Physics 10 Fall 2020

8/28–HW01b: Some Calculus and 1D Kinematics

Please read this, try the problems, and if you have any questions, bring them to Piazza or to class on Monday!

Review differentiation with position and velocity (and acceleration) as the examples

Taking derivatives of polynomials and trig functions is about the extent of what you'll need to do in terms of derivatives. Let's see what you remember!

Here's the table I discussed in class:

f	$\frac{df}{dt}$
A	0
At^n	nAt^{n-1}
$A\cos\omega t$	$-\omega A\sin\omega t$
$B\sin\omega t$	$\omega B\cos\omega t$

For each of the following, x represents the position of a particle as a function of time. Take the derivative for each. (Recall that constants have whatever units they need to make the units work for v, x, and t.

Keep track of your $v(t)$'s, you will need them again.

1. $x = 3$
2. $x = 3t$
3. $x = 3t + 5t^2$
4. $x = \sin 2\pi t$
5. $x = \cos 2\pi t$
6. For problem number 3, what is the velocity at $t = 2$s?

   acceleration, a $\equiv$ time rate of change of *velocity* with respect to time.

$$\vec{a} \equiv \frac{d\vec{v}}{dt}$$

7. For all of the velocities you found in 1-5, find the accelerations of the particle.

   Review integration with acceleration, velocity and position as the examples

   Can you go backwards? Recall that the integral is the inverse operation of the derivative. Thus,

$$\vec{v} = \int \vec{a}dt \qquad \vec{x} = \int \vec{v}dt$$

   For each of the following, given the acceleration, find the velocity and then the position. For all of these, you may assume the particle starts from rest from the origin.

8. $a = 0$
9. $a = 5$
10. $a = 4t$