Diving Clowns

Name: \_\_\_\_\_

Time Allowed 45 Minutes

With CAS Calculator



### High Diving Clowns

At the circus Jack Splash and Billy Bomb are two high diving clowns.

Jack Splash must climb a vertical ladder to the platform, walk out to the edge of the platform and then perform his dive into a small tank of water below.



The height of the Jack Splash path over time can be modelled by the following equation:

$$H_1 = -t^2 + 5t + 3 \quad 0 \leq t \leq 5.54$$

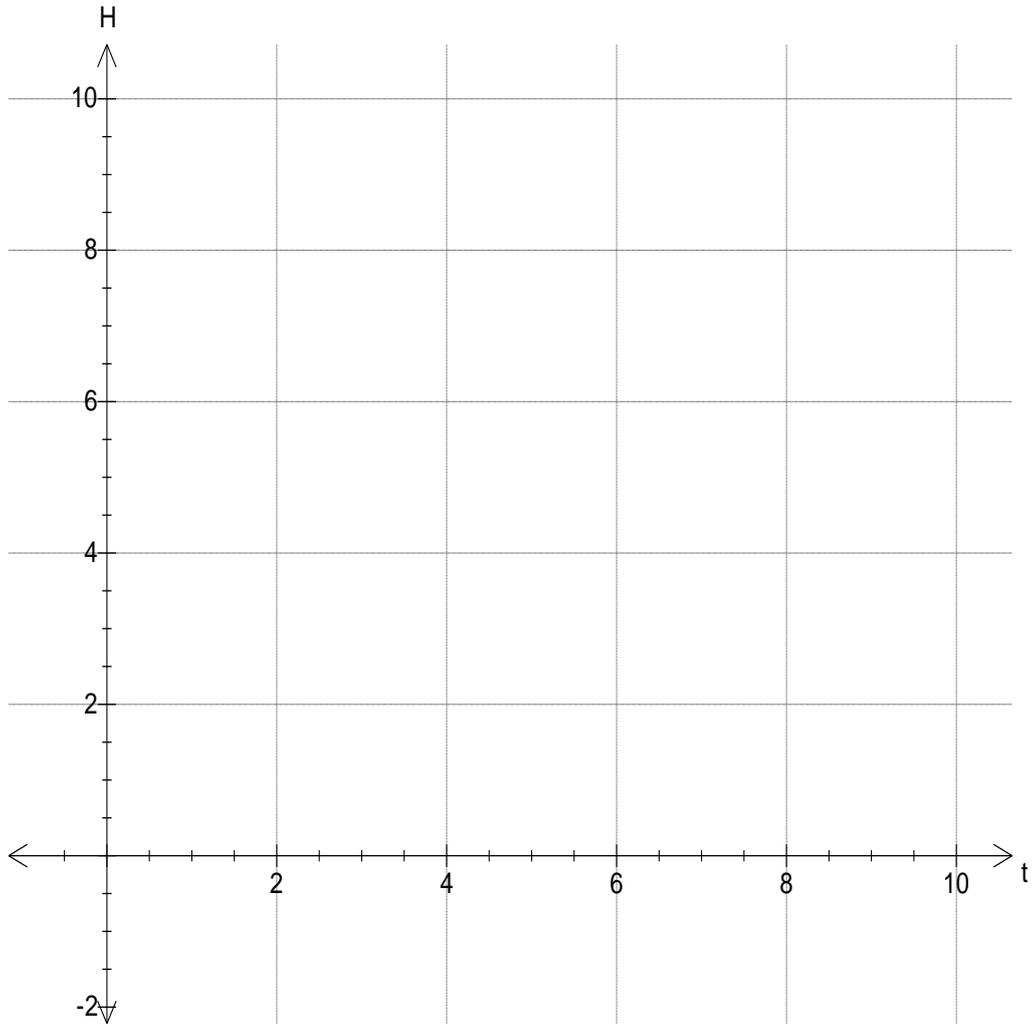
where  $H_1$  represents the height in metres above the ground and  $t$  represents time in seconds. Assume  $t = 0$  is the time when the clown is standing on the platform about to dive.

1. Complete the table of values below.

$t$	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5
$H_1$	3			8.25			9				3	0.25

(1 mark)

2. Plot these values on the co-ordinate axes below and sketch the path Jack Splash would follow.



(2 marks)

Billy Bomb, a second clown, climbs a different ladder and dives off a different platform.

Billy's height over time can be modelled by the following equation:

$$H_2 = -2t^2 + 4t + 6 \quad 0 \leq t \leq 3$$

where  $H_2$  represents the height in metres above the ground and  $t$  represents time in seconds. Assume  $t = 0$  is the time when the clown is standing on the platform about to dive.

3. What is the height (relative to the ground) of the diving platform where Billy starts his daredevil act?

(2 marks)

4. Use your CAS calculator to express  $H_2 = -2t^2 + 4t + 6$  in the turning point form.

(1 mark)

5. Use the turning point form of the equation  $H_2 = -2t^2 + 4t + 6$  to find:

(a) the maximum height (relative to the ground) that Billy Bomb will reach during his dive.

(1 mark)

(b) how long it will take Billy to reach this maximum height?

(1 mark)

6. How long will it take for Billy to splash into the water tank on the ground?

(2 marks)

7. Use your CAS calculator to graph this function ( $H_2$ ). Then sketch the graph below, labelling all the important features with their co-ordinates.

(2 marks)

8. After reaching the maximum height, how long does it take Billy to fall to a height of 6 metres ? (Show your method).

(2 marks)

9. How long does it take Billy to fall from 6 metres to the water ?

(2 marks)

10. What do you notice about these times? Hint: use symmetry properties of a parabola.

(1 mark)

11. What can you conclude about falling objects based on these observations? Support your conclusion with appropriate reasoning.

(2 marks)

12. If the two clowns dive off their platforms at the same time, will there be a time when they are at the same height? If so, find the time and the height when this occurs. Round your answers to 2 decimal places.

(3 marks)