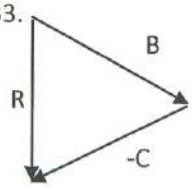
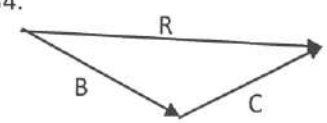
1	B
2	B
3	A
4	D
5	A
6	A
7	D
8	D
9	A
10	B
11	C
12	D
13	9 m
14	19 m
15	2 m
16	26 m
17	-12 m
18	28 m
19	0.143 m/s
20	1 m/s & 2 m/s
21	1.57 m/s
22	0.714 m/s left
23	-5 m/s
24	2.14 m/s
25	A
26	B
27	C
28	A
29	B
30	C
31	D
32	B,D,F
33	
34	
35	
36	4.81 m
37	B
38	C

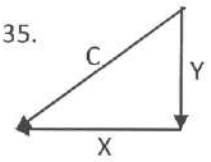
33.



34.



35.



Completion

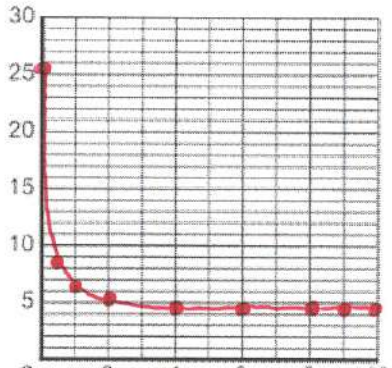
Complete the following problems and SHOW ALL WORK!

1. Convert 12.5 ft/hr^2 into m/s^2.

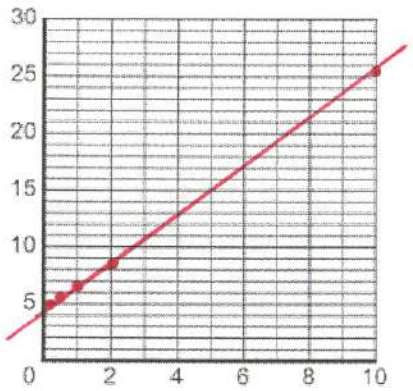
$$12.5 \frac{ft}{hr^2} \times \frac{0.3048\ M}{1\ ft} \times \frac{1\ hr^2}{12960000\ s^2} = 2.94 \times 10^{-7}\ m/s^2$$

2. Determine the mathematical expression that best fits the data below.

Time (s)	Pos. (m)
0.10	25.33
0.50	8.37
1.00	6.25
2.00	5.19
4.00	4.66
5.00	4.55
6.00	4.48
8.00	4.40
9.00	4.37
10.00	4.34



$\frac{1}{x}$	y
10	25.33
2	8.37
1	6.25
0.5	5.19
0.25	4.66
0.20	4.55
0.167	4.48
0.125	4.40
0.111	4.37
0.100	4.34



Mathematical Expression:

$y = m\frac{1}{x} + b$

$y = 2.12\frac{1}{x} + 4.13$

Relationship: Inverse

Slope

$m = \frac{y_f - y_i}{x_f - x_i} = \frac{25.33 - 4.34}{10 - 0.100} = \frac{20.99}{9.90}$

