Questions:

1. A ball is dropped from rest on a planet. After 5 seconds, it has fallen a distance of 30 meters. What is the acceleration of gravity on the planet?

$V_0 = 0$
$a = -10\ m/s^2$
$\Delta x = -30\ m$
$t = ?$

$\Delta X = V_0 t + \frac{1}{2} a t^2$
$-30 = \frac{1}{2} a (5)^2$
$-30 = 12.5a$
$-2.4\ m/s^2 = a$

2. A plane lands on a runway with a speed of 75 m/s. The length of the runway is 100 meters. What is the smallest braking acceleration that will bring the airplane to rest before it goes off the runway?

$V_0 = 75\ m/s$
$\Delta x = 100\ m$
$a = ?$
$V = 0$ (stops)

$v^2 = v_0^2 + 2a\Delta x$
$0 = 75^2 + 2a(100)$
$-5625 = 200a$
$-28.1\ m/s^2 = a$

3. A person is driving at 30 m/s. A dog runs across the street in front of the driver. Her reaction time is 0.12 seconds. The acceleration provided by the brakes is 6 m/s^2.
    a. How far does she travel *before* putting on the brakes?
    b. How far does she travel *after* putting on the brakes, before coming to a stop?
    c. What is her total distance traveled between seeing the dog in front of her, and stopping?

a) before brakes
$\bar{v} = 30\ m/s$ (constant speed)
$\Delta t = .12\ s$
$\Delta x = ?$
$\bar{v} = \frac{\Delta x}{\Delta t}$
$30 = \frac{\Delta x}{.12}$
$\Delta x = 3.6\ m$

b) while braking
$a = -6\ m/s^2$
$V_0 = 30\ m/s$
$V = 0$
$\Delta x = ?$
$v^2 = v_0^2 + 2a\Delta x$
$0 = 30^2 + 2(-6)(\Delta x)$
$-900 = -12\Delta x$
$75\ m = \Delta x$

c) $3.6 + 75 = 78.6\ m$

4. A car traveling at a constant 40 m/s passes a stationary police car. At the moment the car passes the police officer, the police officer takes off in pursuit, with an acceleration of $2 m/s^2$.

   a. Fill out the chart below, showing the position of the car and the police officer as a function of time.

Time (s)	Position of Car (m)	Position of Police Officer (m)
0	0	0
4	160	16
8	320	64
12	480	144
16	640	256
20	800	400
24	960	576
28	1120	784
32	1280	1024
36	1440	1296
40	1600	1600

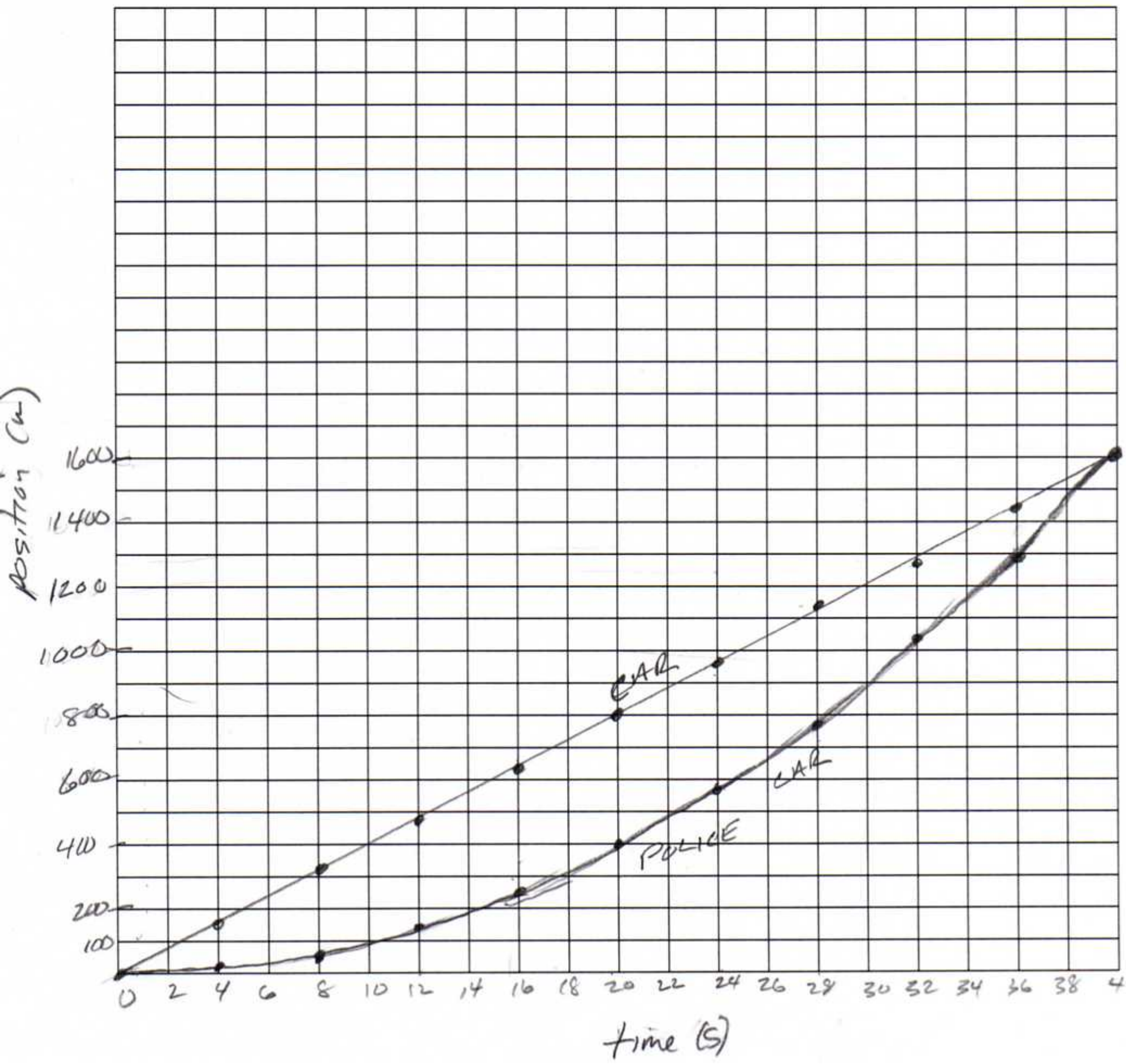
for car
$v = 40$
$\Delta t = 4$
$\Delta x = ?$
$v = \frac{\Delta x}{\Delta t}$
$40 = \frac{\Delta x}{4}$
$\Delta x = 160m$

for P.O.
$v_0 = 0$
$a = 2$
$t = 4s$
$\Delta x = v_0 t + 1/$
$\Delta x = 0(4) +$
$\Delta x = 16$

   b. Graph the data.

   c. How do the shapes of the graphs differ? Why?

   d. What will be the speed of the police officer when he catches up to the car?


position (m)
1600
1400
1200
1000
800
600
400
200
100
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40
time (s)
CAR
CAR
POLICE