If you don't swipe your Oyster card and a ticketing agent catches you, what exactly happens next?

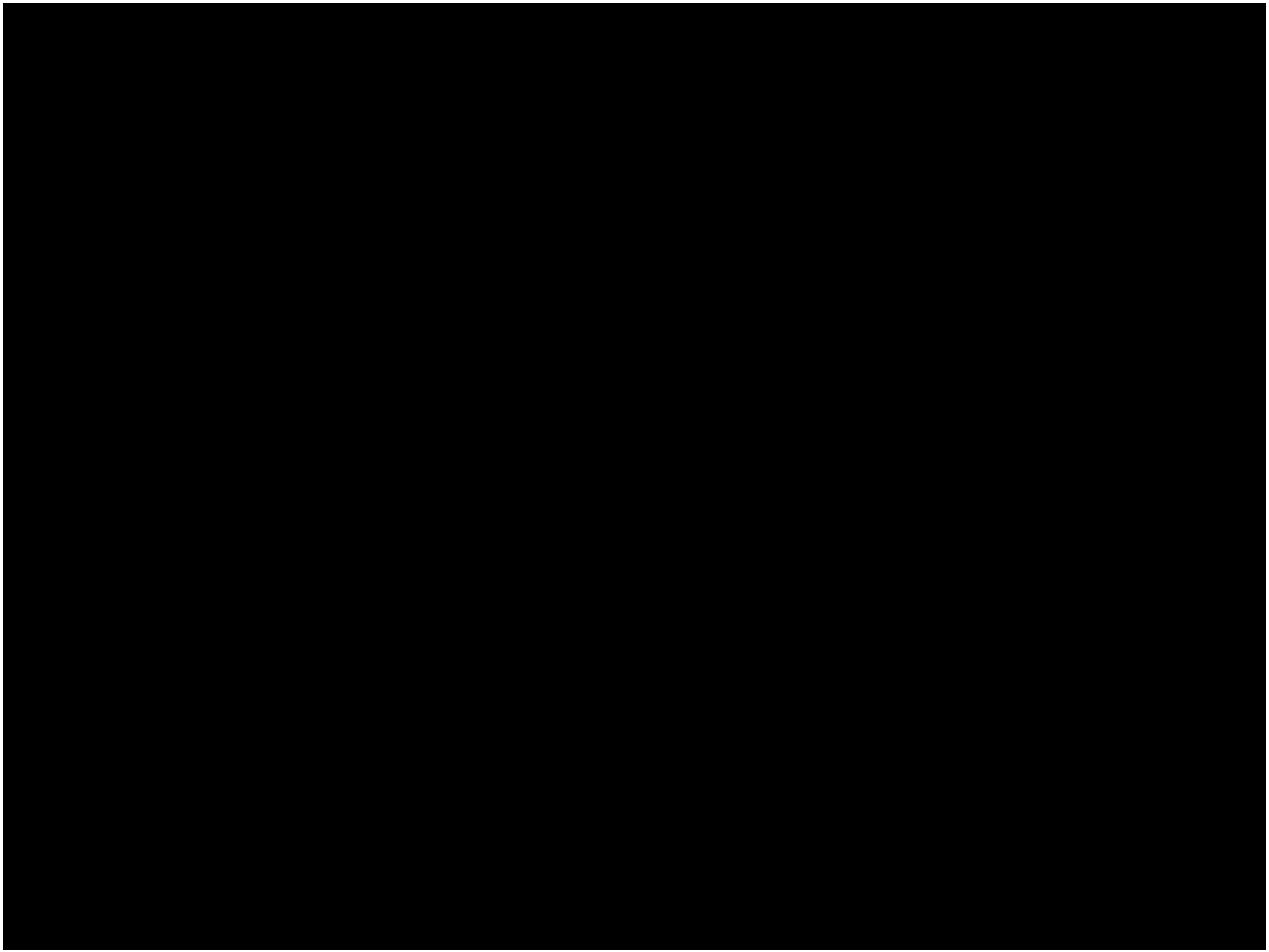
If the westbound DLR service is moving westbound at a constant velocity of –13 ms^{-1} and the eastbound service is moving at a constant velocity of 11 ms^{-1}, at what time, t, will the light rails' first cars pass one another if they were originally 1.3 km apart?

Today's learning objective:

By the end of class, I will be able to utilize differentiation and integration to solve displacement, velocity, and acceleration problems.