$m = 2.12$

Y-Intercept

$y = mx + b$

$y = 2.12x + b$

Point $(1, 6.25)$

$6.25 = 2.12(1) + b$

$6.25 = 2.12 + b$

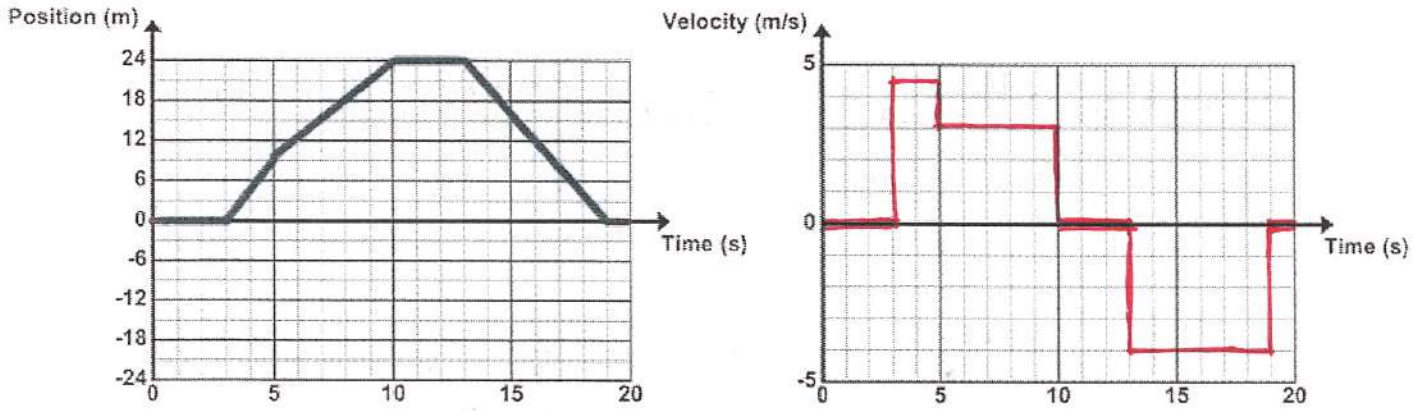
$-2.12 \quad -2.12$

$4.13 = b$

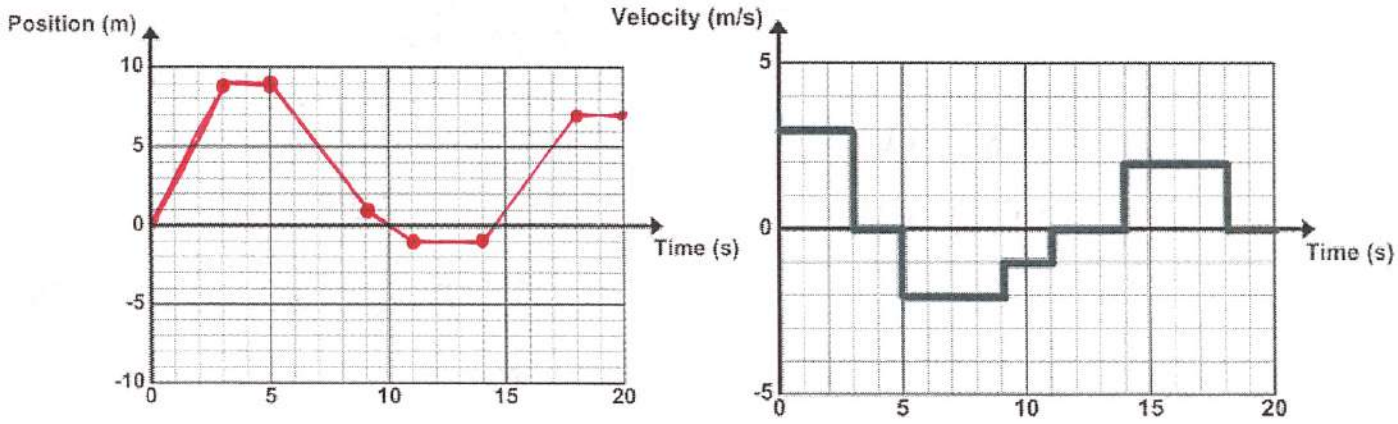
3. The fastest helicopter, the Westland Lynx, can travel 3.33 km in the forward direction in just 30.0 s. What is the average velocity of this helicopter? Express your answer in meters per second.

$v = \frac{\Delta y}{t} = \frac{3.33\,km}{30\,s} = 0.111\ km/s \times \frac{1000\ m}{1\ km} = 111\ m/s$

4. Convert the following position vs. time graph into a velocity vs. time graph.



5. Convert the following velocity vs. time graph into a position vs. time graph.



6. The solid-fuel rocket boosters used to launch the space shuttle are able to lift the shuttle 45 kilometers above Earth's surface. During the 2.00 min that the boosters operate, the shuttle accelerates from rest to a speed of nearly 7.50×10^2 m/s. What is the magnitude of the shuttle's average acceleration? Watch Units!

