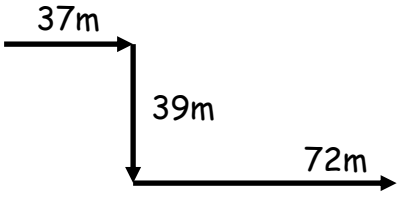
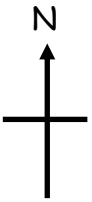
Vector Calculations and Projectile Motion (Higher)

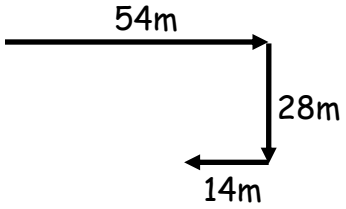
1. Determine the resultant vector in each case

a)





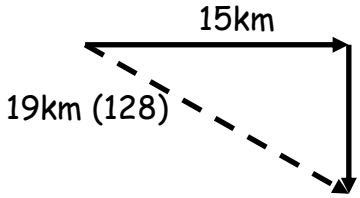
b)

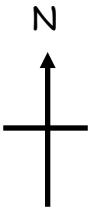


---

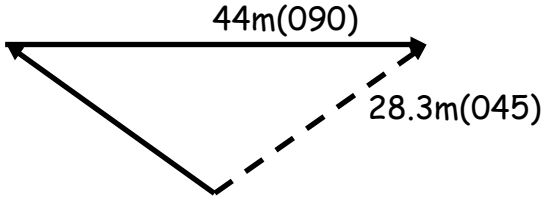
2. Find the unknown vector.

a)

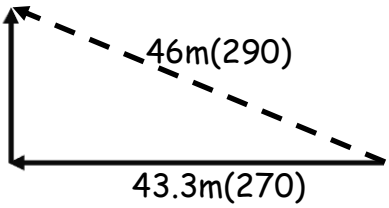




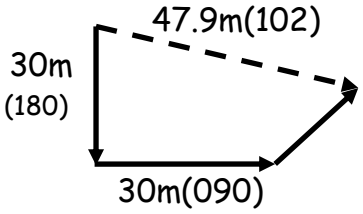
c)



b)



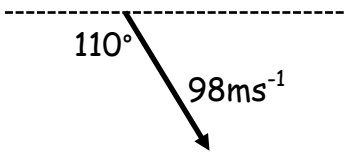
d)



---

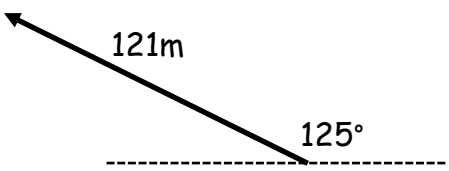
3. Show the Horizontal and Vertical components of the following vectors.

a)

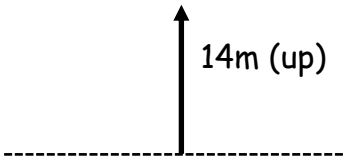


UP
(towards top of page)

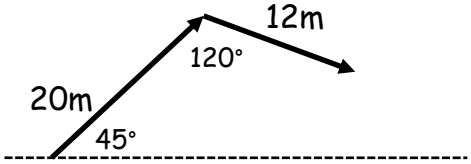
c)



b)



d)



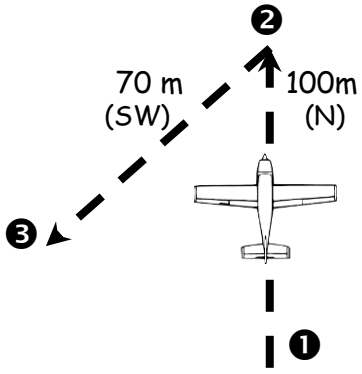
---

4. Use the process of splitting into Horizontal and Vertical components to determine the RESULTANT vectors below. (Show all workings, sketch a diagram of the path taken)

a) A postie leaves her van to deliver letters. She walks 40m (045) to house A; then 60m (310) to house B; finally, 25m (200) to house C. Determine the displacement of house C from the van.

b) A model ATV drives 83m north; then 95m north west; finally 77m south west in 7.5minutes.
Determine
- the displacement from the finish line to the start position.
- speed of the model.
- velocity of the model.

11.



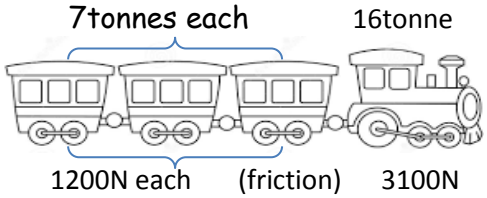
Part of a flight plan, in a model aircraft display, is shown to the left (through check points❶,❷,❸).
This particular 'plane files at 2.4 ms^{-1}.
Determine:

a) displacement❶→❸
b) minimum time between ❶&❸
c) average velocity❶→❸

On the actual display day a 1.7ms^{-1} wind blows from the west.
Determine:

d) how the plane's flight has to change to hit each check point.
e) how flight time ❶→❸ will be affected.

12.



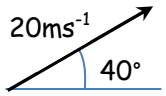
An engine moves a train along a straight track, at a steady speed of 4ms^{-1}, before accelerating by 0.8 ms^{-2} up to 12ms^{-1} when it coasts to a halt in the next station.
Determine, before and during the acceleration:

a) the TENSION on coupling ❶, ❷, & ❸
b) the total engine force
c) How far from the station did the train begin to accelerate?

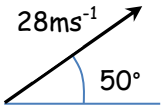
---

13. A number of golf ball hits, on a driving range are recorded.
For each determine: (i) time of flight; (ii) max. height of ball; (iii) range

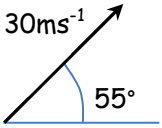
a)



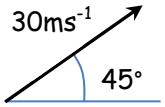
b)



c)

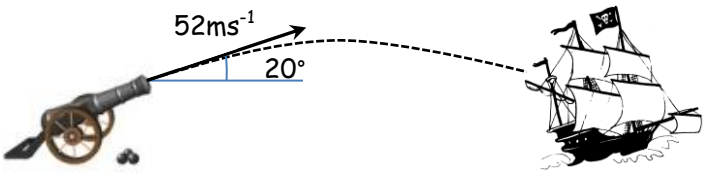


d)



---

14. A damaged pirate ship full of bad guys is escaping at 2.9ms^{-1}.
The on-shore gun battery average 1 shot every 10 seconds and need 4 hits on the rigging to stop the ship. Show by calculation that the ship escapes. (The first hit is shown below)



Determine:

a) the range of the first hit
b) the max range of the gun
c) time ship takes to cover a) →b)
d) how many shots land in this time

(note: muzzle vel. const; max elevation 45°)

---

15. The pirate vessel heads for home at 2.9ms^{-1} (030). A navy frigate is sent in pursuit of the pirates, it averages 7ms^{-1} (045) and intercepts the pirates in 3 hours.

a) Draw a scale diagram to indicate the path of the two ships in these 3 hours.
b) Use your diagram to determine the displacement of the frigate from the pirates as the chase began
c) Confirm by calculation the displacement shown in b).

ANWERS to follow