



Year 10 Mathematics Problem Solver Clash of the High Diving Clowns

This problem solving activity is designed to be taken under test conditions. However, it can be easily adjusted as a learning task to do in class with students, in groups or in pairs with a follow up discussion.

Time: 45 Minutes.

High Diving Clowns

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

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

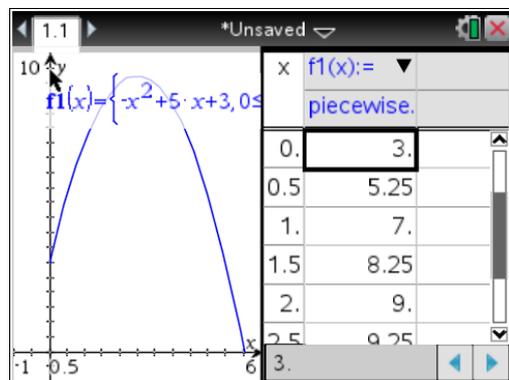
where H_1 represents the height in metres above the ground and t represents time in seconds. Assume $t = 0$ is the time when the clown is standing on the platform about to dive.

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	5.25	7	8.25	9	9.25	9	8.25	7	5.25	3	0.25

A1 for correct values

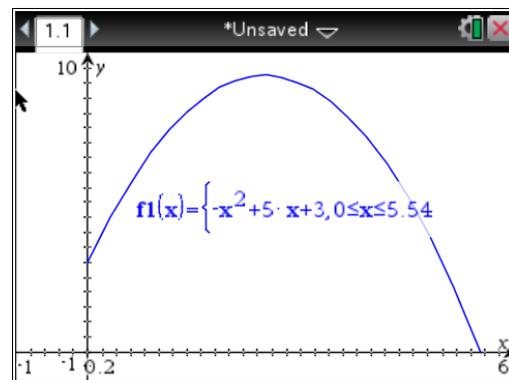
Using the table feature on TI Nspire and adjusting Table settings Table steps 0.5



Note: students may need to be reminded that to sketch graph we need to use x not t .

Alternatively, students may use the

Use ctrl T to insert Table and then ctrl T again to remove it.

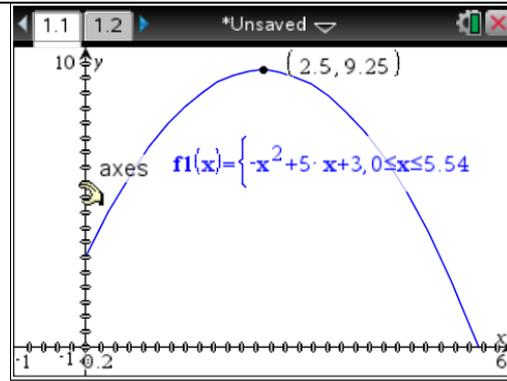


Students need to adjust the viewing window to see the graph.

spread sheet as follows:

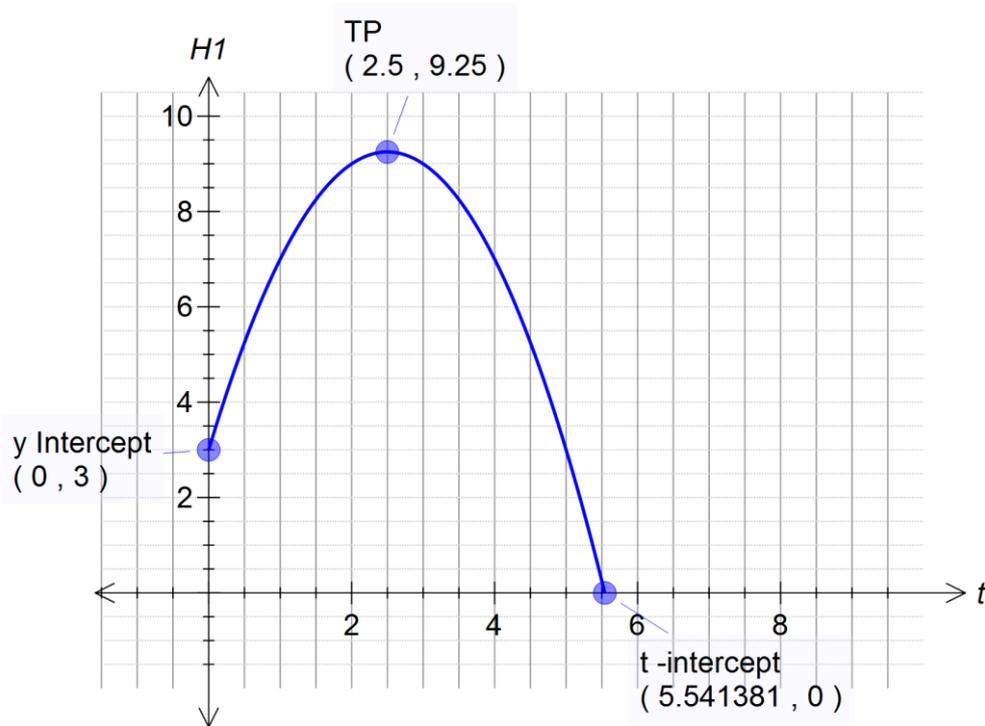
time	height
	=time^2+
1	0
2	0.5
3	1.
4	1.5
5	2.

B height: =-time²+5·time+3



Plot these values on the co-ordinate axes below and sketch the path Jack Splash

would follow.



A1 shape

A1 TP coordinates and axes intercepts

(2 marks)

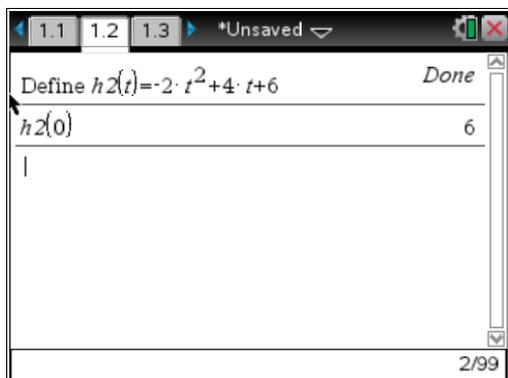
Billy Bomb, a second clown, climbs a different ladder and dives off a different platform.

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.

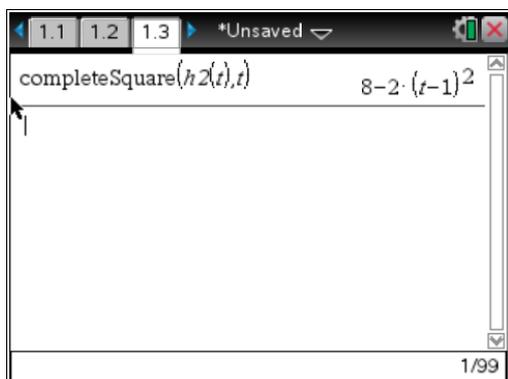
2. What is the height (relative to the ground) of the diving platform where Billy starts his daredevil act?



6 metres M1A1

(2 marks)

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



$$H_2 = 8 - 2(t - 1)^2 \quad \text{A1}$$

4. 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.