$v_i = 0$

$v_f = 7.50 \times 10^2\ m/s$

$t = 2\,min = 120\,s$

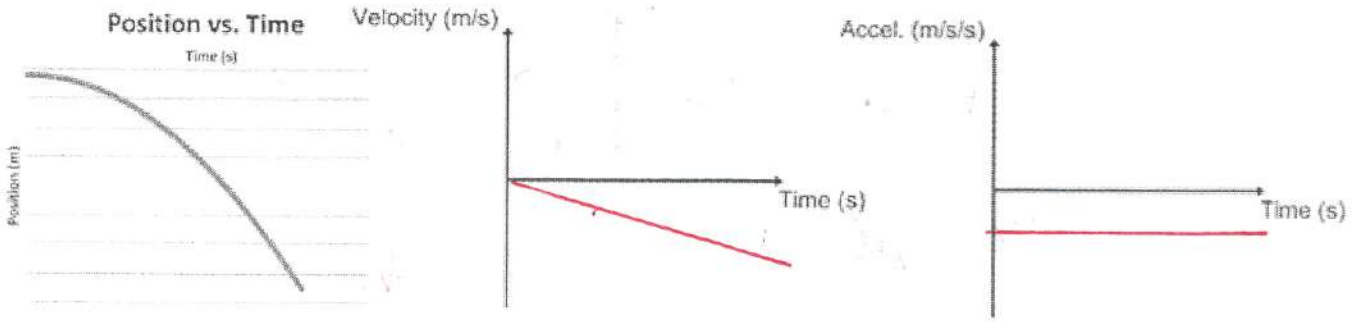
$\Delta y = 45\,km = 45000\,m$

$a = \frac{v_f - v_i}{t}$

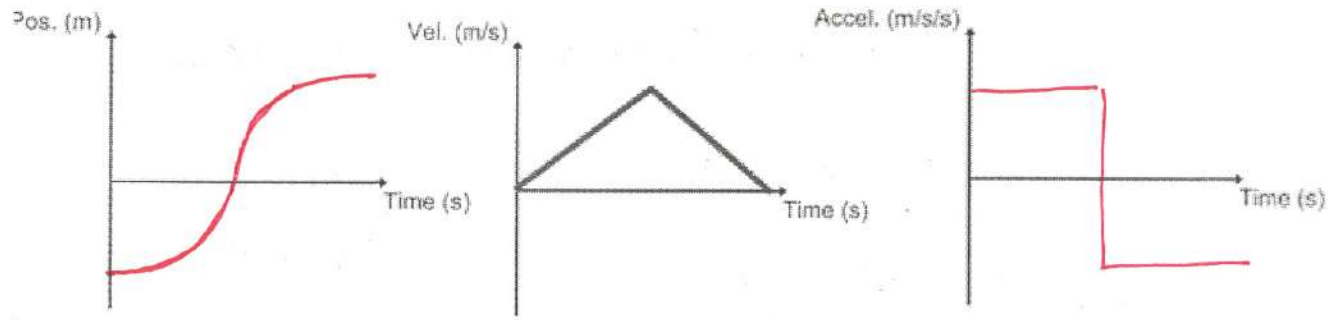
$a = \frac{7.50 \times 10^2\ m/s}{120\,s}$

$a = 6.25\ m/s^2$

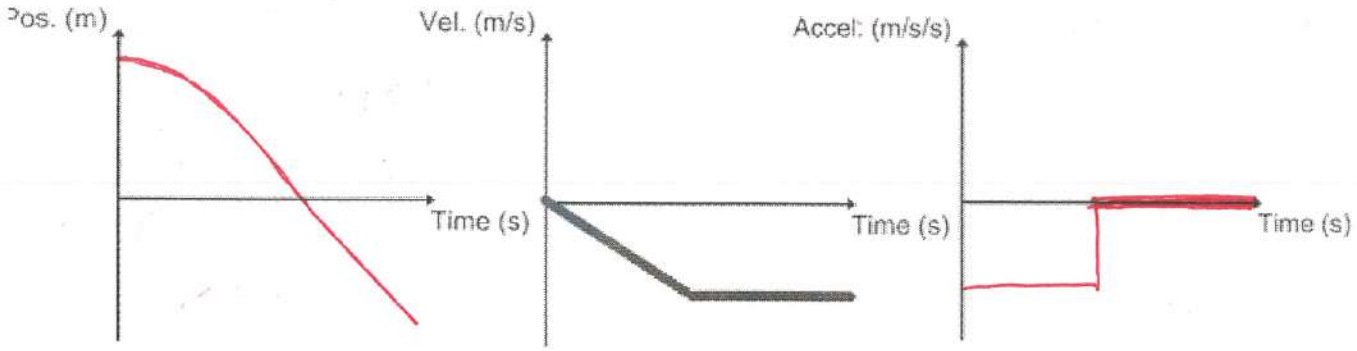
7. Convert the following position vs. time graph into a velocity and acceleration vs. time graph.



8. Convert the following velocity vs. time graph into a position and acceleration vs. time graph.



Convert the following velocity vs. time graph into a position and acceleration vs. time graph.



9. A popular scene in recent action films shows a character in free-fall speed up to catch a freely falling parachute. Suppose a packed parachute is dropped from rest from an airplane and that a daredevil is launched straight down from the plane 3.00 s later. Neglecting air resistance, the daredevil catches up to the parachute 4.00 s after the daredevil leaves the plane. What are the daredevil's initial and final velocities?

10. A plane flies 118 km at 15.0° south of east and then flies 118 km at 35° west of north. Find the magnitude and direction of the total displacement of the plane.

11. A lunch pail is accidentally kicked off a steel beam on a building under construction with an initial horizontal speed is 1.50 m/s. If the building is 2.50×10^2 m tall, and the lunch pail is knocked off the top floor, what is the velocity of the lunch pail when it reaches the ground?

