Always make a rough sketch of the (resultant) vector and it's components. Label it. Show angles used in calculations.

1. During take-off, a plane moves at an average velocity of 256 km/h at [E 28.4 ° up].
    Assume that the velocity was measured during a 30.0 s time interval.
    a)   What is the average horizontal velocity during take-off?
    b)   What horizontal displacement would the plane have traveled during this time?
    c)   What is the average vertical velocity during take-off?
    d)   What vertical displacement would the plane have traveled during this time?

2. Matt is pushing a crate with an applied force of 654 N [E 55 ° down].
    a)   What is the horizontal force that Matt is applying on the crate?
    b)   What is the vertical force that Matt is applying on the crate?
    c)   Which of the forces calculated above is actually pushing the crate into the floor?
    d)   Which of the forces calculated above would be responsible for the horizontal movement of the crate across the floor?

3. A helicopter rises into the air at 30 m/s [N50 °up].
    a)   What is the vertical velocity of the helicopter?
    b)   How long will it take to reach an altitude of 1.00 km ?

4. A ball is thrown from the top of a building at 20 m/s [W 30 ° down]. Assume the ball is in free fall.
    a)   What is the horizontal velocity of the ball?
    b)   What is the vertical velocity of the ball the instant it is released in the throw?
    c)   Gravity pulls objects downwards towards the centre of the Earth. Would the gravitational pull affect the horizontal velocity? Would the gravitational pull affect vertical velocity?
    d)   Based on your answer in (c), what would be the horizontal acceleration (a_x) of the ball?
    e)   Based on your answer in (c), what would be the vertical acceleration (a_y) of the ball?

5. A boat travelling at 3.0 m/s through the water keeps its bow pointing north across a stream, 283 m wide, that flows west at 7.0 m/s.
    a)   What is the resultant velocity of the boat with respect to the shore?
    b)   How long does it take the boat to cross the stream?
    c)   How far downstream does the boat land?

6. A boat wishes to cross a lake and end up directly south of where it started. The boat is capable of moving at 34.0 km/h. There is a current of 8.0 km/h flowing to the west.
    a)   What heading must the boat take in order to successfully complete the trip?
    b)   What is the boat's velocity relative to the ground?
    c)   If the lake was 21 km wide where the boat crossed, how much time would it have taken?

7.　Katelyn throws a ball eastward such that its initial velocity when it leaves her hand is 48.3 m/s at an angle of elevation of 36.4 °.　When the ball leaves her hand it is in free fall. The local acceleration due to gravity is 9.81 m/s^2 [down].

　　a)　What is a_x?
　　b)　What is the initial horizontal velocity ($\vec{V}_{x,1}$)?
　　c)　After 2.00 s of flight time, what would be the horizontal velocity of the ball ($\vec{V}_{x,2}$)?
　　d)　After 2.00 s of flight time, what would be the horizontal displacement (Δd_x) of the ball?
　　e)　What is the a_y?
　　f)　What is the initial vertical velocity ($\vec{V}_{y,1}$) of the ball?

Answers

1. a) 225 km/h [E] b) 1.88 km [E] c) 122 km/h [up] d) 1.01 km [up]

2. a) 375 N [E] b) – 536 N [up] c) Fy d) Fx

3. a) 23 m/s [up] b) 44 s　4. a) 17 m/s [W] b) – 10 m/s [up] d) 0 m/s^2 e) – 9.81 m/s^2[up]

5. a) 7.6 m/s [N 67 °W] b) 94 s c) 6.6 x10^2 m [W]

6. a) [S 14 °E] b) 33 km/h [S] c) 0.64 h

7. a) 0 m/s^2 [E] b) 38.9 m/s [E] c) 38.9 m/s [E] d) +77.8 m e) – 9.81 m/s^2 [up] f) 38.7 m/s [up]