Units

The seven fundamental units of the SI system are defined in the lecture notes below. For more(6>BDC8E0295 668.95T)v12

¶ Without a common reference point, no one would be able to agree on a given measurement, which could lead to all kinds of problems. The Système Internationale of measurements (or SI system) was developed to define common units for each of the fundamental quantities of nature

¶ The accuracy of a measurement tells you how close you are to the real-world answer (either the true or accepted value). If you think of a target, good accuracy would mean hitting close to the bullseye. Many scientific instruments use a calibration standard to adjust for a loss of accuracy over time. Precision, on the other hand, refers to the repeatability of a measurement. Thinking of the target again, good precision would mean hitting in the same spot multiple times, regardless of how close you are to the bullseye.

¶ Significant figures are used to record a measurement within the precision of a given measurement. All digits in a number, except for zero, contribute to the number of significant figures. Zeros can only be counted as significant if they appear two non-zero numbers, or another number the decimal place. For example, the number 0.003 has only 1 significant figure, 0.0030 has 2 significant figures, 3.00 has 3 significant figures, and 303 has 3 significant figures. Zeros before the decimal place only count the decimal place is included in the number. For example, the number 2700. has 4 significant figures, but the number 2700 only has 2. If it is unclear how many significant figures a number has, the number should be written using scientific notation or SI prefixes. Significant figures should be including when making calculations using the following rules:

For multiplication and division, the answer should have the same number of significant figures as the number with the least significant figures.

For addition and subtraction, the answer should have the same number of decimal places as the number with the least number of significant decimal places.

Numbers or constants with exact values do not contribute to the significant figures.

Wait to round answers until all steps have been calculated. Keep as many significant figures or decimal places as possible until the end to avoid rounding error.

Trigonomet Et example,0Q2(xam)6(p)-19(e,0Q2(xam)6(p)-19(e,0Q2(v2 0 T(p)-7(l)-3(fi)-5(c)9(a)17(h)-7(t)6(f)-2(i)-3(g)-2(u)14(4h)

Scalars & Vectors (3.2)

- A scalar can be thought of as a single number that can be used to quantify something; it may or may not have units associated with it. A vector, on the other hand, consists of 2 or more numbers, or scalars, and is often described graphically using arrows.
- The first physical quantity that we will talk about is position. A position vector ( ) gives the location of an object in any coordinate system, with the tail of the vector at the origin, and the head of the vector at the location of the object. The arrow above the variable tells you that it is a vector and not a scalar. The components of the position vector gives the x- and y-coordinates of its location, such as

$$= \ 200\text{ m}, 100\text{ m} \quad \text{or} \quad = \ 200, 100 \ \text{ m}$$

  These individual components are in turn scalars.
- In physics, vectors are often written out using unit vector notation, such as

$$= 200\text{ m}\ \hat{} + 100\text{ m}\ \hat{} \quad \text{or} \quad = (200\ \hat{} + 100\ \hat{})\text{ m}$$

  In this notation, $\hat{}$ and $\hat{}$ refer to the positive x- and y-directions, respectively. The general position vector (in 2D) is given in Equation 3.4.
- When adding or subtracting vectors, we can use the unit vector notation to add or subtract just like we would with algebra. Just like with scalar math, both vectors and the answer (which is also a vector) have the same units. Note: with subtraction, make sure to keep the same order.

If $\quad {}_1 = {}_1\,\hat{} + {}_1\,\hat{}$

And $\quad {}_2 = {}_2\,\hat{} + {}_2\,\hat{}$

Then $\quad {}_3 = {}_1 + {}_2 = ({}_1 + {}_2)$

The direction can then be described as the angle between the +x axis (or the unit vector ˆ) and the vector itself. This angle can be found by using the inverse tangent function (Eq. 3.2), where x is the adjacent side and y is the opposite side.

$$= \tan^{-1}(\text{——}) = \tan^{-1}(\text{–})$$

Conversely, you can use a vector's magnitude, direction angle and the corresponding trig functions to find its components (Eq. 3.9).

Start with	$\cos = \text{——}$	and	$\sin = \text{——}$
Replace adj, opp, and hyp with x, y, and r	$\cos = \text{–}$	and	$\sin = \text{–}$
Multiply both sides by the magnitude to get	$= \cos$	and	$= \sin$