

Note: On September 29, there will be an office hour at 10am but not at 2pm.

Practice

§3.1: 1,3,4,8,9,12,18

Hand In

21) A spool of tape rolls with constant angular velocity ω along a plane winding off the tape in the process and reducing its radius $r(t)$ in turn (so its velocity is $\frac{dx}{dt} = v(t) = \omega \cdot r(t)$.) If it has rolled a distance of x , its radius reduces to $r(x) = r_0 - \frac{x \cdot d}{2\pi}$, where d is the tape thickness and r_0 the initial radius.

Write down a differential equation for $x(t)$ and determine a general solution of it.

22*) (Putnam Competition 1988) A not uncommon calculus mistake is to believe that the product rule for derivatives says that $(fg)' = f'g'$. If $f(x) = e^{x^2}$, determine, with proof, whether there exists an open interval (a, b) and a nonzero function g defined on (a, b) such that the wrong product rule is true for $x \in (a, b)$.

23) Find a general solution to the differential equation

$$\frac{d^2y}{dt^2} - 5\frac{dy}{dt} - 36 = 0$$

24*) Find a general solutions for the differential equation

$$\frac{d^2y}{dt^2} + 1 = 0$$

Problems marked with a * are bonus problems for extra credit.