No "GRASS" method is required. However, **all final results must be justified and clearly identified.**

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1. What height did a 20-kg object fall if it took 5 s for it to hit the ground after it was dropped? What assumptions do you make?

Would your answer change if the object weighed 60 kg instead of 20kg? Why or why not?

2. Find the magnitude of a displacement vector $\vec{d}$ = [-3,4] m.

What is the magnitude of a displacement vector called in phys ics? (Hint: speed is the magnitude of a velocity vector)

3. Find the direction of a velocity vector $\vec{v}$ = [7,-2] m/s. Note: you have to indicate both degree measure and the vector's placement in a coordinate system.

4. Find vector components of vector $\vec{v} = 56$km/h [W 36°S]. Your solution must include a labeled diagram with a clear coordinate system. Remember that vector components are also vectors and such they need not only magnitude and units but also **direction**.

5. Consider a projectile shot in the air with initial velocity of 300 m/s [75° above horizontal].

a) Sketch a labeled diagram of the projectile's path

b) Sketch a diagram of the initial velocity vector

c) Calculate the vector components of the initial velocity.

d) Find the maximum height of the projectile.

e) Find the total time the projectile spends in the air.

5. continued:

f) Find the range of the projectile.

g) How would your answers a) –f) differ if the projectile was 10 times heavier? **Why?**

6. Consider a projectile launched 150m above the ground level at velocity of 70m/s [38° above horizontal].

a) Sketch a labeled diagram of the projectile's path

b) Sketch a diagram of the initial velocity vector

c) Calculate the vector components of the initial velocity.

d) Find the maximum height of the projectile.

e) Find the time the projectile spends free-falling from the maximum height.

#6 continued.

f) Find the total time the projectile spends in the air.

g) Find the range.

h) What would be the range of the projectile if it landed at the same level it was launched from?

BONUS: Explain how the direction (angle) of initial velocity of a projectile affects the projectile's range and its maximum height. Justify your answer and make sure to investigate many different angles between 0°-90°.