Warm-up: 10.15.08

Scooby Doo is being chased by a ghost! If Scooby starts from rest, and he is running 12.5 $m \cdot s^{-1}$ when he reaches a doorway 25.0 m away, what was his acceleration?

$v_i = 0$

$v_f = 12.5\ m/s$

$a = ?$

$t = ?$

$d = 25.0\ m$

$$v_f^2 = v_i^2 + 2ad$$

$$a = \frac{\left(\frac{v_f^2 - v_i^2}{2}\right)}{d}$$

$$a = \frac{\frac{12.5^2}{2}}{25}$$

$$a = \frac{78.125}{25}$$

$$a = 3.13\ m \cdot s^{-2}$$

A car traveling 88 km·h^{-1} is 110 m behind a truck traveling 75 km·h^{-1}. How long will it take the car to reach the truck?

v_i =

v_f =

a =

t =

d =

$88\ km \cdot h^{-1} - 75\ km \cdot h^{-1} =$

$13\ km \cdot h^{-1}$

$\frac{13\ Km}{1\ hr} \left| \frac{1\ hr}{60\ min} \right| \frac{1\ min}{60\ s} \left| \frac{1000\ m}{1\ Km} \right. = \frac{13 \cdot 1000}{3600}$

$= 3.6\ m \cdot s^{-1}$

$Speed = \frac{distance}{time}$ $\quad 3.6 = \frac{110\ m}{Sec}$

$\frac{110}{3.6} =$ 31 seconds

A sprinter accelerates from rest to 10.8 $m \cdot s^{-1}$ in 1.35 s. What is her acceleration in $m \cdot s^{-2}$?

$v_i = 0\ m \cdot s^{-1}$

$v_f = 10.8\ m \cdot s^{-1}$

$a = ?$

$t = 1.35\ s$

$d =$

$V_f = V_i + at$

$10.8\ m \cdot s^{-1} = 0 + a \cdot 1.35$

$a = \frac{10.8}{1.35} = 8.00\ m \cdot s^{-2}$

At highway speeds, a car is capable of an acceleration of 1.6 $m \cdot s^{-2}$. How long will it take to accelerate from 80. $km \cdot h^{-1}$ to 100. $km \cdot h^{-1}$? How far has the car traveled during its acceleration?

$v_i = 80 km \cdot h^{-1} = 22.2 m \cdot s^{-1}$

$v_f = 100 km \cdot h^{-1} = 27.8 m \cdot s^{-1}$

$a = 1.6 m \cdot s^{-2}$

$t = ?$

$d = ?$

$\left(80 \frac{km}{h}\right)\left(\frac{1000 m}{1 km}\right)\left(\frac{1 h}{3600 s}\right)$

$= 22.2 m \cdot s^{-1}$

$v = v_0 + at$

$(27.8) = (22.2) + (1.6)t$

$3.5 s = t$

$v^2 = v_0^2 + 2ad$

$(27.8)^2 = (22.2)^2 + 2(1.6)d$

$98 m = d$

You are driving down the highway with an initial velocity of 27.5 $m \cdot s^{-1}$ when you spot a herd of buffalo standing by the side of the road in the distance. You step on your brakes and eventually come to a stop with an acceleration of -5.00 $m \cdot s^{-2}$.

a) How much time does it take you to come to a complete stop?
b) How much distance have you traveled while coming to a stop?

$v_i = 27.5 m \cdot s^{-1}$
$v_f = 0$
$a = -5.00 m \cdot s^{-2}$
$t =$
$d =$

$v = v_0 + at$
$0 = 27.5 + (-5.00)t$
$-27.5 = -5t$
$5.50 = t$

$v^2 = v_0^2 + 2ad$
$0^2 = (27.5)^2 + 2(-5)d$
$0 = 756.25 - 10d$
$-756.25 = -10d$
$75.6 m = d$

A car traveling 85 km·h^{-1} strikes a tree. The front end of the car compresses and the driver comes to rest after traveling 0.80 m. What was the average acceleration of the driver during the collision?

$v_i = 85\ km/hr = 24\ m/s$ $\quad \frac{85\ Km}{1\ hr} \left| \frac{1000\ m}{1\ Km} \right| \frac{1\ hr}{3600\ s} = 24\ m/s$

$v_f = 0\ km/hr = 0\ m/s$

$a =$

$t =$

$d = .80\ m$

$a = -360\ m/s^2$

$V^2 = V_0^2 + 2ad$

$0 = 24^2 + 2a(.8)$

$-576 = 1.6a$

A police car is stationary by the side of a road. A Porsche speeds past the police car at a constant velocity of 34.5 $m \cdot s^{-1}$. The police car sets off to catch the Porsche; he starts accelerating at the exact instant that the Porsche is right next to him. The police car's acceleration is 6.25 $m \cdot s^{-2}$. He accelerates for 6.00 s and then continues to pursue the Porsche at a constant speed.

a) Calculate the distance traveled by the police car in the first 6.00 s of travel.

$v_i = 0\ m \cdot s^{-1}$

$v_f = ?$

$a = 6.25\ m \cdot s^{-2}$

$t = 6.00\ s$

$d = ?$

$d = v_i t + \frac{1}{2} a t^2$

$d = 0 + \frac{1}{2}(6.25)(6.00)^2$

$d = 112.5\ m = \boxed{113\ m}$

b) Determine the speed of the car at the end of the first 6.00 s of travel.