9)

Parachute

Δy

$V_i = 0\ m/s$

V_f

$a = -9.81\ m/s^2$

$t = 3.00s + 4.00s = 7.00s$

$\Delta y = V_i t + \frac{1}{2} a t^2$ ($V_i = 0$)

$\Delta y = \frac{1}{2}(-9.81\ m/s^2)(7.00s)^2$

$\Delta y = -240\ m$

Skydiver

$\Delta y = -240\ m$

$V_i = ?$

$V_f = ?$

$a = -9.81\ m/s^2$

$t = 4.00s$

$\Delta y = V_i t + \frac{1}{2} a t^2$

$-\frac{1}{2}at^2 \quad -\frac{1}{2}at^2$

$\frac{\Delta y - \frac{1}{2}at^2}{t} = \frac{V_i t}{t}$

$V_i = \frac{\Delta y - \frac{1}{2}at^2}{t}$

$V_i = \frac{-240 - \frac{1}{2}(-9.81)(4)^2}{4}$

$V_i = -40.4\ m/s$

Explanation

In order to catch the parachute the skydiver + the parachute have to be in the same position. This means they both have the same displacement or Δy.

The parachute fell for 3 seconds before the skydiver jumped so before the parachute is caught a total of 7 seconds elapses.

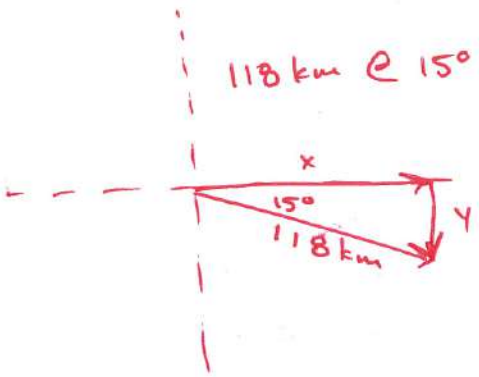
Using the parachutes information we can solve for Δy. We then use the Δy in the skydiver scenario to find V_i + V_f

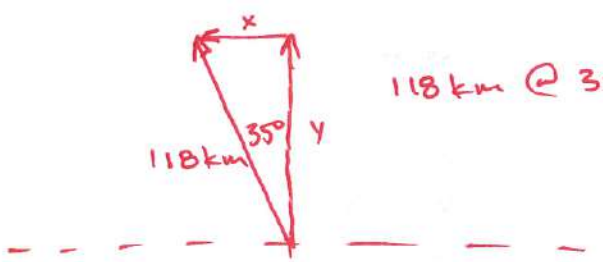
$V_f = V_i + at$

$V_f = -40.4\ m/s + (-9.81\ m/s^2)(4.00s)$

$V_f = -79.6\ m/s$

10.





$x = H\cos\phi$ $\quad y = H\sin\phi$

$= 118\cos 15$ $\quad = 118\sin 15°$

$= 114$ km $\quad = -30.5$ km

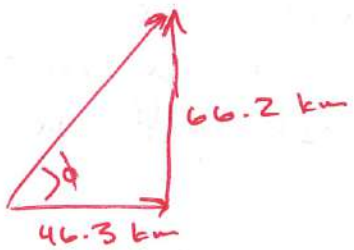
$x = H\sin\phi$ $\quad y = H\cos\phi$

$= 118\sin 35$ $\quad = 118\cos 35$

$= -67.7$ m $\quad = 96.7$ km

total $x + y$

x	y
114 km	96.7 km
−67.7 km	−30.5 km
46.3 km	66.2 km



$a^2 + b^2 = c^2$

$c = \pm\sqrt{a^2 + b^2}$

$c = \pm\sqrt{(46.3)^2 + (66.2)^2}$

$c = 80.8$ km

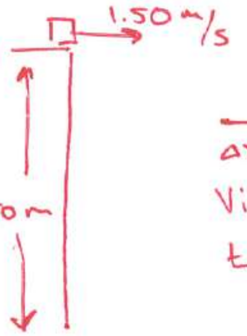
$\tan\phi = \frac{O}{A}$

$\phi = \tan^{-1}\left(\frac{66.2}{46.3}\right)$

$\phi = 55.0°$

80.8 km @ 55.0° N of E

1)



x	y
Δx	$\Delta y = -250\ m$
$V_i = 1.50\ m/s$	$V_i = 0\ m/s$
t	$V_f = ?$
	$a = -9.81\ m/s^2$
	t

$\Delta y = V_i t + \frac{1}{2} a t^2$ ($V_i t \to 0$)

$2(\Delta y) = \left(\frac{1}{2} a t^2\right) 2$

$\frac{2\Delta y}{a} = \frac{a t^2}{a}$

$\sqrt{t^2} = \sqrt{\frac{2\Delta y}{a}}$

$t = +\sqrt{\frac{2(-250)}{-9.81}}$

$t = 7.14\ s$

$V_f = V_i + at$

$V_f = 0 + (-9.81)(7.14)$

$V_f = -70.0\ m/s$