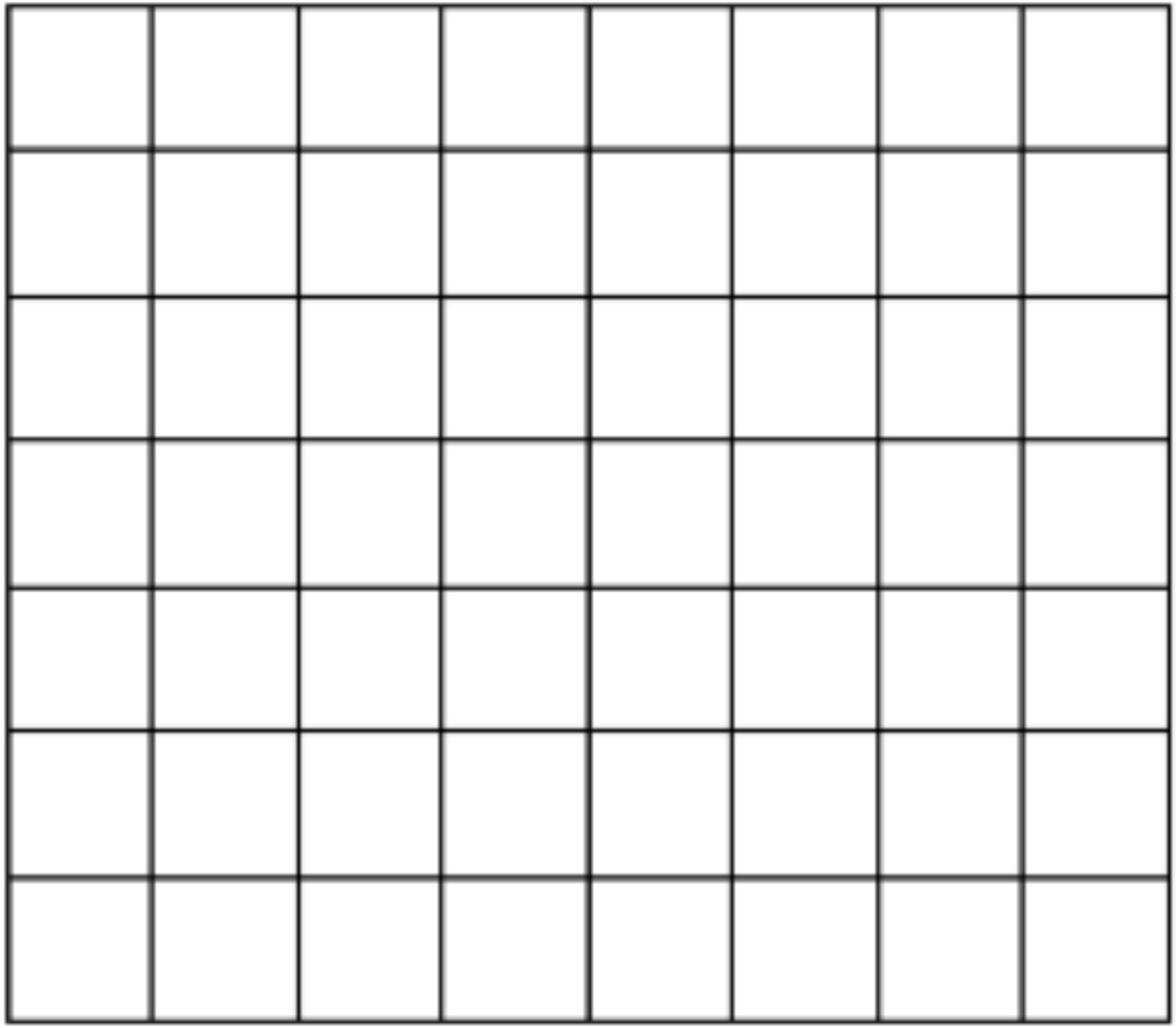
Today's language objective:

Displacement
Velocity
Acceleration
Units
Negative exponents



Please discuss all critical physics vocabulary that give you numerical mathematical values.

"stop" =
"at rest" =
"initial" =
"gravity" =
c =
"constant velocity" =
"returned to origin" =
"instantaneous" =



In this question, s represents displacement in metres, and t represents time in seconds.

a) The velocity v m s^{-1} of a moving body may be written as $v = \frac{ds}{dt} = 30 - at$, where a is a constant. Given that $s = 0$ when $t = 0$, find an expression for s in terms of a and t.

non-calc

Trains approaching a station start to slow down when they pass a signal which is 200 m from the station.

b) The velocity of Train 1 t seconds after passing the signal is given by $v = 30 - 5t$.

(i) Write down its velocity as it passes the signal.

(ii) Show that it will stop before reaching the station.

c) Train 2 slows down so that it stops at the station. Its velocity is given by $v = \frac{ds}{dt} = 30 - at$, where a is a constant.

(i) Find, in terms of a, the time taken to stop.

(ii) Use your solutions to parts (a) and (c)(i) to find the value of a.

75.) (a) $\frac{ds}{dt} = 30 - at \Rightarrow s = 30t - a\frac{t^2}{2} + C$ (A1)(A1)(A1)

Note: *Award (A1) for 30t, (A1) for* $a\frac{t^2}{2}$, *(A1) for C.*

$t = 0 \Rightarrow s = 30(0) - a\frac{(0^2)}{2} + C = 0 + C \Rightarrow C = 0$ (M1)

$\Rightarrow s = 30t - \frac{1}{2}at^2$ (A1) 5

(b) (i) $\text{vel} = 30 - 5(0) = 30 \text{ m s}^{-1}$ (A1)

(ii) Train will stop when $0 = 30 - 5t \Rightarrow t = 6$ (M1)

Distance travelled $= 30t - \frac{1}{2}at^2$

$= 30(6) - \frac{1}{2}(5)(6^2)$ (M1)

$= 90\text{m}$ (A1)

$90 < 200 \Rightarrow$ train stops before station. (R1)(AG) 5

answer key continues on next page...

(c) (i) $0 = 30 - at \Rightarrow t = \frac{30}{a}$ (A1)

(ii) $30\left(\frac{30}{a}\right) - \frac{1}{2}(a)\left(\frac{30}{a}\right)^2 = 200$ (M1)(M1)

Note: *Award (M1) for substituting* $\frac{30}{a}$, *(Ml) for setting equal to 200.*

$\Rightarrow \frac{900}{a} - \frac{450}{a} = \frac{450}{a} = 200$ (A1)

$\Rightarrow a = \frac{450}{200} = \frac{9}{4} = 2.25 \text{ m s}^{-2}$ (A1) 5

Note: *Do not penalize lack of units in answers.*