$v_i = 0$

$v_f = ?$

$a = 6.25\ m \cdot s^{-2}$

$t = 6.00\ s$

$d = 112.5\ m$

$$V = V_0 + at$$

$$V = 0 + (6.25)(6.00)$$

$$V = 37.5\ m \cdot s^{-1}$$

Recap:

Porsche

$V_p = 34.5\ m \cdot s^{-1}$

$D = (34.5)t$

Police Car

From $t = 0$ to $t = 6\ s$

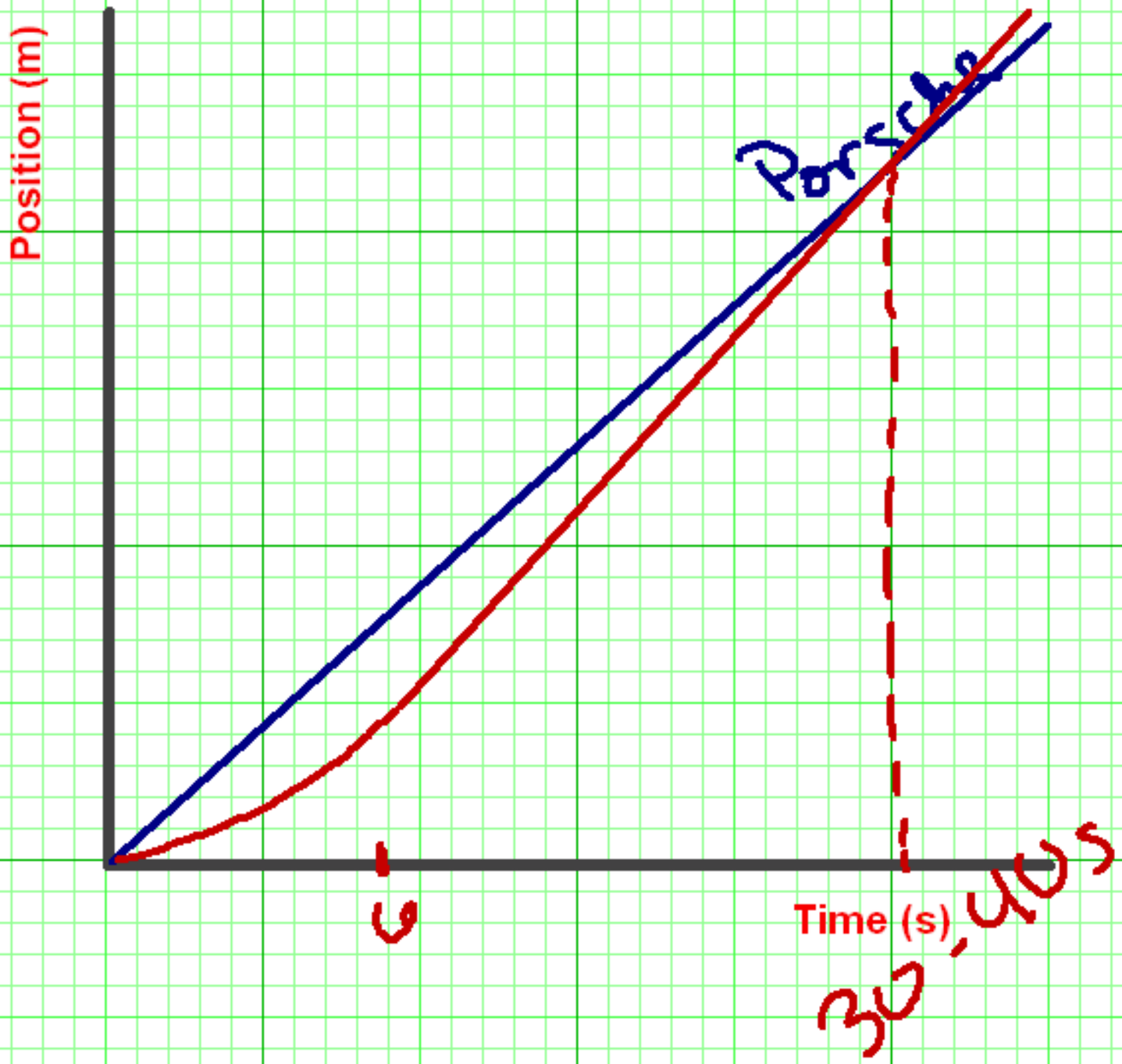
$a = 6.25\ m \cdot s^{-2}$

$d_1 = 112.5\ m$

After 6.0 s...

$V_c = 37.5\ m \cdot s^{-1}$

$d_2 = (37.5)(t - 6)$



Accurately draw a position-time graph that indicates the motion of both the Porsche and the police car. According to your graph, at what time will the police car draw level with the Porsche?

Mathematically determine the amount of time it will take for the police car to draw level with the Porsche.

$$D = d_1 + d_2$$

$$(34.5t) = (112.5m) + (37.5)(t-6)$$

$$34.5t = 112.5 + 37.5t - 225$$

$$-3.0t = -112.5$$

$$t = 37.5\ s$$