**VELOCITY-TIME GRAPHS**

**Question 1**

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.

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**Question 2**

Larry (the Lunatic) jumps out of a plane with a parachute. For the first 10 seconds of his flight he is in a free fall. After that, the parachute opens and his velocity can be modelled by the function 

1. Sketch the velocity-time graph for the first 40 seconds of his motion.





1. Find the distance travelled in the first 20 seconds.
2. Find his velocity after 30 seconds.
3. Find the time after which Larry lands on the ground if his initial height was

906 metres.

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**Question 3**

Michelle, who is speeding in her car along a straight road at a constant speed of 20 metres per second, passes a stationary police motorcyclist, John. Three seconds later, John starts in pursuit. He accelerates for 6 seconds, at which time he has reached a speed of *V* metres per second which he maintains until he overtakes Michelle. Let *t* seconds be the time elapsed since Michelle passed John. John’s speed, *v(t)* m/s, until he reaches the constant speed of *V* m/s at t = 9 sec, is given by 

1. Find the value of *V*.
2. Find an expression *a(t)* for John’s acceleration for the time interval between 3 and 9 seconds and hence find when he achieves maximum acceleration.

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1. i. Sketch the velocity-time graph for John and Michelle on the same set of axes.

ii. Write down an expression for the number of metres travelled by Michelle in terms of *t* for 



1. i. How far has John travelled when he reaches his maximum speed *V* at *t = 9*?

ii. If *d(t)* is the distance in metres John has travelled after t seconds, write down an expression for *d(t),* for 

1. i. For what value of *t* does John draw level with Michelle?

ii. How far does John travel before he draws level with Michelle?



1. From the moment John draws level with Michelle, she starts to reduce speed. Find the time and distance required for her to stop if, while reducing speed, her acceleration is given by 

where *t* is the time measured in seconds from when Michelle starts to reduce speed and *v* m/s is her speed at time *t*.