8 metres A1

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

1 second A1

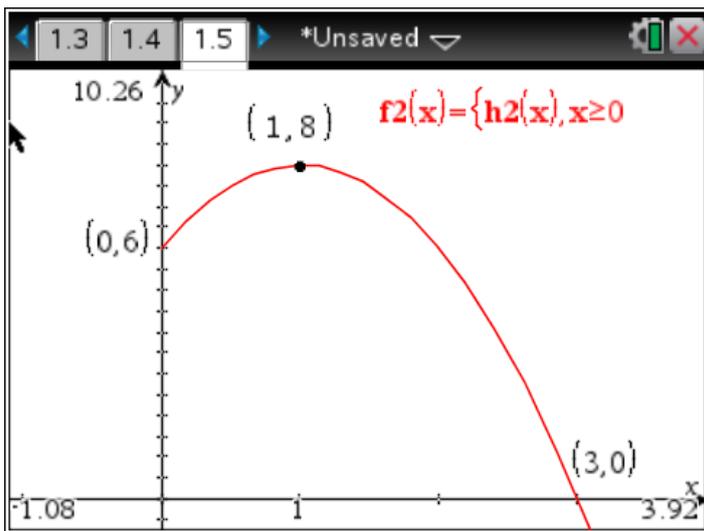
5. How long will it take for Billy to splash into the water tank on the ground?



3 seconds M1A1

(2 marks)

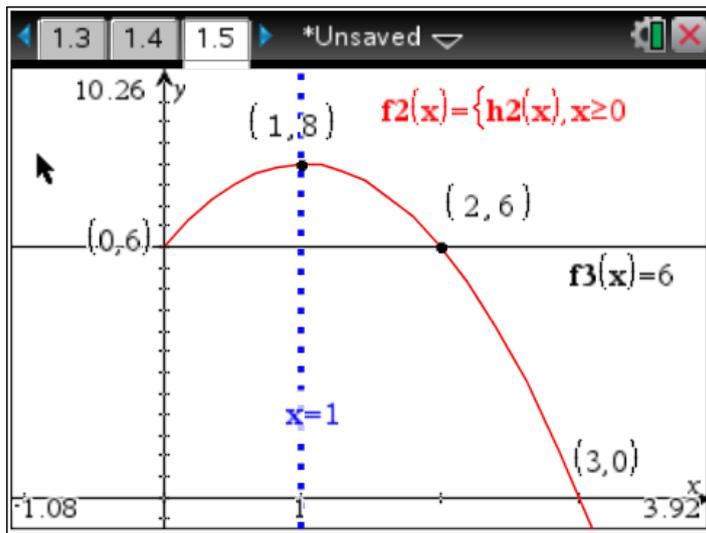
6. Use your CAS calculator to graph this function (H_2). Then sketch the graph below, labelling all the important features with their co-ordinates.



Shape A1

TP and axes intercepts A1

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



1 second M1A1

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

1 second M1A1

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

The times are the same A1

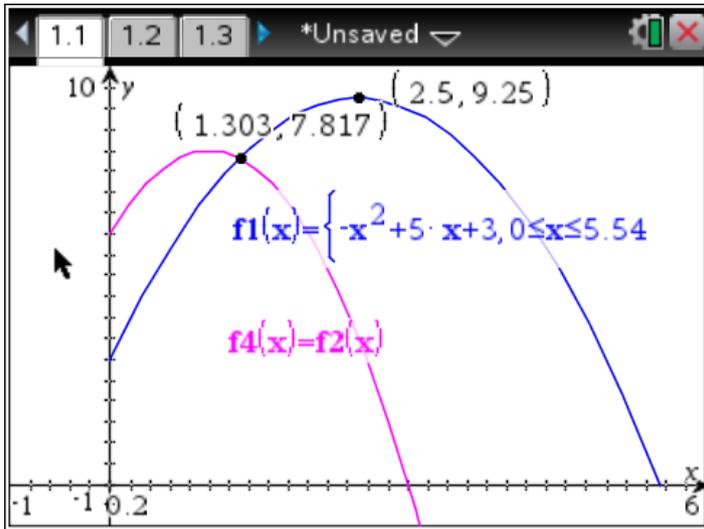
10. What can you conclude about falling objects based on these observations? Support your conclusion with appropriate reasoning.

The speed of falling objects increases the further they fall. R1

The clown took 1 second to fall the first 2 metres and then 1 second to fall a further 6 metres. R1

11. 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.

M1 graphically or algebraically using solve:



time = 1.30 sec A1

height = 7.82 seconds A1

