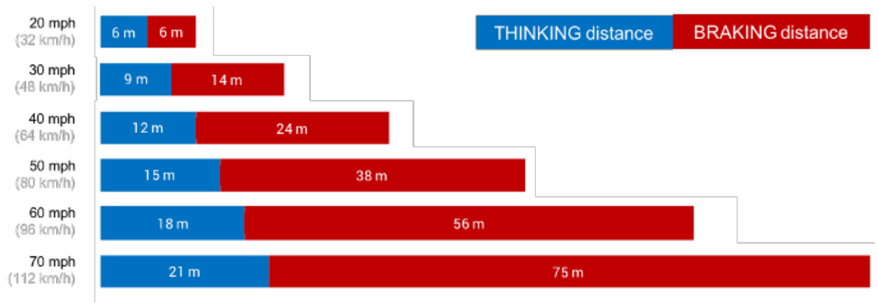
0 1

The below diagram shows how the thinking and braking distances of the average driver are affected by their initial speed under normal conditions.



0 1 . 1

Calculate the average stopping distance at a speed of 30 mph.

Stopping distance = thinking distance + braking distance = 9 + 14 = **23 m**

0 1 . 2

List **two** factors which affect the *thinking distance* of a driver.

Tiredness, distractions, alcohol or drug consumption (any TWO)

0 1 . 3

Karen looks at the above diagram and says that "the *thinking distance* of a driver is proportional to their speed".

Is she correct? Explain your answer.

Yes [1]. As the speed of the driver doubles, so too does their thinking distance [1]. Thinking distance is proportional to speed (thinking distance $\propto v$). For example, when their speed increases from 20 to 40 mph, their thinking distance increases from 6 to 12 m.

0 1 . 4

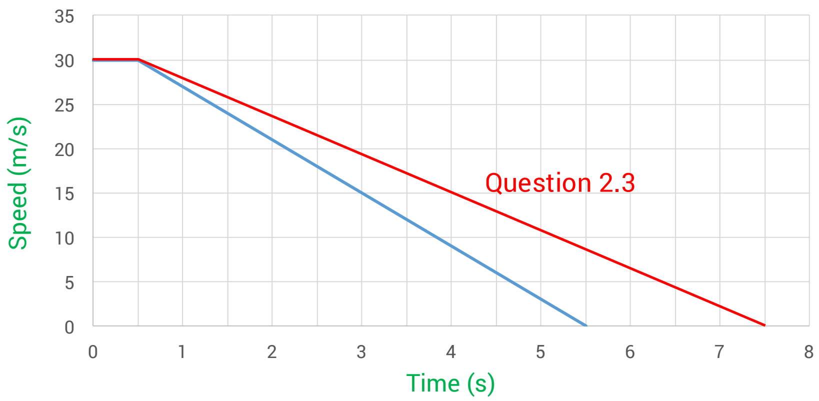
She then goes on to say that "the *braking distance* of a driver is also proportional to their speed".

Is she correct now? Explain your answer.

No [1]. As the speed of the *driver* doubles, their braking distance increases by a factor of *four* [1]. For example, when their speed increases from 20 to 40 mph, their braking distance increases from 6 to 24 m. Braking distance is proportional to the *square* of speed (braking distance $\propto v^2$) [1].

0 2

A driver is travelling at 30 m/s (just under 70 mph) on the motorway when they see a queue of traffic ahead. The below graph shows how their speed changes as they decelerate to rest.



0 2 . 1

The driver sees the traffic ahead at t = 0 seconds.
Use information from the graph to determine their **reaction time**.

Reaction time = **0.5 s**

0 2 . 2

Calculate the **stopping distance** of the car.

Stopping distance = total area under line
Stopping distance = (0.5 × 30) + ½ (30) (5) = **90 m**

0 2 . 3

Fortunately, the driver had replaced their tyres several months earlier, and so they were able to stop their car safely. Had they still been using their old, worn tyres, their braking time would have been **two seconds** longer.

On the axes above, sketch the speed-time graph which would have been obtained had they still been using their old tyres. Hence calculate what the stopping distance of the car would have been then.

Stopping distance with old tyres = area under new line (red)
Stopping distance with old tyres = 0.5 × 30 + ½ (30) (7) = **120 m**

0 2 . 4

Write down one other factor which would have increased the **braking distance** of the car.

Condition of brakes, type of road surface, weather conditions, size of braking force (any ONE)