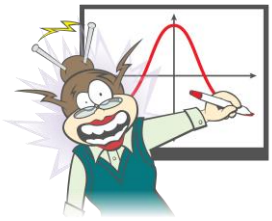
Kinematics worksheet



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Each of the questions included here can be solved using the TI-Nspire CX CAS.

Question 1

An object is dropped from the top of a 150-metre high building. If the acceleration due to gravity is 9.8 m/s², what will be the height of the object after 5 seconds?
Assume motion at a constant acceleration.

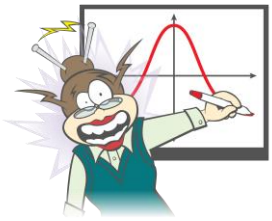
Response:

Question 2

A particle moves in a straight line, and at time t its displacement from a fixed origin is x and its velocity is v.

If $\ddot{x} = \frac{1}{2}(v^2 - 1)$ and $v = 2$ when $x = 0$, find v in terms of x.

Response:



Question 3

At the same time as a car travelling at 20 m/s passes a certain point, a second car starts from rest at that point and accelerates uniformly in pursuit of the first car until it reaches 30 m/s after 20 seconds. This speed is then maintained. Find the time taken for the second car to overtake the first car.

Response:

Question 4

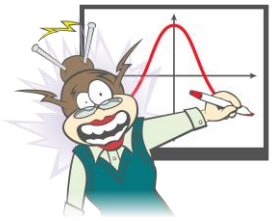
The velocity, v m/s, of a particle at time t seconds $(t \geq 0)$ is given by:

$$v = \begin{cases} \sqrt{100 - t^2}, & 0 \leq t \leq 10 \\ 10 - t, & t > 10 \end{cases}$$

If the particle starts at the origin, the time at which it returns to the origin, in seconds, is:

A 12.5 B. 22.5 C. 32.5 D. 38.2 E. 42.5

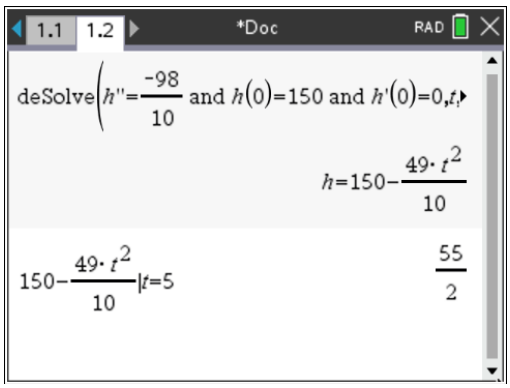
Response:



Answers

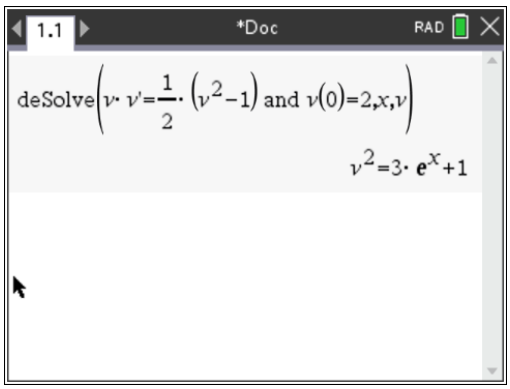
Question 1

Answer: $\frac{55}{2}$ metres.

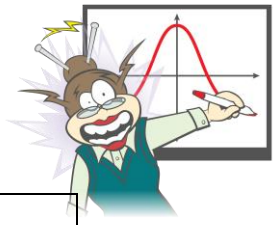


Question 2

Answer: $v = \sqrt{3e^x + 1}$



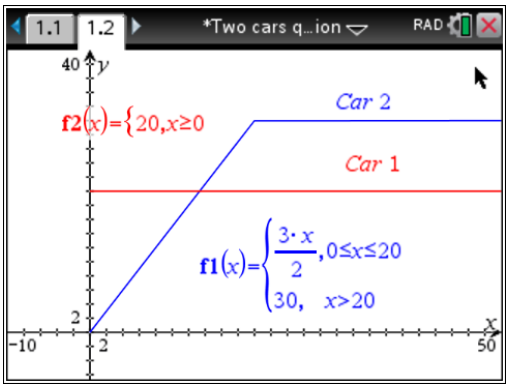
Select a positive square root to fulfil the initial condition.



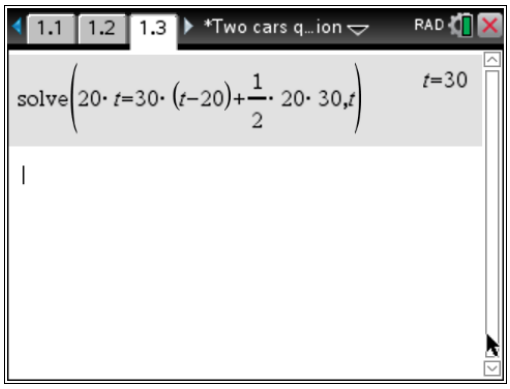
Question 3

Answer: 600 seconds

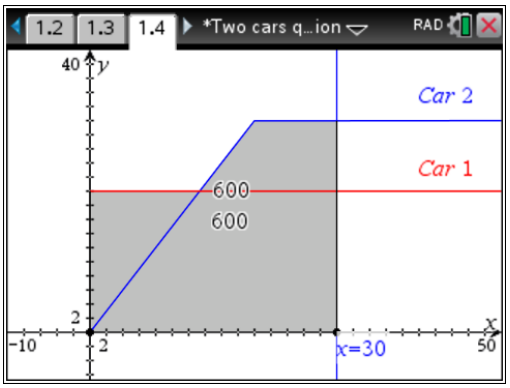
Draw velocity-time graph:

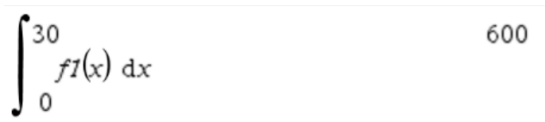


Equate distances travelled:



Check:





Question 4

Answer: B

Equate the areas: